

Effects of herbicides and sugarbeet cultivars on *Rhizoctonia* root and crown rot development

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Introduction

- Glyphosate-resistant sugarbeet cultivars are widely planted in the United States due to the ease of weed management. However, a previous greenhouse study indicated that host plant resistance to *Rhizoctonia* root and crown rot (RRCR) was compromised in glyphosate-resistant sugarbeet following glyphosate application (Larson et al., 2006).
- RRCR is a serious sugarbeet disease caused by the fungus, *Rhizoctonia solani* (AG-2-2) (Franc et al., 2001; Sneh et al., 1991). Symptoms include darkened petioles, sudden or permanent wilting of leaves and brown to black lesions or cankers on the root surface.
- The objective of our research was to determine the effect of herbicides on RRCR disease development in glyphosate-resistant sugarbeet cultivars.



Fig. 1A: Healthy sugarbeet plant



Fig. 1B: Crown rot symptoms in sugarbeet plant

Materials and Methods

- Greenhouse experiment conducted at the University of Wyoming, summer 2010.
- Factorial treatment arrangement set in a randomized complete block design with 12 replicates.

Table 1. Factors included in the experiment

Herbicide treatment ^a	Cultivars ^b	<i>R. solani</i> ^c
Glyphosate	Beta 66RR60	Yes
Conventional mix	Beta 66RR70	No
No herbicide	Hilleshog 9032	
	Hilleshog 9027	

^a Glyphosate (1260 grams acid equivalent (ae) per ha), Conventional mix: Phenmedipham + Desmedipham (364 grams active ingredient (ai) per ha) + Triflurosulfuron methyl (17.5 grams ai per ha) + Clopyralid (105 grams ai per ha), No herbicide (deionized water)

^b Cultivars inoculated and herbicide applied at 6-8 true-leaf stage

^c Inoculated plants - *R. solani* isolate R1 (AG-2-2), Non-inoculated plants – sterile barley

- Plants were watered daily and fertilized weekly.
- Foliar and root-rot disease severity were rated using Horsfall and Barratt scale (Horsfall and Barratt, 1945).
 - Foliar or crown rot rated first at 11 days after inoculation (DAI) and then rated every week for 4 weeks on a scale of 0-11; 0=healthy sugarbeet plant, 11=dead sugarbeet plant.
 - Overall crown rot disease severity calculated by area under disease progress curve (AUDPC) from the 4 weeks data.
 - Roots were harvested 49 DAI and evaluated for root rot severity on a scale of 0-11; 0=no lesion, 11=100% decayed sugarbeet root.
- Statistical analysis conducted using ARM (version 8; GDM inc.) statistical software and mean separations determined using Fisher's protected LSD ($\alpha=0.05$).

Results

- RRCR disease severity differed significantly among all sugarbeet cultivars ($P \leq 0.05$). The order of decreasing RRCR severity (increasing disease tolerance) was Beta 66RR60, Hilleshog 9032, Beta 66RR70, and Hilleshog 9027 (Fig. 2A & 2B).

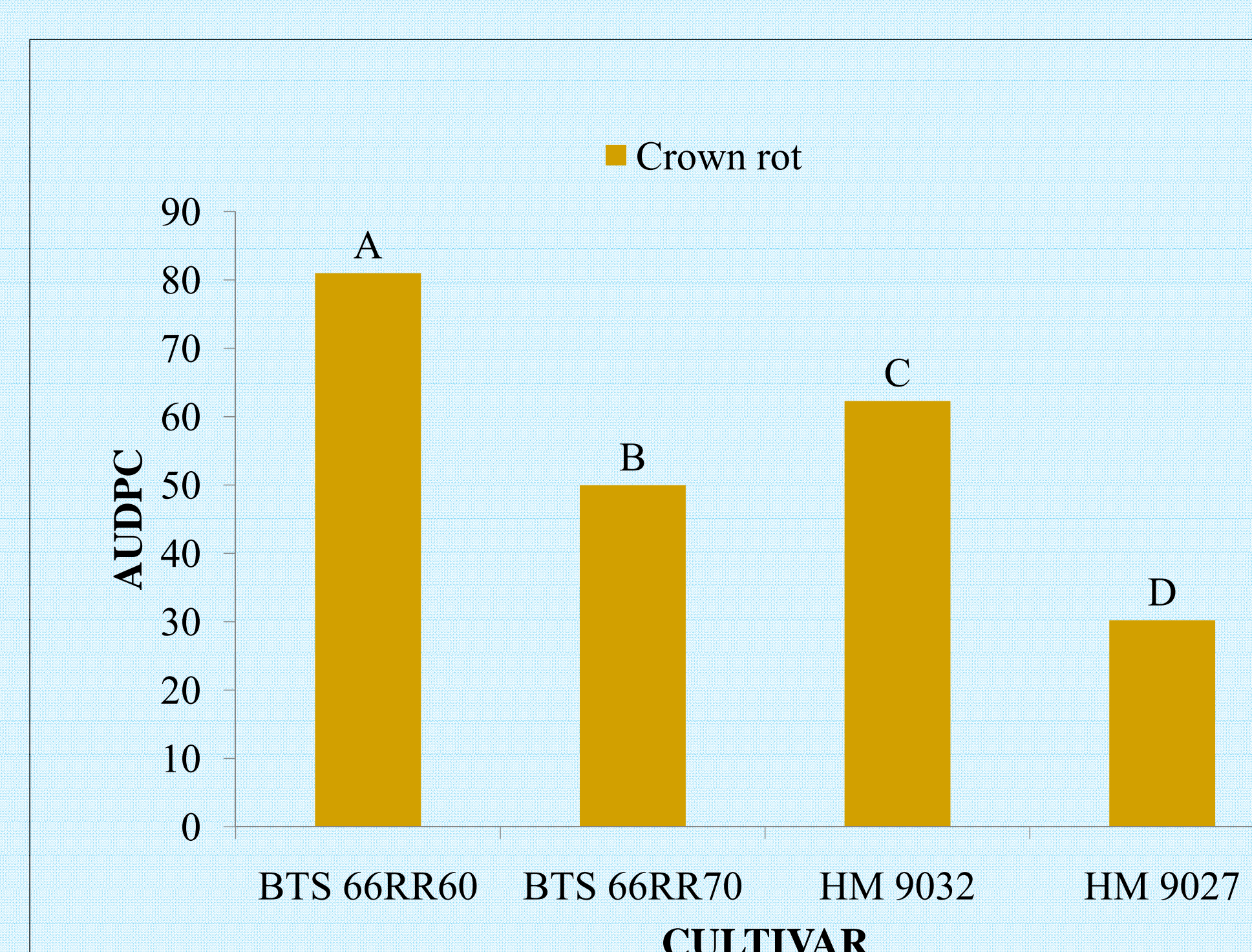


Figure 2A: Relative crown rot severity among four glyphosate-resistant cultivars

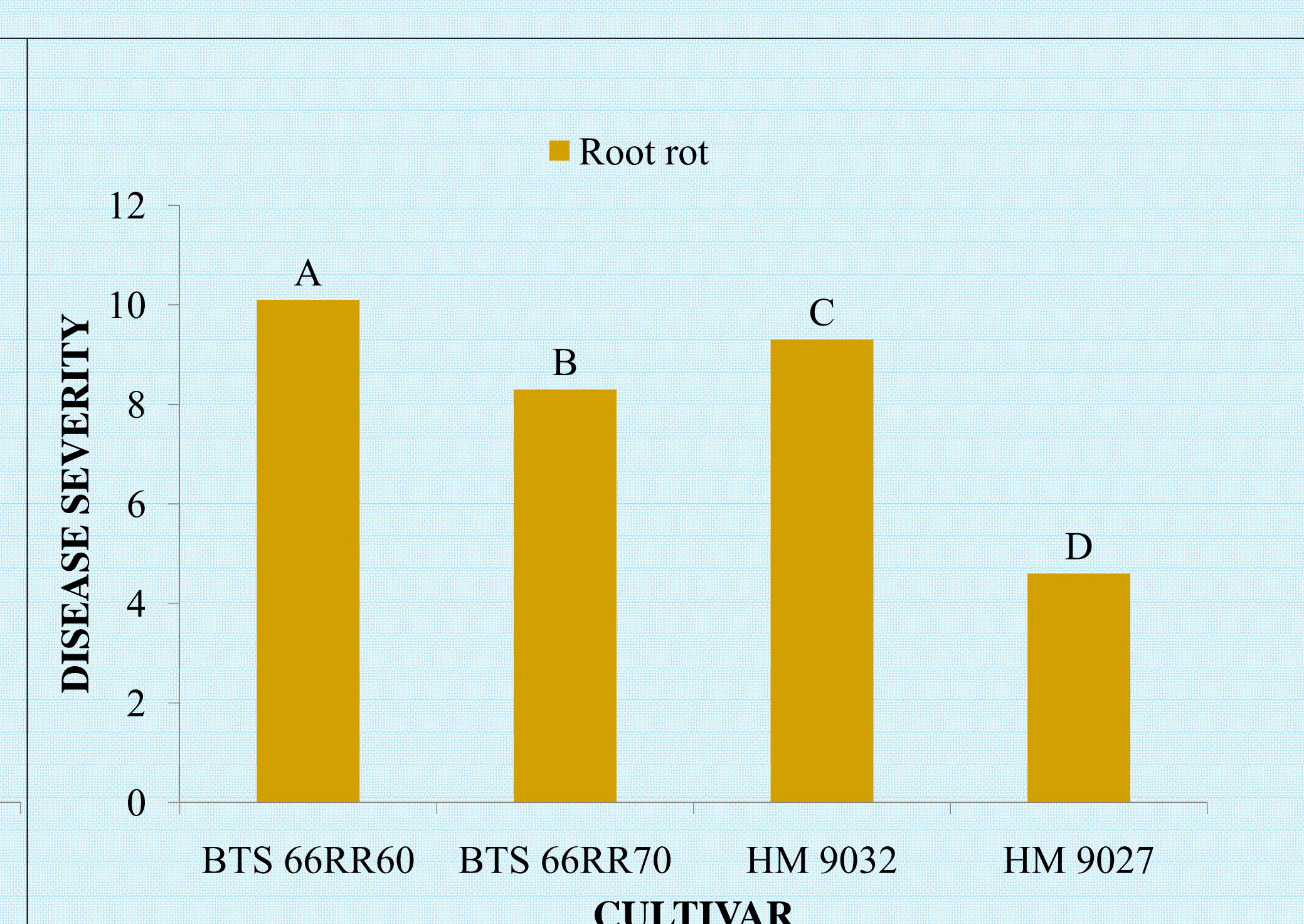


Figure 2B: Relative root-rot severity among four glyphosate-resistant cultivars

- Both herbicide treatments significantly increased RRCR disease severity compared to no herbicide ($P \leq 0.05$).
- RRCR disease severity was significantly greater following conventional herbicide compared to glyphosate treatment ($P \leq 0.05$ Fig. 3A & 3B).

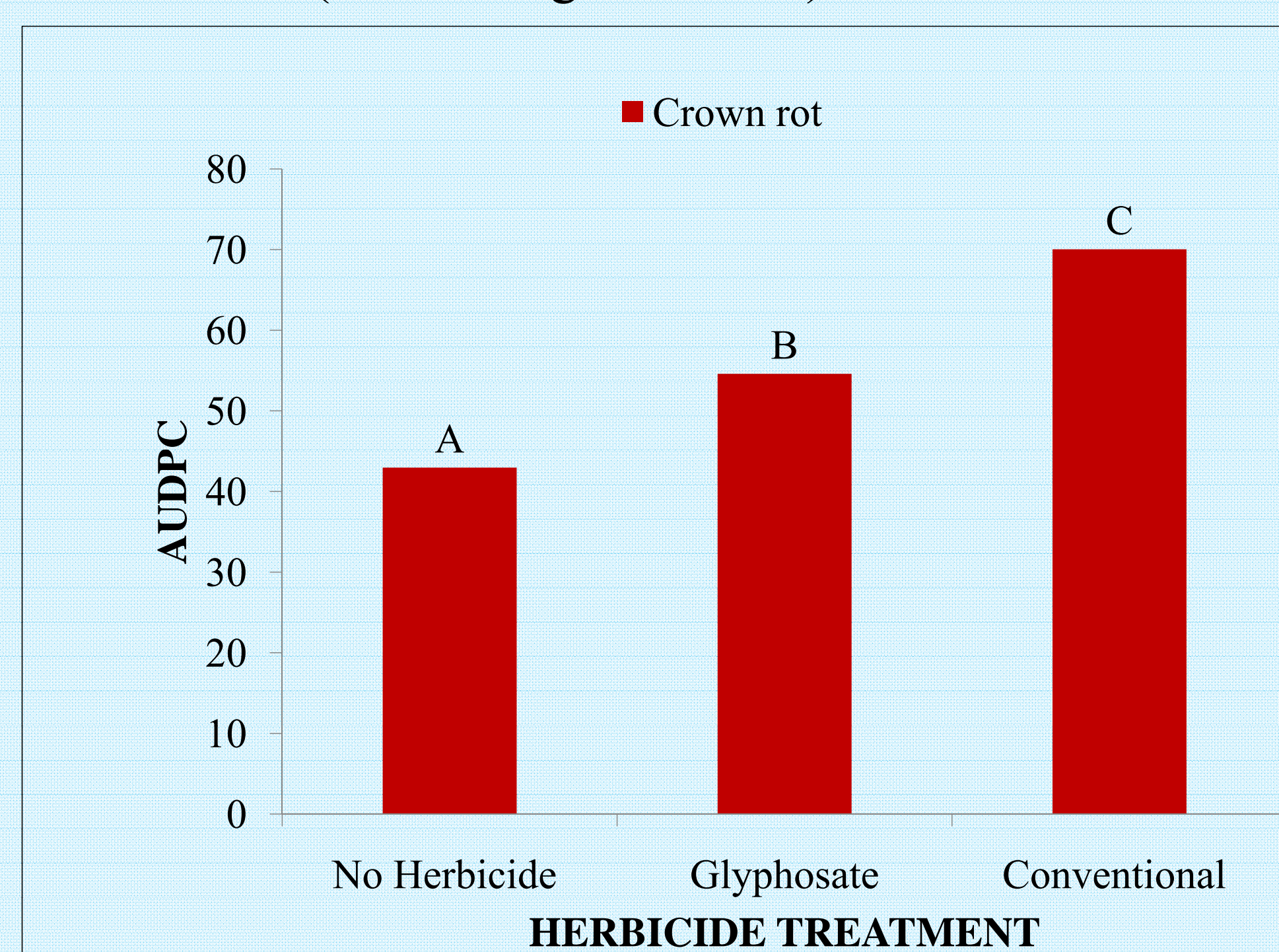


Figure 3A: Effect of herbicide treatments on crown rot disease severity averaged across four glyphosate-resistant cultivars

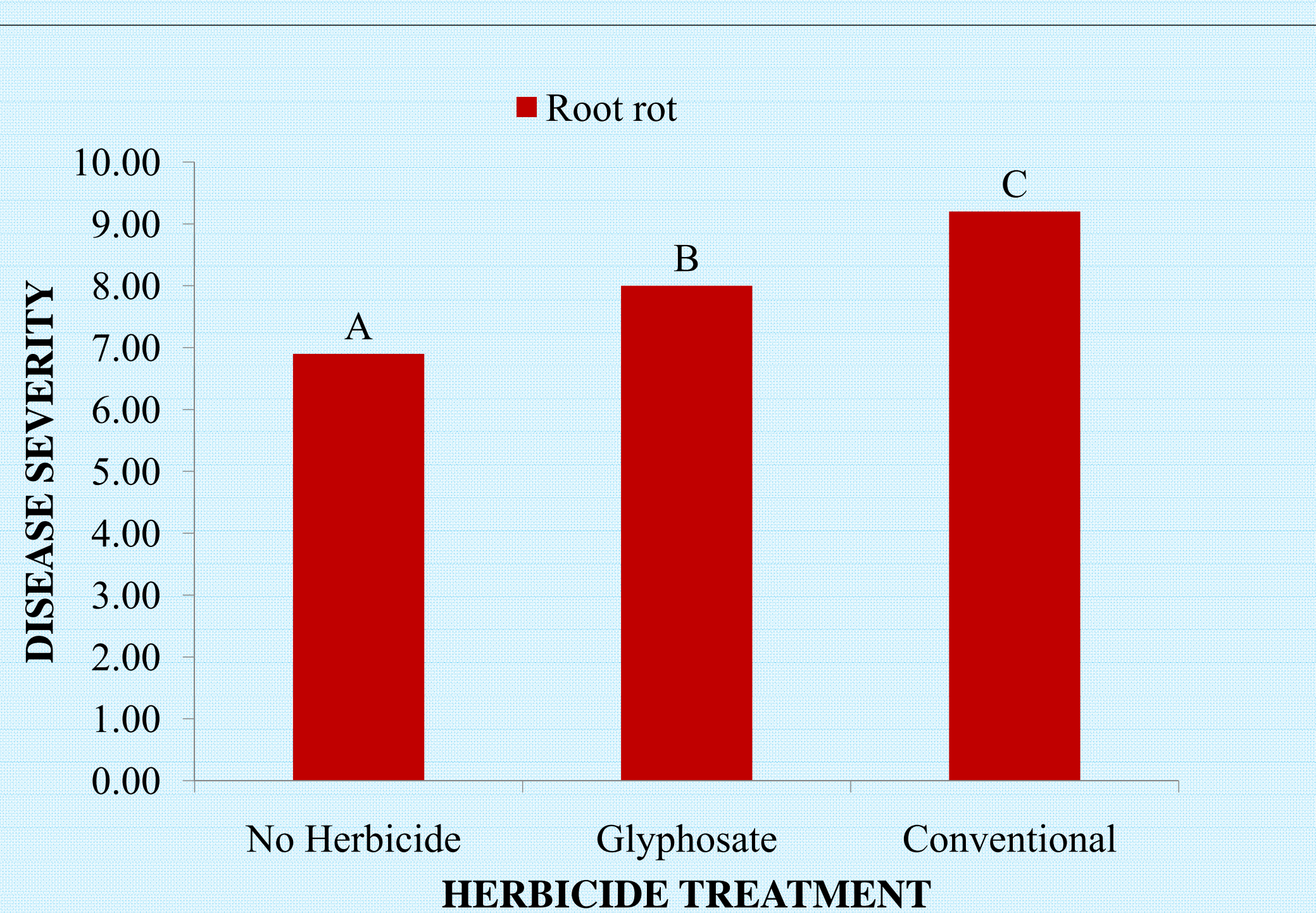


Figure 3B: Effect of herbicide treatments on root rot disease severity averaged across four glyphosate-resistant cultivars

Conclusion

- Herbicide application to glyphosate-resistant sugarbeet affected RRCR development and resultant disease severity under greenhouse conditions. The increase in disease severity following conventional herbicide treatment was significantly greater than that following glyphosate treatment.

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