

PRIMISULFURON EFFECTS ON ROTATIONAL CROPS IN CENTRAL OREGON

P.E. Hendrickson, C.A. Mallory-Smith and B.D. Brewster

Introduction

Primisulfuron (Beacon) is registered in the Pacific Northwest for use in Kentucky bluegrass (*Poa pratensis* L.). This sulfonylurea herbicide controls annual and perennial grasses, including downy brome (*Bromus tectorum* L.), a major weed problem in central Oregon. Primisulfuron has a short to moderate soil persistence with a half-life of about 1 to 8 weeks under field conditions. Because sulfonylurea herbicides often have soil residuals that can injure subsequent rotational crops, studies were conducted to determine which crops might be injured following primisulfuron use.

Materials and Methods

Two experiments were conducted in Central Oregon to evaluate the tolerance of rotational crops to primisulfuron. Experiment 1 was conducted at the Central Oregon Agricultural Research Center (COARC) near Madras, OR, and consisted of two similar field trials to simulate planting a field with a different crop after losing a seedling stand of Kentucky bluegrass. Trial 1 was established in 1996 and Trial 2 was established in 1997. Experiment 2 (Trials 3 to 5) was conducted in established fields of Kentucky bluegrass near Madras and Culver, OR. Primisulfuron application data are presented in Table 1 and the soil characteristics are presented in Table 2.

The treatments were applied in 20 gpa of water at a pressure of 19 psi with a plot sprayer. A crop oil concentrate was added to all treatments at a rate of 1% v/v. Treatments were replicated four times in a randomized complete block design.

Table 1. Primisulfuron application data.

Rate	Date of application	
	Trial 1,3,4,5	Trial 2
(lb a.i./a)		
0.038	11/1/96	11/5/97
0.076	11/1/96	11/5/97
0.019 + 0.019	11/1/96 + 3/27/97	11/5/97 + 4/8/98

Table 2. Soil characteristics at each location.

Trial	Location	Soil texture	Soil pH	Organic matter (%)
1	COARC	Madras sandy loam	6.5	1.4
2	COARC	Madras sandy loam	6.8	1.4
3	Madras	Madras loam	4.9	1.8
4	Madras	Madras loam	5.4	2.2
5	Culver	Agency loam	5.6	1.8

Experiment 1: Plot dimensions were 8 ft by 20 ft and 8 ft by 10 ft for spring and fall planted crops, respectively. The seedling Kentucky bluegrass was killed with glyphosate in early spring, and the area was rototilled in the direction of primisulfuron application to restrict soil mixing among plots. Row spacing and planting dates for the two trials are presented in Table 3.

Table 3. Crops and planting dates for Experiment 1 in 1997 and 1998.

Crop	Planting date	
	Trial 1	Trial 2
Alfalfa	5/30/97	6/12/98
Canola	5/30/97	6/12/98
Spring wheat	5/30/97	6/12/98
Sugarbeets	5/30/97	6/12/98
	6/12/98	
Kentucky bluegrass	9/18/97	8/18/98
Peppermint	10/9/97	10/1/98
Winter wheat	10/9/97	10/1/98

The front half of each trial was seeded to alfalfa, canola, spring wheat, and sugarbeets in the spring following primisulfuron application, and was irrigated as needed. The back half of each trial was not irrigated during the summer, and was planted to Kentucky bluegrass, peppermint, and winter wheat in the fall. Crop rotation restrictions following primisulfuron applications to corn is 3 months for winter wheat, 8 months for alfalfa and spring-seeded small grains, and 18 months for canola, sugarbeets, Kentucky bluegrass, and peppermint (Anonymous 1999). Dry soil and limited rainfall during fall planting in Trial 2, resulted in poor stand establishment. Alfalfa, canola, spring wheat, and sugarbeets will be planted in Trial 2 in the spring of 1999. Only sugarbeets were seeded in Trial 1 in the spring of 1998. The crops were seeded perpendicular to the direction of herbicide application and the plots were hand-weeded.

Above-ground fresh weight yields were obtained from 12 ft of row in each plot about 5.5 weeks after planting the spring crops and 7 months after planting the fall crops. The data are presented as a percent of the untreated check while the mean separation procedures reflect differences observed in the fresh weights.

Experiment 2: Plot dimensions were 8 ft by 25 ft. The Kentucky bluegrass was harvested from 62.5 ft² per plot in July 1997. Carrots, spring wheat, and winter wheat were seeded in Trials 3, 4, and 5, respectively. The winter wheat and carrots were seeded in the fall of 1997, while the spring wheat was seeded in the spring of 1998. Visual estimates of percent crop injury were recorded for the three trials.

Results

Experiment 1: Injury from soil residues of primisulfuron varied with the crop in Trial 1. Canola, spring wheat, and sugarbeets planted in May 1997 were injured with sugarbeets suffering greater than 50 percent reduction in fresh weight at the 0.038 lb a.i./a rate (Figure 1). Alfalfa seeded in May 1997 and sugarbeets seeded in June 1998 were not significantly affected. There were no significant reductions of the fresh weights of crops planted in the fall of 1997 (Figure 2).

Fresh weight reductions of spring-planted crops in Trial 2 were greater than in Trial 1 (Figure 1). Fresh weights were reduced by an average of 71, 84, 76, and 100 percent for alfalfa, spring wheat, canola, and sugarbeets, respectively. Environmental factors known to increase the probability of phytotoxic residues of sulfonylurea herbicides persisting in the soil include low soil temperature and low soil moisture content. Rainfall from August 1996 to July 1997 was 15 in and from August 1997 to July 1998 was 14 in . In the 1996-1997 crop year, 61 percent of the precipitation was recorded between November 1 and January 31. During this period, Trial 1 was flooded with 4 in of water. In the 1997-1998 crop year, 37 percent of the precipitation was recorded in May. These factors may have contributed to the differences observed in primisulfuron persistence between the two trials.

Figure 1. Fresh weights of crops planted in the spring of 1997 and 1998 in soil previously treated with primisulfuron.

Figure 2. Fresh weights of crops planted in the fall of 1997 in soil treated with primisulfuron.

Experiment 2: No yield reductions occurred in the three established Kentucky bluegrass trials (Figure 3). The rotation crops of spring wheat, winter wheat, and carrots were not visibly injured by any of the primisulfuron treatments.

Figure 3. Effect of primisulfuron treatments on established Kentucky bluegrass seed yields.

Conclusions

Experiment 1: Crops planted in the spring after the loss of the seedling Kentucky bluegrass stand were injured in both trials. Crop injury was greater when dry weather occurred during the time between the primisulfuron application and seeding of these crops. This is consistent with the Beacon label which states that injury may occur under these conditions.

Experiment 2: Kentucky bluegrass yields were not reduced by fall applications of primisulfuron. None of the crops tested (carrots, winter wheat, and spring wheat) showed carry-over effects from primisulfuron.

Literature Cited

Anonymous. 1999. Sample labels and reference guide. Novartis Corp. Greensboro, NC. pp. 35-49.