

ROTATIONAL CROP RESPONSE TO WHEAT HERBICIDE CARRYOVER

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Introduction

Herbicide carryover can restrict crop rotation following application of soil residual herbicides in the previous year(s). Rotational restrictions following herbicide application vary depending upon the herbicide used, rotational crop, and various environmental factors influencing the duration of herbicide soil persistence at or above injurious levels. In this study several crops were evaluated for their rotational response to the experimental herbicide BAS 635 00H, as well as the registered herbicides Paramount and Ally.

Methods

A trial was established at the Malheur Experiment Station to evaluate BAS 635 00H, Paramount, and Ally herbicides for rotational crop injury following postemergence application to spring wheat in the previous year. The soil type for the trial was an Owyhee silt loam having an organic matter content of 1.4 percent, a pH of 7.7, and a cation exchange capacity of 15 meq/100 g of soil. Experimental plots measured 24 ft by 60 ft and were arranged in a randomized complete block with three replicates. Herbicide treatments were applied with a CO₂-pressurized backpack sprayer calibrated to deliver 20 gal/acre at 30 psi.

Spring wheat (var. 'Penawawa') was seeded at a rate of 120 lbs/acre on April 15, 2000. Herbicides were applied postemergence to spring wheat on May 15, 2000. BAS 635 00H was applied at rates of 0.054, 0.108, and 0.162 lb ai/acre. Paramount application rates were 0.188, 0.375, and 0.56 lb ai/acre. Application rates for Ally were 0.004, 0.008, and 0.012 lb ai/acre. Both BAS 635 00H and Ally were applied with a non-ionic surfactant (NIS) applied at 0.25 percent v/v. Paramount was applied with a methylated seed oil (MSO) at a rate of 1.5 percent v/v.

The rotational crops evaluated were alfalfa, dry beans, potato, sugar beet, and wheat. Rotational crops were planted across the width of the herbicide treatments. Alfalfa (var. 'Rustler II') was planted at 25 lbs/acre on April 20. Pinto beans (var. 'Othello') were planted on May 21 using a two-inch seed spacing. 'Russet burbank' potatoes were planted using a 9-inch spacing on April 18. Sugar beets (var. 'PM-21') were planted on April 20 using a 2-inch spacing. Spring wheat (var. 'Alpowa') was planted at 120 lbs/acre on April 19. Injury evaluations were taken throughout the growing season. Yield data was collected for alfalfa on July 2 and August 9, wheat on August 6, pinto beans on August 20, potatoes on September 9, and sugar beets on October 3. Data were analyzed using ANOVA, and treatment means were separated using Fishers protected LSD (0.05).

Results

Crop injury from residual herbicide treatments was not apparent for alfalfa or wheat on May 18 or at any point during the growing season (Table 1). Injury to pinto beans was greatest with Paramount treatments ranging from 24 to 28 percent on July 2. Significant potato injury was observed on both

May 22 and July 2 in plots treated with Paramount. Injury in these plots ranged from 21 to 45 percent. Paramount injury to both dry beans and potatoes was characterized by growth regulator-type injury such as leaf crinkling and leaf cupping. On May 18, sugar beet injury was apparent in all treated plots and ranged from 9 to 56 percent. The greatest sugar beet injury was in plots treated with BAS 635 00H (0.162 lb ai/acre), and those treated with Ally at both 0.008 and 0.012 lb ai/acre. BAS 635 00H (0.162 lb ai/acre) injured sugar beets 37 and 24 percent on May 18 and July 2, respectively. BAS 635 00H applied at 0.162 lb ai/acre produced significantly greater injury than when applied at 0.054 lb ai/acre. Ally applied at 0.012 and 0.008 lb ai/acre injured sugar beets 26 and 28 percent greater on May 18 and 20 and 22 percent greater on July 2 than Ally applied at 0.004 lb ai/acre. On July 2, Paramount applied at 0.375 lb ai/acre was the only Paramount treatment that produced injury significantly greater than the untreated check.

There were no differences in yield among treatments for alfalfa, spring wheat, and pinto beans (Table 2). None of the herbicide treatments significantly reduced potato yields compared to the untreated check. Despite potato injury from Paramount soil residual activity, only Paramount applied at 0.375 lb ai/acre provided potato yields lower than the untreated check. Potato yields in plots treated with Ally were from 109 to 125 percent of the untreated check. In plots treated with BAS 665 00H potato yields ranged from 116 to 126 percent of the untreated yield. Overall, sugar beet yields were lower in plots treated with Ally. Yields were 87, 84, and 75 percent of the untreated check for Ally applied at 0.004, 0.008, and 0.012 lb ai/acre, respectively. Sugar beet yields with BAS 635 00H were 92 to 99 percent of the untreated and yields with Paramount were 97 to 102 percent of the untreated check.

Table 1. Rotational crop injury with BAS 635 00H, Paramount, and Ally, Malheur Experiment Station, Oregon State University, Ontario, OR, 2001.

| Treatment* | Rate lb ai/acre | Rotational crop injury† | | | | | | | |
|-------------------|--------------------|-------------------------|------|-------|-------------|--------|------|------------|--|
| | | Alfalfa | | Wheat | Dry bean | Potato | | Sugar beet | |
| | | 5-18 | 5-18 | 7-2 | 5-22 | 7-2 | 5-18 | 7-2 | |
| BAS 635 00H + NIS | 0.054 + 0.25% v/v | 0 | 0 | 2 | 0 | 0 | 9 | 0 | |
| BAS 635 00H + NIS | 0.108 + 0.25% v/v | 0 | 0 | 0 | 0 | 0 | 24 | 8 | |
| BAS 635 00H + NIS | 0.162 + 0.25% v/v | 0 | 0 | 2 | 0 | 0 | 37 | 24 | |
| Paramount + MSO | 0.188 + 1.5% v/v | 0 | 0 | 28 | 21 | 22 | 13 | 10 | |
| Paramount + MSO | 0.375 + 1.5% v/v | 0 | 0 | 24 | 37 | 28 | 17 | 20 | |
| Paramount + MSO | 0.56 + 1.5% v/v | 0 | 0 | 25 | 45 | 35 | 14 | 13 | |
| Ally + NIS | 0.004 + 0.25% v/v | 0 | 0 | 7 | 0 | 0 | 28 | 20 | |

| | | | | | | | | |
|------------|-------------------|----|----|----|----|----|----|----|
| Ally + NIS | 0.008 + 0.25% v/v | 0 | 0 | 3 | 0 | 0 | 56 | 42 |
| Ally + NIS | 0.012 + 0.25% v/v | 0 | 0 | 7 | 2 | 0 | 54 | 40 |
| Untreated | -- | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| LSD (0.05) | | NS | NS | 10 | 25 | 16 | 22 | 19 |

*Treatments were applied to wheat on May 15, 2000.

†Crop injury was based on visual evaluations using a scale from 0 percent (no injury) to 100 percent (plant death).

Table 2. Rotational crop yield as a percent of the untreated with BAS 635 00H, Paramount, and Ally, Malheur Experiment Station, Oregon State University, Ontario, OR, 2001.

| Treatment* | Rate lb ai/acre | Rotational crop yield† | | | | | |
|-------------------|--------------------|------------------------|-----|-------|--------|---------------|----------|
| | | Alfalfa‡ (fresh wt) | | Wheat | Potato | Sugar beet | Dry bean |
| | | 7-2 | 8-9 | 8-6 | 9-4 | 10-3 | 8-20 |
| | | ----- % of untreated§ | | | | | |
| BAS 635 00H + NIS | 0.054 + 0.25% v/v | 89 | 97 | 109 | 126 | 99 | 78 |
| BAS 635 00H + NIS | 0.108 + 0.25% v/v | 98 | 95 | 116 | 126 | 96 | 79 |
| BAS 635 00H + NIS | 0.162 + 0.25% v/v | 92 | 96 | 115 | 116 | 92 | 85 |
| Paramount + MSO | 0.188 + 1.5% v/v | 102 | 97 | 119 | 124 | 102 | 72 |
| Paramount + MSO | 0.375 + 1.5% v/v | 109 | 99 | 127 | 94 | 97 | 99 |
| Paramount + MSO | 0.56 + 1.5% v/v | 98 | 96 | 131 | 104 | 101 | 100 |
| Ally + NIS | 0.004 + 0.25% v/v | 119 | 93 | 123 | 109 | 87 | 103 |
| Ally + NIS | 0.008 + 0.25% v/v | 97 | 94 | 113 | 119 | 84 | 73 |
| Ally + NIS | 0.012 + 0.25% v/v | 117 | 89 | 107 | 125 | 75 | 104 |
| Untreated | -- | 100 | 100 | 100 | 100 | 100 | 100 |

| | | | | | | |
|------------|----|----|----|----|----|----|
| LSD (0.05) | NS | NS | NS | 21 | 13 | NS |
|------------|----|----|----|----|----|----|

*Treatments were applied to previous wheat crop on May 15, 2000.

†Yield for rotational crops produced following herbicide application in the previous growing season.

‡Alfalfa fresh weight taken immediately after cutting. Yields shown for both the July 2 and August 9 harvest dates.

§Yields are reported as a percentage of the untreated for each crop.