

Carrot Tolerance to Pendimethalin and Oxyfluorfen

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Abstract

Two field trials were conducted in commercial hybrid carrot fields to determine carrot tolerance to pendimethalin and oxyfluorfen applied as an over-the-top broadcast treatment at layby. Broadcasting oxyfluorfen resulted in necrotic spots on carrot leaves that were visible at 6 and 28 days after application, but were no longer evident 42 days after application. Pendimethalin resulted in almost no visual injury to carrots at either location.

Introduction

Pendimethalin (Prowl[®]) and oxyfluorfen (Galigan[®]) herbicides are currently registered for use in carrot seed as a directed spray at layby. This application technique requires special spray equipment that can make the application complicated. These herbicides would be more useful as an over-the-top broadcast treatment at layby, but it is unknown if adequate carrot crop safety can be maintained with this type of application.

A single trial was conducted last year to evaluate carrot tolerance to pendimethalin (Affeldt et al. 2007). An unusual growth form was observed in that trial, but it was unclear if the growth form was the result of herbicide injury. The objective of these trials was to determine carrot tolerance to pendimethalin and oxyfluorfen applied as an over-the-top broadcast treatment at layby.

Materials and Methods

Two field trials were conducted in commercial hybrid carrot fields. The carrots were 'Nance' type and were steckling transplanted. One field was west and one field was north of Madras, Oregon. Herbicide application dates and carrot growth stages are shown in Table 1. Plots were 10 ft by 15 ft with four replications arranged as randomized complete blocks, with two blocks in female rows and two blocks in male rows. Treatments were applied with a CO₂ backpack sprayer delivering 20 or 40 gal/acre operating at 20 psi and 3 mph. Crop injury was quantified by making visual evaluations on a percentage scale. After the herbicide applications, carrot seed was collected prior to the fields being swathed to conduct germination testing. Carrot flowers were sampled at various heights from the two replications that were in the female rows and combined into one sample. The samples were then dried at 80°F for 5 days. The flowers were broken apart by hand and a representative sample of seed was sent to a commercial testing lab. The testing procedure was conducted on 400 seeds randomly sampled and tested over a 14-day period.

Results and Discussion

The field north of Madras had less vigorous carrots than the field west of Madras. The north field was transplanted later than the west field, and the north field had a volunteer winter wheat infestation that competed for resources early in the season. Broadcasting oxyfluorfen resulted in necrotic spots on carrot leaves that were visible at 6 and 28 days after application, but were no longer evident 42 days after application (Tables 1 and 2). Injury from oxyfluorfen was more severe on the north field than on the west. Carrot seed germination from oxyfluorfen plots was not tested.

Pendimethalin resulted in almost no visual injury to carrots at either location (Tables 1 and 2). There were no unusual growth habits in the carrot similar to what were observed in the trial in 2006. Carrot seed germination was extremely low compared to germination rates that would be typical for commercial seed production. There are at least two factors that likely are contributing to the low seed germination rate. First, the seed was not cleaned, which would have removed inert matter and immature seeds that ended up in the test sample; this would also have increased the variability of the results. Second, the seed was handled differently than in a commercial operation. Samples were collected prior to the fields being swathed and were oven dried as opposed to air drying in the field. This process likely prevented some of the immature seed from ripening properly.

Low seed germination and variability notwithstanding, pendimethalin at 1.9 lb/acre did not reduce germination at either location compared to untreated check plots. Pendimethalin at 3.8 lb/acre appears to have reduced germination in the west field. However, these differences in germination rate are not established statistically. The current pendimethalin label for carrot grown for seed allows for use rates of 0.475 to 1.9 lb/acre (1 to 4 pt of Prowl H₂O 3.8 CS). The rates evaluated in these trials represent one and two times the highest labeled rate. Therefore an over-the-top broadcast application of pendimethalin at layby should have adequate crop safety on carrot grown for seed at current labeled rates.

References

Affeldt, R., J. MacKenzie, B. Martens, and K. Farris. 2007. Carrot tolerance to pendimethalin and mesotrione broadcast at layby. Central Oregon Agricultural Research Center 2006 Annual Report. Special Report 1072:5-6.

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Table 1. Carrot response to pendimethalin and oxyfluorfen west of Madras, Oregon, 2007.

Treatment	Herbicide rate lb/acre	Application date	Application rate gal/acre	Carrot injury			Carrot seed germination ⁴
				17 May	8 June	22 June	
Check	---	---	---	0	0	0	19.75
Pendimethalin	1.9	11 May ²	20	0	0	0	29.25
Pendimethalin	3.8	11 May ²	20	0	0	0	11.25
Oxyfluorfen ¹	0.125	11 May ²	40	23	4	0	---
Oxyfluorfen ¹	0.25	11 May ²	40	26	4	0	---
Pendimethalin	1.9	22 Jun ³	20	---	---	0	32.0
Pendimethalin	3.8	22 Jun ³	20	---	---	0	13.0

¹Applications included non-ionic surfactant at 0.25% v/v.

²Carrots were 6 inches tall and still in a vegetative growth stage.

³Carrots were 40 inches tall and in an early reproductive growth stage.

⁴Data shown are not means across replications. Seed was not cleaned prior to testing.

Table 2. Carrot response to pendimethalin and oxyfluorfen north of Madras, Oregon, 2007.

Treatment	Herbicide rate lb/acre	Application date	Application rate gal/acre	Carrot injury			Carrot seed germination ⁴
				17 May	8 June	22 June	
Check	---	---	---	0	0	0	29
Pendimethalin	1.9	11 May ²	20	0	1	0	44
Pendimethalin	3.8	11 May ²	20	0	0	0	50
Oxyfluorfen ¹	0.125	11 May ²	40	34	25	0	---
Oxyfluorfen ¹	0.25	11 May ²	40	40	30	0	---
Pendimethalin	1.9	22 Jun ³	20	---	---	0	60
Pendimethalin	3.8	22 Jun ³	20	---	---	0	57

¹Applications included non-ionic surfactant at 0.25% v/v.

²Carrots were 3 inches tall and still in a vegetative growth stage.

³Carrots were 36 inches tall and in an early reproductive growth stage.

⁴Data shown are not means across replications. Seed was not cleaned prior to testing.