

Effect of Granular Norflurazon (Zorial 5G) on Alfalfa Establishment in Parker Valley

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Abstract

The tolerance of seedling alfalfa to norflurazon applied at planting or 6, 14, or 20 weeks after planting was evaluated in Parker Valley in the spring of 1998. At each application date, rates of 0, 1.5, 2, 3, or 4 lbs a.i./A of norflurazon formulated as a 5% sand granule (Zorial 5G) were applied using a ground driven Valmar granule applicator. Zorial 5G at rates ranging from 1.5 to 4.0 lbs a.i./acre applied no earlier than 6 weeks after planting had no effect on alfalfa seedling emergence and stand establishment. These applications also did not reduce the fresh weight of foliage harvested on July 1, 1998. For effective spring and summer purple nutsedge control, the first spring application of Zorial 5G should not be any earlier than 14 weeks after planting alfalfa or late January whichever is later. In a newly planted alfalfa field prone to high purple nutsedge weed pressure, spring Zorial 5G application rates ranging from 1.5 to 2.0 lbs a.i./acre should be considered.

Introduction

Purple nutsedge (*Cyperus rotundus*) is one of the most common weeds in Arizona (McCloskey *et al.*, 1998) and is difficult to control in alfalfa production systems. It is a perennial that reproduces vegetatively from an underground rhizome and tuber system. Nutsedge shoots emerge in the spring as temperatures increase and die in fall and winter when temperatures decrease. Preemergence applications of EPTC (EPTAM) prior to or at planting and in established alfalfa stands are registered in Arizona. However, when fields are prepared and planted to alfalfa in late fall there is usually little active nutsedge growth. EPTC has a half-life in the soil of 6 days and usually provides 4 to 6 weeks of weed control (WSSA, 1994). As a result of the growth habit of purple nutsedge and the short soil residual of EPTC, the most common method of nutsedge control in alfalfa has been multiple applications of EPTC granules (Eptam 20G) initiated in the spring prior to emergence of shoots. Eptam 20G is applied after the hay is removed from the field and is incorporated by irrigation. In Arizona's low desert alfalfa fields, four to five applications per season are required to suppress nutsedge and reduce the amount of nutsedge foliage in the hay (Tickes, 1990). Tickes (1991) has shown in Yuma County alfalfa fields that although nutsedge foliage in the hay was reduced by multiple EPTC applications, the number of nutsedge shoots per unit area continue to increase despite treatment. Thus, alternative methods of purple nutsedge control in alfalfa have been investigated.

Norflurazon (Zorial Rapid 80 or Zorial 5G) is applied as a preemergence herbicide for the control of nutsedges as well as many annual broadleaf and grass weeds and has recently been registered for use in Arizona alfalfa fields. Norflurazon is absorbed by soil colloids, has low soil mobility and has a half-life of 45-180 days in soil (WSSA, 1994) that usually provides 6 to 12 months of weed control at the rates applied in alfalfa. The current Zorial label specifies that Zorial can not be applied to new alfalfa stands until 5 months after planting. If alfalfa fields are planted in late October to early November, then Zorial can not be applied until late March or early April. In Parker Valley, purple nutsedge commonly emerges in February or early March. Since little data exists to justify the 5 month waiting period and because nutsedge control would be more efficacious with earlier applications, the tolerance of newly seeded alfalfa

to norflurazon was evaluated. Field experiments were established during 1997-98 in Parker Valley (located in southwestern La Paz County, Arizona) and the responses of alfalfa to norflurazon applied at planting and at 6, 14, and 20 weeks after planting were measured.

Materials and Methods

Four experiments were conducted in a Parker Valley alfalfa field with loam soils from the Gilman soil series. Following the last alfalfa harvest in the fall of 1997, the field was ripped and disced on an angle from the cutting direction. After drying for two weeks, a disc and cultipacker were run over the field in the same pass in the cutting direction and then the field was land planed. The field was planted with a grower collected F2 generation of 'CUFF101' seed applied at a rate of 22 lb/A. Granule 11-52-0 fertilizer was applied at 100 lb/A. The initial at planting treatments of Zorial 5G were applied and then the cultipacker was run over the field a second time. The field was irrigated to germinate the alfalfa seed and additional fertilizer was applied in the irrigation water (8 gal of 10-34-0 fertilizer/A).

Four experiments that differed only with respect to the Zorial 5G application time were established using a randomized complete block design with four replications or blocks. Individual plots were 25 ft wide by 30 ft long but norflurazon was applied only in the center 20 ft of each plot. Zorial 5G was applied at planting on 10-31-97 and incorporated with irrigation on 11-1-98 (referred to as the 0 WAP application). Zorial 5G was also applied to the newly established alfalfa on 12-12-97 when the alfalfa had 1 to 2 trifoliolate leaves and incorporated by irrigation on 12-15-97 (6.4 WAP), on 1-21-98 when the alfalfa had 5 to 8 trifoliolate leaves and incorporated on 2-4-98 by 1.03 inches of rain (13.7 WAP), and on 3-5-98 after the first cutting and incorporated by irrigation on 3-23-98 (20.4 WAP). Since irrigation or rainfall was required to incorporate and activate the herbicide, the application times are hereafter referred to by the number of weeks between planting and incorporation. The soil texture varied between experiments and was determined by taking 12 soil cores (1 in diameter by 12 in deep) in each of the experiments (Table 1). At each application time, norflurazon was applied at approximately 0, 1.5, 2, 3, and 4 lbs a.i./acre corresponding to 30, 40, 60, and 80 lbs of Zorial 5G, respectively. Actual treatment rates of Zorial 5G are given in the data tables. The Zorial 5G was applied with a Valmar (model 1255 PT) small plot granular applicator.

Alfalfa stand counts were conducted at various times after planting in all four experiments (see data tables for dates) by subsampling each plot three or four times using 0.25 m² squares and counting all green seedlings in the sampling squares. Visual estimates of winter weed species control were made in the 0 WAP application timing experiment on January 21, 1998. Final alfalfa stand counts were conducted in all plots on April 2, 1998. Visual estimates of purple nutsedge control were made following each hay cutting on May 30, 1998, July 6, 1998, and on August 4, 1998 in all plots. Fresh weight forage yields were measured in the 6.4, 13.7, and 20.4 WAP application timing experiments on July 1, 1998 with a small plot forage harvester. Alleys between adjacent plots were cut with a commercial forage harvester resulting in harvested areas that were 5 ft wide (the width of the small plot cutting bar) by the length of the remaining length of alfalfa in each plot. Actual harvested plot lengths were measured and ranged between 14 to 18 feet. The small plot forage harvester deposited the harvested alfalfa in a weight basket and the fresh weight of each sample was measured immediately after cutting.

Results and Discussion

Norflurazon applied at planting reduced alfalfa plant stand counts by an average over all counting dates of 57 to 82 percent at rates ranging from 1.5 to 4 lbs a.i./A (30 to 80 lbs Zorial 5G), respectively (Table 2). This data indicates that norflurazon applications at planting will severely reduce stand establishment and most likely subsequent alfalfa yields. However, norflurazon applied at rates up to 4 lbs a.i./A at 6.7, 13.7 and 20.4 weeks after planting had no effect on alfalfa populations or forage fresh weights harvested on July 1, 1998 about 35 WAP (Table 2). On December 4, 1997 the alfalfa plants had 1 to 2 trifoliolate leaves. The smaller plants had roots 2 to 3 in deep while the larger plants had roots 4 to 6 in deep. Applications of norflurazon 6 weeks after planting or later allowed initial root growth to occur in the absence of herbicide. Furthermore, 6 weeks allowed sufficient root growth to occur such that the alfalfa was tolerant to high herbicide concentrations suggesting that the alfalfa roots were utilizing moisture and nutrients in the soil profile below the herbicide treated soil zone at the top of the profile. The current norflurazon label for use in alfalfa states that

“Zorial 5G may be applied to healthy stands of established alfalfa at 1 lb a.i./A no earlier than 5 months following emergence”. However, there is no research data in the literature to support or disclaim either the 5 month waiting period before application or the 1 lb a.i./A (20 lb Zorial 5G/A) rate limitation. The results of this study show that norflurazon and can be applied much earlier than 5 months after emergence and at higher rates than 1.0 lbs a.i./A (20 lbs Zorial 5G/A) in loam soils.

Winter weed control was visually rated on January 21, 1998 in the experiment where Zorial 5G was applied at planting. At this time, alfalfa plant densities in treated plots ranged from 2.1 to 6.5 plants/ft². Winter annual weed suppression resulting from Zorial 5G applied on October 31, 1997 was good for shepherdspurse (*Casella bursa-pastoris*) and rabbitfoot grass (*Polypogon monspeliensis*) (66-85% control) and fair for annual sowthistle (*Sonchus oleraceus*) (48-69%) (Table 3). Purple nutsedge control was also visually estimated in the spring and summer of 1998 (Table 4). Zorial applications at 13.7 and 20.4 weeks after planting provided a higher degree of nutsedge control on the August 4th observation date, compared to applications made at planting and 6.4 weeks after planting. Application rates of 3.0 to 4.0 lbs a.i./acre were necessary to provide sufficient purple nutsedge suppression from a single mid-December application (13.7 WAP). For effective spring and summer purple nutsedge suppression, the first spring application of Zorial 5G should not be any earlier than about 14 weeks after planting alfalfa or late January, which ever comes later. In a newly planted alfalfa field prone to high purple nutsedge weed pressure, spring Zorial 5G application rates ranging from 1.5 to 2.0 lbs a.i./acre should be considered.

References

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Table 1. Soil texture analysis for the Gilman loams in the Zorial 5G experiments conducted in Parker Valley in 1997-98.

Zorial 5G Application Timing	Textural Class	Organic matter	Sand	Silt	Clay
(WAP)		(%)	(%)	(%)	(%)
0	silt loam	2.72	20	62	18
6.4	loam	2.03	44	62	18
13.7	loam	1.53	38	49	13
20.4	-	-	-	-	-

Table 2. Alfalfa plant stand counts for various dates and fresh weights harvested on July 1, 1998.

Zorial 5G Application Date	Application Rate	Alfalfa Stand Counts ¹				Alfalfa Fresh Weight ²
		12-4-97	12-30-97	1-21-98	4-2-98	
(WAP)	(lbs Zorial 5G/A)	(plants/ft ²)	(plants/ft ²)	(plants/ft ²)	(plants/ft ²)	(lbs/plot)
0	0	31.7 a	17.8 a	-	15.6 a	-
	29.8	12.9 b	6.4 b	-	8.0 b	-
	40.1	10.9 b	5.6 b	-	8.0 b	-
	59.1	9.7 b	3.5 bc	-	7.3 bc	-
	80.3	4.8 c	2.1 c	-	4.2 c	-
6.4	0	-	14.3 a	18.4 a	18.2 a	161 a
	29.2	-	12.4 a	19.3 a	18.1 a	162 a
	39.2	-	13.8 a	20.9 a	19.5 a	178 a
	58.7	-	13.0 a	19.9 a	19.1 a	167 a
	78.1	-	13.1 a	22.4 a	19.8 a	183 a
13.7	0	-	-	-	18.9 b	201 a
	30.6	-	-	-	21.1 a	197 a
	41.1	-	-	-	19.7 ab	195 a
	61.2	-	-	-	20.6 a	186 a
	82.2	-	-	-	19.9 ab	197 a
20.4	0	-	-	-	18.8 a	176 a
	30.6	-	-	-	21.2 a	170 a
	41.1	-	-	-	21.2 a	166 a
	61.2	-	-	-	20.7 a	177 a
	82.2	-	-	-	20.2 a	175 a

¹Data are means of four plots with three or four 0.25 m² subsamples per plot. Means within an experiment (i.e., WAP application time) within columns followed by the same letter are not significantly different at the 0.05 level of probability according to Duncan's Multiple Range Test.

²Data are means standardized to 600 sq ft per plot. Means within an experiment (i.e., WAP application time) within columns followed by the same letter are not significantly different at the 0.05 level of probability according to Duncan's Multiple Range Test.

Table 3. Visual estimates of winter annual weed control 82 days after treatment (11.7 WAP, January 21, 1998) for various rates of Zorial 5G applied at planting.

Norflurazon Rate	Zorial 5G Rate	Percent Weed Control ¹		
		Annual Sowthistle	Shepherdspurse	Rabbitfoot grass
<i>(lbs a.i./A)</i>	<i>(lbs/A)</i>	<i>(%)</i>	<i>(%)</i>	<i>(%)</i>
0	0	0 c	0 b	0 c
1.49	29.8	48 b	73 a	66 b
2.01	40.1	45 b	74 a	73 ab
2.96	59.1	58 ab	73 a	78 ab
4.01	80.3	69 a	85 a	83 a

¹Means within columns followed by the same letter are not significantly different at the 0.05 level of probability according to Duncan's Multiple Range Test.

Table 4. Visual estimates of purple nutsedge suppression at various rates of Zorial 5G applied at various times after planting.

Zorial 5G Application Date	Application Rate	Purple Nutsedge Control ¹		
		5-30-97	7-6-98	8-4-98
(WAP)	(lbs Zorial 5G/A)	(%)	(%)	(%)
0	0	0 j	0 h	0 i
	29.8	13 i	25 g	14 g
	40.1	19 fg	28 fg	18 h
	59.1	23 ef	35 de	26 fg
	80.3	30 bc	34 def	29 ef
6.4	0	0 j	0 h	0 i
	29.2	14 hi	29 efg	20 gh
	39.2	21 ef	35 de	33 def
	58.7	24 de	53 b	54 c
	78.1	29 bc	63 a	65 b
13.7	0	0 j	0 h	0 i
	30.6	16 gh	34 def	36 def
	41.1	23 ef	45 c	38 d
	61.2	29 bc	53 b	64 b
	82.2	35 a	60 a	74 a
20.4	0	0 j	0 h	0 i
	30.6	23 ef	38 d	30 ef
	41.1	26 cd	48 bc	40 d
	61.2	31 ab	60 a	55 c
	82.2	35 a	65 a	70 a

¹Data are means of four plots. The data were analyzed across all application times so that all means within a column can be compared. Means within a column followed by the same letter are not significantly different at the 0.05 level of probability according to Duncan's Multiple Range Test.