Chapter 2. TOLERANCE OF BERMUDAGRASS CULTIVARS AND TALL FESCUE TO FENOXAPROP AND FLUAZIFOP

Abstract: Field studies were conducted to evaluate turfgrass tolerance to fenoxaprop and fluazifop. The objectives were to determine the efficacy of fenoxaprop and fluazifop for control of various bermudagrass cultivars and the degree of tolerance tall fescue exhibits to these herbicides. Fenoxaprop and/or fluazifop, when applied alone, suppressed bermudagrass shoots; however, abundant regrowth via rhizomes occurred within 21 days after treatment (DAT) with respect to both the initial and sequential applications. Fenoxaprop at 1.18 kg ai/ha reduced bermudagrass cover from 100% to 11% in Tifgreen I, 9% in Tifway, and 14 % in Vamont two weeks after the third application. However, the bermudagrass recovered to 75%, 73%, and 44 % cover, respectively, at 35 days after the third application. Fluazifop at 0.20 kg ai/ha gave excellent control of bermudagrass leaving only 0 to 6 % cover at two weeks after the third application. Recovery to 23 % cover in Tifgreen I, 6% cover in Tifway, and 26% cover in Vamont was observed at 28 DAT of the third application. The mixture of fenoxaprop plus fluazifop proved effective at controlling bermudagrass shoots and significantly suppressing rhizomes at lower herbicide rates than the sequential applications of the single treatments. Control ratings of 90% in Tifgreen I, 99% in Tifway and 97% in Vamont were observed at five weeks after the third treatment.

Nomenclature: Bermudagrass (*Cynodon dactylon* (L.) Pers. 'Tifway', 'Tifgreen I', 'Vamont'; fenoxaprop [2-[4-(6-chloro-2-benzoxazobyl] oxy]phenoxy] propanoate]; fluazifop [2-[4-(5 trifluromethyl-2-pyridinyl)oxy] phenoxy]propionate]; chlorthalonil [tetrachloroisophthalonitrile]; brown patch (*Rhizoctonia solani* Kuhn); dollar spot *(Sclerotinia homeocarpa* F.T. Bennet); isophenos [1-Methylethyl 2-[[ethoxy[(1-methylethylamino] phosphinothioyl]oxy]benzoate]; prodiamine [N' N-di-n-propyl-2,4-dinitro-6-(trifluromethyl)-m- phenylenediamine]; oxadiazon [3-[2,4-dichloro-5-(1-methylethoxy) phenyl]-5-(1,1-dimethyl)-1,3,4-oxadiazol-2-(3H)-one]; 2,4-D [(2,4-dichlorophenoxy) acetic acid]; and dicamba [3,6-dichloro-2-methoxy benzoic acid.

2.1. INTRODUCTION

Bermudagrass (*Cynodon dactylon* (L.) *Pers.)* is considered to be one of the most difficult weeds to control in the world (10). It causes severe economic losses in both agronomic and horticultural crops (2, 3, 5, 6, 7, 9, 10, 11, 12, 13). Bermudagrass infestation and/or contamination is a significant problem due to its vigorous growth habit and ability to survive in diverse conditions. When other grasses are controlled with selective herbicides or desirable turfgrass is injured, bermudagrass populations can increase rapidly (10, 12).

Bermudagrass in mixed stands is very difficult to control due to the high degree of specificity selective herbicides must exhibit to suppress bermudagrass in other desirable turfgrasses. Moreover, bermudagrass suppression for extended periods without significant injury to desirable turfgrasses is most desirable, allowing the desirable turfgrass to grow into and compete with the suppressed bermudagrass. Problems with cross contamination occur in transition zones where both warm- and cool-season grasses are grown in close proximity. In addition, infestations of numerous bermudagrass cultivars into one another induce significant economic losses on sod farms, golf courses and recreational turf areas throughout the U.S (2, 7, 12). Areas with contamination cannot be harvested as sod or used in high profile turf such as putting greens. Furthermore, the financial and time resources required for chemical or cultural control can be prohibitive. Currently, no herbicides are commercially available for bermudagrass control in tall fescue or other cool-season grasses (3, 4, 7, 8).

The combination of fenoxaprop [2-[4-(6-chloro-2-benzoxazoxyl]oxy]phenoxy] propanoate] plus fluazifop [2-[4-(5 trifluromethyl-2-pyridinyl)oxy] phenoxy]propionate] is used to control perennial weeds such as dallisgrass and johnsongrass in both agronomic and horticultural crops. In preliminary studies with this combination safety to tall fescue as well as excellent control of various bermudagrass cultivars was attained (1).

The objectives of this research were three fold. First, field tests were performed to determine the efficacy of fenoxaprop and/or fluazifop for control of various bermudagrass cultivars. Second, measurements were taken to determine the degree of extended control or suppression by measuring regrowth after a period of winter dormancy. Third, tests were established to determine the degree of tolerance tall fescue has to fenoxaprop and fluazifop.

2.2. MATERIALS AND METHODS

Field studies were conducted in 1993, 1994, and 1995 to determine the efficacy of fenoxaprop and/or fluazifop for control of bermudagrass cultivars and the tolerance of tall fescue to these herbicides (Table 2.1). Test sites were in Baskersville, Virginia, which is located 90 meters above sea level. The climate is well suited for bermudagrass and tall fescue production. The bermudagrass areas were developed for 10 months after sprigging. The soil consisted of an Appling sandy loam (clayey, koaolinitic, thermic typic Hapludult) with a pH of 6.7 and an organic matter content of 1.9%.

Irrigation was performed on an as needed basis (12). Chlorothalonil (tetrachloroisoph thalonitrile] at 4.76- 17.5 kg ai /ha was used to control brown patch (*Rhizoctonia solani* Kuhn) and dollar spot *(Sclerotinia homeocarpa* F.T. Bennet). Rates varied depending on disease pressure, climatic conditions and acres of turf affected. Isophenos [1-Methylethyl 2-[[ethoxy[(1-methylethylamino] phosphinothioyl] oxy]benzoate] at 2.2 kg ai/ha was used for white grub control. Ammonium nitrate was applied to turfgrasses at 75-100 kg nitrogen (N)/ha/year. For annual grass control, either prodiamine [N',N'-di-n-propyl-2,4-dinitro-6-(trifluromethyl)-m-phenylenediamine] at 0.8 kg ai/ ha, or oxadiazon [3-[2,4-dichloro-5-(1-methylethoxy) phenyl]-5-(1,1-dimethyl)-1,3,4-oxadiazol-2-(3H)-one] at 2.2-4.5 kg ai/ha was used. To control broadleaf weeds, a mixture of 2,4-D [(2,4-dichlorophenoxy)acetic acid] at 0.6 kg ai/ha and dicamba [3,6-dichloro-2-methoxybenzoic acid] at 0.3 kg ai/ha was used (12). Mowing heights were 2.5 cm for bermudagrass and at 7.5 to 8.75 cm for tall fescue with greater cutting heights used during June, July and August. Mowing was performed 2 or 3 times a week depending on the weather conditions.

Chemical treatments were applied to 1.8 m x7.2 m plots with a CO_2 bicycle sprayer[1] using 8004 flat fan nozzle tips[2] and a pressure of 210 kPa to apply 280 L/ha. Herbicide rates were selected after reviewing previous research regarding fenoxaprop and fluazifop on tall fescue and bermudagrass. Sequential applications of both fenoxaprop isomers at 0.40, 0.80, 1.18 kg ai/ha, fluazifop at 0.20 kg ai/ha and the mixture of fenoxaprop (R + isomer) and fluazifop at 0.025+0.075,

1 R & D sprayers Inc., 790 E. Natchez Blve., Opelousas, LA 70570
2 Spraying Systems Co., North Ave., Wheaton, IL 60187-7900

0.05+0.15, and 0.10+0.30 kg ai/ha respectively were made in all tests. All chemical treatments were applied with 0.25% v/v nonionic surfactant[3].

In 1994 and 1995, treatments were applied to 'Vamont', 'Tifgreen' and 'Tifway' cultivars with each cultivar being a separate test in isolated fields, along with an adjacent tall fescue field to evaluate its tolerance to these herbicides. In 1994, the initial treatments were made on June 28 and followed with sequential treatments on July 26 and August 30. In 1995, the initial treatments were made on May 9 and followed with sequential treatments June 9 and July 10.

Visual estimates of bermudagrass control, percent cover and injury were conducted from two weeks after the initial treatment and continued on biweekly intervals until eight weeks after the third herbicide treatment with an additional rating the following spring approximately four weeks after green up. Each plot was rated as a direct comparison to the control plot in the same replication.

Turf injury was rated on a 0 to 10 scale. The numeric values indicated the following:

0	no apparent injury to turfgrass
1 to 3	slight injury, acceptable color, very little discoloration
4 to 6	definite turfgrass injury, noticeable discoloration
7 to 9	unacceptable injury to serious injury, necrosis
10	dead and brown turfgrass

Bermudagrass control was rated on a 0 to 100 scale. The numeric values indicate the following:

0	no apparent response
10 to 30	slight control or injury, slight yellowing
40 to 60	poor to fair control, number of green shoots minimally reduced
70 to 80	fair to good control, number of green shoots moderately reduced
80 to 90	good weed control, number of green shoots severely reduced
90 to 95	excellent weed control, 90 to 95% green shoot reduction
97 to 99	excellent weed control, 97 to 99% green shoot reduction
100	complete control of targeted weed

3 Kinetic, Helena Chemical Co., 6075 Poplar Ave., Memphis, TN 38119. Organisilicone and NIS.

Bermudagrass percent cover was rated as a percentage of actively growing (green) bermudagrass (0-100) in the plot being observed. Percent cover was used as an indicator of rhizome regrowth. Bermudagrass shoot regrowth from rhizomes at various soil depth occurs between two and four weeks after herbicide application.

Data were subjected to analysis of variance and means were separated using Duncan's new multiple range test at the 0.05 significance level. A homogeneity test was performed and acceptable variances were present. Data were combined from both the 1994 and 1995 experiments producing one randomized complete block experiment with six replications.

2.3. RESULTS AND DISCUSSION

Only comparisons among chemical treatments within each individual grass can be evaluated due to the use of separate test sites. This precludes the ability to compare susceptibility among various bermudagrass cultivars. Injury levels of bermudagrass were as high as 8.5 2 weeks after treatment with fenoxaprop on Tifgreen, Tifway and Vamont however within four weeks after application injury levels were acceptable visually or minimal shoot control was expressed. The 0.20 rate of fluazifop and the mixture maintained high levels of injury at all ratings for each of the three grasses (Tables 2.2, 2.3 and 2.4).

Multiple applications of fenoxaprop and fluazifop when applied alone were effective for control of bermudagrass shoots, however abundant regrowth occurred within 21 – 28 days after all three sequential treatments. Tables 2.5, 2.6 and 2.7 provide percent cover ratings for Tifgreen, Tifway and Vamont and show initial reduction in cover followed by rapid recovery at 28 to 35 DAT for first and second application. Tifway bermudagrass had 43% cover ten days after initial treatment of fenoxaprop at 0.80 kg ai and 19 % cover fourteen days after second application while recovering to 89% two weeks later and to 92% cover thirty-five days after the third application. Vamont cover was reduced with sequential applications; however, it recovered to 44% cover at the 1.18 kg ai rate fenoxaprop and 26% with 0.20 kg ai/ha rate of the premix thirty five days after the third application. Fluazifop was significantly more effective in control of bermudagrass than fenoxaprop (Table 2.7). Tifgreen cover at 35 days after the third application of 0.20 kg ai/ha of

fluazifop was 23% cover whereas the 1.18 kg ai/ha rate of fenoxaprop had 75% cover at the same rating (Table 2.9).

The premix fenoxaprop and fluazifop formulation proved effective in bermudagrass control with reduced rates of fenoxaprop. The more active isomer of fenoxaprop, present in the premix formulation, at 25% of the fluazifop rate, provided between 59 -77% control at the 0.20 kg ai/ha rate and 90-99% control of each bermudagrass cultivar at the 0.40 kg ai/ha rate at thirty five days after the third application. (Table 2.8).

Bermudagrass vegetatively reproduces and overwinters via rhizomes at various depths beneath the soil surface. Therefore, treatments that suppress or control rhizome growth and/or development would attain lower levels of bermudagrass cover during spring green up and establishment. By evaluating percent cover after a dormancy period a correlation could be made with regard to rhizome control with herbicides applied in the previous year.

During the spring of 1995, approximately 28 days after green up, experiments were rated for percent ground cover (12). At 203 days after the third application, percent bermudagrass cover was as low as 2-3% in the premix plots while the fenoxaprop plots were approximately 100% (Table 2.9). The principal difference between individual application of fenoxaprop and fluazifop from treatments with the premix of fenoxaprop plus fluazifop is the degree of rhizome suppression achieved. In some synergistic manner, the combined application provides greater rhizome control, as is indicated by the significantly lower levels of bermudagrass cover at 203 days after last application.

Injury to tall fescue:. Fenoxaprop was safe on tall fescue; however, these rates did not significantly suppress bermudagrass for an extended period of time. No visible injury symptoms were attained at any time from fenoxaprop treatments. Fluazifop at 0.20 kg ai/ha produced injury levels as high as 4.7 on tall fescue yet recovery was observed prior to the next application except for treatment three(Table 2.10). A substantial degree of variance in tall fescue injury levels from fluazifop was observed from the separate applications and replicates within a single treatment. In some instances, moderate injury levels were attained; however, at other times only minimal turf injury was visible. The premix containing fenoxaprop plus fluazifop produced an injury level of 5.0 at 14 days after the third application of the 0.40 kg ai/ha rate. Lower rates of the combination did not significantly injure the tall fescue and the levels of injury remained much more consistent than

when the fluazifop was applied alone. Moreover, the fluazifop alone at 0.20 kg ai/ha produced statistically equal injury levels to that of the 0.40 kg ai/ha rate of the mixture which contains 0.30 kg ai/ha fluazifop (Table 2.10).

Bermudagrass suppression was achieved with higher rates (i.e. 0.80 and 1.18 kg ai/ha) of fenoxaprop however an abundant regrowth from rhizomes and stolons would soon occur minimizing long-term suppression. The fluazifop and mixture treatments did achieve extended suppression and/or eradication of bermudagrass even apparent 203 days after treatment the following spring. This demonstrated the degree of rhizome suppression; however, these rates also placed visual injury on tall fescue ranging from weeks to months. Sequential applications of fenoxaprop could be used to suppress bermudagrass without injuring tall fescue or to suppress other grassy weeds in bermudagrass while fluazifop or combination treatments could be used to control bermudagrass growth when levels of tall fescue injury could be tolerated.

Table 2.1. Test Sites

Variety	Location	Dates	Year
TiFway (419)	Baskersville VA	6/28, 7/26 & 8/30	1994
		5/9, 6/8 & 7/10	1995
Tifgreen(328)	Baskersville VA	6/28, 7/26 & 8/30	1994
		5/9, 6/8 & 7/10	1995
Vamont	Baskersville VA	6/28, 7/26 & 8/30	1994
		5/9, 6/8 & 7/10	1995
Confederate Tall Fescue	Baskersville VA	6/28, 7/26 & 8/30	1994
		5/9, 6/8 & 7/10	1995

Table 2.2.

Tifgreen I bermudagrass injury ratings (0-10) with fenoxaprop and fluazifop applied alone and in combination in 1994 & 1995[a]

		Days after each of the sequential treatments					
		Treatment 1		Treatment 2		Treatment 3	
Fenoxaprop	Fluazifop	10 DAT	28 DAT	14 DAT	28 DAT	14 DAT	35 DAT
-------- kg ai ha $^{-1}$ --------							
0.4		4.5c b	3e	7.5b	1.3ed	5.3c	1de
0.8		5.5 bc	4.4de	8b	2cd	7.3b	1de
1.18		5.8bc	5.3dc	9.2a	3.5bc	7.7b	3.2c
	0.2	7.4a	7.3ab	10a	7.5a	10a	8a
0.025	0.075	5.5bc	3.7e	9.7a	5b	9.5a	4.8b
0.05	0.15	6.3ab	6.3bc	9.7a	5b	9.5a	4.8b
0.1	0.3	7.7a	8.7a	10a	8a	9.8a	8.5a
	Untreated	0d	0f	0c	0e	0d	0e

a All treatments contained 0.25 % v/v non-ionic surfactant

b Means within a column followed by the same letter do not differ at the 0.05 significance level by Duncan's Multiple Range Test

Table 2.3.

Tifway bermudagrass injury ratings (0-10) with fenoxaprop and fluazifop applied alone and in combination in 1994 & 1995[a]

		Days after each of the sequential treatments					
		Treatment 1		Treatment 2		Treatment 3	
Fenoxaprop	Fluazifop	10 DAT	28 DAT	14 DAT	28 DAT	14 DAT	35 DAT
-------- kg ai ha $^{-1}$ --------							
0.4		4.5c [b]	2.8d	7c	1.3ed	5.8c	1.2b
0.8		5.5bc	4.3dc	7.7bc	2cd	7.3b	1.3b
1.18		5.8bc	4.8c	8.5ab	3.3cb	7.7b	3b
	0.2	7.9a	8ab	10a	8.2a	10a	9.3ab
0.025	0.075	6.2b	5.2c	9.7a	4.9b	6.8b	4.3b
0.05	0.15	6.9ab	7.2b	9.8a	6.9a	9.5a	6.3ab
0.1	0.3	8.2a	9.2a	10a	8.7a	10a	9.8ab
	Untreated	0d	0e	0d	0e	0d	0b

a All treatments contained 0.25 % v/v non-ionic surfactant
b Means within a column followed by the same letter do not differ at the 0.05 significance level by Duncan's Multiple Range Test

Table 2.4.

Vamont bermudagrass injury ratings (0-10) with fenoxaprop and fluazifop applied alone and in combination in 1994 & 1995[a]

		Days after each of the sequential treatments					
		Treatment 1		Treatment 2		Treatment 3	
Fenoxaprop	Fluazifop	10 DAT	28 DAT	14 DAT	28 DAT	14 DAT	35 DAT
-------- kg ai ha $^{-1}$ --------							
0.4		4.6c [b]	3.7c	6.3c	2.8e	6.7d	2.7cd
0.8		5.1c	4.9bc	5.7c	3.8de	7.8dc	3.8bc
1.18		5.6bc	4.8bc	7.3bc	5.2cd	8bc	5.5b
	0.2	5.5bc	4.2c	8.3b	4.2de	7.3cd	2.7cd
0.025	0.075	7ab	6.1b	9.7a	6.2bc	9.2ab	6.2b
0.1	0.3	8a	7.8a	10a	9.2a	10a	9.7a
	Untreated	0d	0e	0d	0e	0d	0b

a All treatments contained 0.25 % v/v non-ionic surfactant

b Means within a column followed by the same letter do not differ at the 0.05 significance level by Duncan's Multiple Range Test

Table 2.5.

Tifgreen I bermudagrass cover (%) with fenoxaprop and fluazifop applied alone and in combination in 1994 & 1995[a]

		Days after each of the sequential treatments					
		Treatment 1		Treatment 2		Treatment 3	
Fenoxaprop	Fluazifop	10 DAT	28 DAT	14 DAT	28 DAT	14 DAT	35 DAT
-------- kg ai ha $^{-1}$ --------		---------- % Cover ----------					
0.4		60b [b]	71bc	21b	93a	50b	97ab
0.8		42bc	57bcd	15bc	89a	18c	93ab
1.18		42bc	52cd	10bcd	71b	11cd	75cd
	0.2	20d	18e	0d	14d	0d	23e
0.025	0.075	46bc	72b	5cd	74b	15cd	82bc
0.05	0.15	33cd	43d	1d	54c	2d	63d
0.1	0.3	15d	7e	1d	17d	1d	9e
	Untreated	100a	99a	99a	100a	99a	100a

a All treatments contained 0.25 % v/v non-ionic surfactant
b Means within a column followed by the same letter do not differ at the 0.05 significance level by Duncan's Multiple Range Test

Table 2.6.

Tifway bermudagrass cover (%) with fenoxaprop and fluazifop applied alone and in combination in 1994 & 1995[a]

		Days after each of the sequential treatments					
		Treatment 1		Treatment 2		Treatment 3	
Fenoxaprop	Fluazifop	10 DAT	28 DAT	14 DAT	28 DAT	14 DAT	35 DAT
-------- kg ai ha $^{-1}$ --------		---------- % Cover ----------					
0.4		59b[b]	72b	26b	93a	42b	95a
0.8		43bc	59b	19bc	89ab	17c	92ab
1.18		36cd	54b	14bc	71bc	9c	73bc
	0.2	18de	11c	1c	15de	0c	6e
0.025	0.075	38cd	59b	15bc	58c	16c	62c
0.05	0.15	23cde	27c	0c	33d	1c	33d
0.1	0.3	15e	3c	0c	9e	0c	1e
	Untreated	98a	100a	100a	100a	100a	100a

a All treatments contained 0.25 % v/v non-ionic surfactant

b Means within a column followed by the same letter do not differ at the 0.05 significance level by Duncan's Multiple Range Test

Table 2.7.

Vamont bermudagrass cover (%) with fenoxaprop and fluazifop applied alone and in combination in 1994 & 1995[a]

		Days after each of the sequential treatments					
		Treatment 1		Treatment 2		Treatment 3	
Fenoxaprop	Fluazifop	10 DAT	28 DAT	14 DAT	28 DAT	14 DAT	35 DAT
-------- kg ai ha $^{-1}$ --------		---------- % Cover ----------					
0.4		53b[b]	71ab	32b	85ab	26b	75ab
0.8		37bc	53b	29bc	63bc	17bc	57bc
1.18		43b	53b	22bc	56cd	14bcd	44cd
	0.2	25cd	30c	2c	35de	6cd	26de
0.025	0.075	43b	58b	8c	54cd	28b	67bc
0.05	0.15	25cd	30c	2c	35de	6cd	26de
0.1	0.3	16d	14c	1c	3f	0d	0e
	Untreated	97a	90a	99a	99a	97a	94a

a All treatments contained 0.25 % v/v non-ionic surfactant
b Means within a column followed by the same letter do not differ at the 0.05 significance level by Duncan's Multiple Range Test

Table 2.8.

Bermudagrass control ratings (0-100) with fenoxaprop and fluazifop applied alone and in combination in 1994 & 1995[a]

		35 days after third application		
Fenoxaprop	Fluazifop	Tifgreen I	Tifway	Vamont
------ kg ai ha $^{-1}$ -----		---------- % Control ----------		
0.4		29d[b]	7e	23de
0.8		48dc	11e	43cd
1.18		58bc	24d	53bc
0.2		77ab	94a	98a
0.025	0.075	42cd	45c	23de
0.05	0.15	69b	59b	77ab
0.1	0.3	90a	99a	97a
Untreated		0e	0e	6e

a All treatments contained 0.25 % v/v non-ionic surfactant
b Means within a column followed by the same letter do not differ at the 0.05 significance level by Duncan's Multiple Range Test

Table 2.9.

Bermudagrass cover (%) ratings with fenoxaprop and fluazifop applied alone and in combination in 1994 & 1995[a]

		Days after the third application					
		28 DAT		35 DAT		203 DAT	
Fenoxaprop	Fluazifop	Tifgreen	Tifway	Tifgreen	Tifway	Tifgreen	Tifway
------ kg ai ha $^{-1}$ -----							
0.4		93ab	93a	97ab	95a	98a	99a
0.8		89a	89ab	93ab	92ab	83a	80a
1.18		71b	71bc	75cd	73bc	75ab	75ab
0.2		14d	15de	23e	6e	22c	32c
0.025	0.075	74b	58c	82bc	62c	52b	55b
0.05	0.15	54c	33d	63d	33d	15c	20c
0.1	0.3	17d	9e	9e	1e	2c	3c
Untreated		100a	100a	100a	100a	99a	100a

a All treatments contained 0.25 % v/v non-ionic surfactant

b Means within a column followed by the same letter do not differ at the 0.05 significance level by Duncan's Multiple Range Test

Table 2.10.

Tall fescue injury (0-10) with fenoxaprop and fluazifop applied alone and in combination in Baskersville during 1994[a]

		Days after each of the sequential treatments					
		Treatment 1		Treatment 2		Treatment 3	
Fenoxaprop	Fluazifop	10 DAT	28 DAT	14 DAT	28 DAT	14 DAT	35 DAT
------ kg ai ha $^{-1}$ -----							
0.4		0b[b]	0b	0b	0b	0c	0b
0.8		0b	0b	0b	0b	0c	0b
1.18		0b	0b	0b	0b	0c	0b
0.2		3.7a	2.3a	4.7a	3a	2.3b	3.3a
0.025	0.075	0b	0b	0b	0b	0c	0b
0.05	0.15	1.3b	0b	0.7b	1.3b	1.7b	0b
0.1	0.3	3.7a	2.7a	4a	3.7a	5a	4.3a
Untreated		0b	0b	0b	0b	0c	0b

a All treatments contained 0.25 % v/v non-ionic surfactant

b Means within a column followed by the same letter do not differ at the 0.05 significance level by Duncan's Multiple Range Test

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