

Dry bean tolerance to sulfentrazone. Delahoyde, Eric S., Richard K. Zollinger, and Jerry L. Ries. Experiments were conducted to evaluate the tolerance of six dry bean types to sulfentrazone. At Buffalo, ND, tillage preparation was performed with a field cultivator implement and was followed by the planting of 'T-39' Black bean, 'IU465' Great Northern bean, 'Vista' Navy bean, '312' Pink bean, 'Maverick' Pinto bean, and 'Garnett' Small Red bean on May 27, 2004. PRE treatments were applied on May 27 at 2:00 pm with 59 F air, 55 F soil surface, 34% relative humidity, 0% clouds, 3 to 8 mph N wind, dry soil surface, and moist subsoil. Soil texture in this experiment was a loam. Soil pH for the experiment ranged from 7.8 to 8.3, soil organic matter ranged from 4.5 to 5.5%, EC ranged from 0.3 to 0.7, and CEC ranged from 0 to 22.5%.

At Minot, ND, tillage preparation was performed with a field cultivator implement and was followed by the planting of 'T-39' Black bean, 'IU465' Great Northern bean, 'Vista' Navy bean, '312' Pink bean, 'Maverick' Pinto bean, and 'Garnett' Small Red bean on June 4, 2004. PRE treatments were applied on June 4 at 8:15 am with 65 F air, 60 F soil surface, 85% relative humidity, 100% clouds, 0 to 5 mph E wind, dry soil surface, and moist subsoil. Soil pH was extremely variable in this experiment, ranging from 5.2 to 8.1. Soil texture for the experiment was a silt loam. Soil organic matter ranged from 2.5 to 3.5%, EC ranged from 0.15 to 0.35, and CEC ranged from 0 to 0.5%.

Treatments were applied to the center 6.7 feet of 10 by 25 foot plots with a backpack-type sprayer delivering 17 gpa at 40 psi through 8002 TeeJet flat fan nozzles. The experiments were arranged in a randomized complete block design with three replications per treatment.

At Buffalo, herbicide was incorporated into the soil by 2.82 inches of rainfall within four days of application. None of the bean types exhibited injury symptoms until 21 days after treatment (DAT) and 11 days after bean emergence. Primary injury symptoms included stunted growth, wrinkling of leaf tissue, necrotic leaf spotting, chlorosis, and veinal discoloration. At 21 DAT, the Black and Navy bean types showed 7% injury at 0.375 lb/A (Table 1). No significant injury symptoms were observed in the other bean types. At 42 DAT, slight to moderate injury symptoms were observed in the Black, Navy, Pink, Pinto, and Small Red bean types at 0.25 lb/A and 0.375 lb/A. At 84 DAT, 6 to 8% injury was observed across the Black, Navy, Pink, and Small Red bean types at 0.375 lb/A. Overall, 0 to 2% injury was observed at sulfentrazone rates of 0.188 lb/A or less. Treatment rates less than 0.375 lb/A caused 10% injury or less. The 0.25 lb/A and 0.375 lb/A treatments exhibited slight to moderate injury symptoms early in the growing season, but symptoms declined as the season progressed. In this experiment, injury appeared to be correlated most strongly to sulfentrazone rate than any other factor. Injury increased as sulfentrazone rate increased.

At Minot, herbicide was incorporated into the soil by 0.62 inches of rain two days after application. Visible injury symptoms were not observed until 14 days after treatment (DAT) and four days after bean emergence. At 14 DAT, injury symptoms were observed in the Black, Navy, Pink, Pinto, and Small Red bean types (Table 2). Black and Navy bean were most affected by sulfentrazone injury at 14 DAT. Primary injury symptoms included stunted growth, slow emergence, leaf wrinkling, chlorosis, and necrotic leaf spotting. At 35 DAT, all bean types showed sulfentrazone injury symptoms. Sulfentrazone injury was most severe in the Navy bean type, as significant injury occurred at all treatment rates. Greater than 10% injury was also observed in the Black and Pink bean types at rates greater than 0.094 lb/A. Sulfentrazone injury was observed at rates greater than 0.188 lb/A in the Great Northern and Pinto bean, but symptoms were less severe than the other bean types. At 77 DAT, injury symptoms were observed across all bean types. Sulfentrazone injury to all bean types at 77 days was generally less severe than 35 days, but injury still persisted in the Black, Navy, Pink, and Small Red bean types. Great Northern and Pinto bean types showed less than 7% injury at all treatment rates at 77 DAT. Navy bean was most susceptible to sulfentrazone injury in this experiment, followed by Pink, Black, Small Red, Pinto, and Great Northern. In this experiment, sulfentrazone injury appeared to be more strongly correlated to soil pH than any other factor. Sulfentrazone injury was more severe in high pH plots than low pH plots.

In other research, sulfentrazone injury increased as soil pH increased because the sulfentrazone was more soluble in the soil solution. Additionally, sulfentrazone injury decreased as soil organic matter increased because the herbicide was adsorbed to the organic matter. (Department of Plant Sciences, North Dakota State University, Fargo).

Table 1. Dry bean tolerance to sulfentrazone, Buffalo (Delahoyde, Zollinger, and Ries).

| Treatment | Rate (lb/A) | Black | | | Great Northern | | | Navy | | |
|---------------|----------------|---------------|---------------|---------------|----------------|---------------|---------------|---------------|---------------|---------------|
| | | 21 DAT (%) | 42 DAT (%) | 84 DAT (%) | 21 DAT (%) | 42 DAT (%) | 84 DAT (%) | 21 DAT (%) | 42 DAT (%) | 84 DAT (%) |
| <u>PRE</u> | | | | | | | | | | |
| Sulfentrazone | 0.094 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sulfentrazone | 0.14 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Sulfentrazone | 0.188 | 0 | 5 | 2 | 0 | 2 | 0 | 0 | 5 | 2 |
| Sulfentrazone | 0.25 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| Sulfentrazone | 0.375 | 7 | 24 | 6 | 2 | 5 | 0 | 7 | 24 | 6 |
| Untreated | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LSD (0.05) | | 6 | 10 | 5 | 3 | 4 | 0 | 6 | 10 | 5 |

Table 1 continued. Dry bean tolerance to sulfentrazone, Buffalo (Delahoyde, Zollinger, and Ries).

| Treatment | Rate (lb/A) | Pink | | | Pinto | | | Small Red | | |
|---------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | | 21 DAT (%) | 42 DAT (%) | 84 DAT (%) | 21 DAT (%) | 42 DAT (%) | 84 DAT (%) | 21 DAT (%) | 42 DAT (%) | 84 DAT (%) |
| <u>PRE</u> | | | | | | | | | | |
| Sulfentrazone | 0.094 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sulfentrazone | 0.14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sulfentrazone | 0.188 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Sulfentrazone | 0.25 | 0 | 8 | 2 | 0 | 4 | 0 | 0 | 2 | 2 |
| Sulfentrazone | 0.375 | 2 | 22 | 8 | 3 | 9 | 0 | 0 | 9 | 6 |
| Untreated | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LSD (0.05) | | 2 | 9 | 3 | 2 | 4 | 0 | 0 | 4 | 5 |

Table 2. Dry bean tolerance to sulfentrazone, Minot (Delahoyde, Zollinger, and Ries)

| Treatment | Rate (lb/A) | Black | | | Great Northern | | | Navy | | |
|---------------|----------------|---------------|---------------|---------------|----------------|---------------|---------------|---------------|---------------|---------------|
| | | 14 DAT (%) | 35 DAT (%) | 77 DAT (%) | 14 DAT (%) | 35 DAT (%) | 77 DAT (%) | 14 DAT (%) | 35 DAT (%) | 77 DAT (%) |
| <u>PRE</u> | | | | | | | | | | |
| Sulfentrazone | 0.094 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 17 |
| Sulfentrazone | 0.14 | 7 | 10 | 7 | 0 | 2 | 0 | 0 | 34 | 43 |
| Sulfentrazone | 0.188 | 8 | 16 | 9 | 2 | 5 | 2 | 2 | 47 | 38 |
| Sulfentrazone | 0.25 | 19 | 20 | 14 | 0 | 4 | 2 | 0 | 55 | 62 |
| Sulfentrazone | 0.375 | 48 | 58 | 38 | 2 | 5 | 6 | 18 | 73 | 87 |
| Untreated | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LSD (0.05) | | 10 | 8 | 5 | 4 | 7 | 6 | 11 | 13 | 38 |

Table 2 continued. Dry bean tolerance to sulfentrazone, Minot (Delahoyde, Zollinger, and Ries)

| Treatment | Rate (lb/A) | Pink | | | Pinto | | | Small Red | | |
|---------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | | 14 DAT (%) | 35 DAT (%) | 77 DAT (%) | 14 DAT (%) | 35 DAT (%) | 77 DAT (%) | 14 DAT (%) | 35 DAT (%) | 77 DAT (%) |
| <u>PRE</u> | | | | | | | | | | |
| Sulfentrazone | 0.094 | 0 | 8 | 7 | 0 | 0 | 0 | 0 | 2 | 0 |
| Sulfentrazone | 0.14 | 0 | 21 | 15 | 3 | 2 | 0 | 0 | 16 | 3 |
| Sulfentrazone | 0.188 | 0 | 29 | 27 | 2 | 6 | 2 | 2 | 17 | 7 |
| Sulfentrazone | 0.25 | 2 | 30 | 29 | 7 | 13 | 7 | 8 | 16 | 12 |
| Sulfentrazone | 0.375 | 6 | 31 | 38 | 13 | 11 | 5 | 16 | 25 | 19 |
| Untreated | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LSD (0.05) | | 4 | 17 | 24 | 7 | 9 | 7 | 5 | 22 | 26 |