RESPONSE OF 37 SUGARBEET CULTIVARS TO CLOPYRALID

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INTRODUCTION. Current weed control recommendations in sugarbeet rely heavily on postemergence herbicides. Many herbicides registered for use in sugarbeet have been shown to cause significant injury to the crop, sometimes resulting in reduced root yield or sugar content at harvest. Smith et al. (1982) and Smith and Schweizer (1983) reported that sugarbeet cultivars can respond differently to herbicides. Both studies indicate that while herbicide by cultivar interactions are observable with respect to foliar suppression a few weeks following herbicide application, no interactions could be detected in any harvest-time yield factors. Since the time this research was conducted, several additional herbicides have been registered for use in sugarbeet, including clopyralid. Wilson (1999) investigated the response of nine approved sugarbeet cultivars to postemergence herbicide treatments including clopyralid, but no mention was made to whether or not cultivars responded differently to treatments containing clopyralid

TABLE 1. Herbicide treatment descriptions and application timings. Research and Extension Centers, Torrington and Powell, WY, 2004.

Treatment	Herbicide	Rate	Timing	Application date		
				Torrington 1	Torrington 2	Powell
		lbs ai/A				
1	Nortron	1.0	PPI	4/14	5/26	4/22
	Progress	0.25	cot	5/7	6/14	5/15
	Progress	0.33	7d	5/14	6/21	5/22
	Progress	0.33	14d	5/21	6/28	5/29
2	Nortron	1.0	PPI	4/14	5/26	4/22
	Progress	0.25	cot	5/7	6/14	5/15
	Progress	0.33	7d	5/14	6/21	5/22
	Stinger	0.094	7d			
	Progress	0.33	14d	5/21	6/28	5/29
3	Nortron	1.0	PPI	4/14	5/26	4/22
	Progress	0.25	cot	5/7	6/14	5/15
	Progress	0.33	7d	5/14	6/21	5/22
	Progress	0.33	14d	5/21	6/28	5/29
	Stinger	0.094	14d			
4	Nortron	1.0	PPI	4/14	5/26	4/22
	Progress	0.08	cot	5/7	6/14	5/15
	UpBeet	0.004	cot			
	Stinger	0.02	cot			
	MSO	0.25%	cot			
	Progress	0.08	7d	5/14	6/21	5/22
	UpBeet	0.004	7d			
	Stinger	0.02	7d			
	MSO	0.25%	7d			
	Progress	0.08	14d	5/21	6/28	5/29
	UpBeet	0.004	14d			
	Stinger	0.02	14d			
	MSO	0.25%	14d			

compared to those without. It was the objective of this research to quantify the response of 37 approved sugarbeet cultivars to the herbicide clopyralid applied at various timings.

MATERIALS & METHODS. Field studies were conducted at three locations in 2004 near Torrington and Powell, WY to investigate sugarbeet cultivar response to the herbicide clopyralid. Thirty-seven cultivars were evaluated with respect to visual injury and stand at all three locations, as well as root yield and sugar content at two locations (Torrington 1 and Powell) following application of clopyralid. Four herbicide treatments included a treated control with no clopyralid, clopyralid applied at 0.094 lbs ai/A at the sugarbeet 2 or 4 true-leaf stage, and clopyralid applied at 0.02 lbs ai/A in a micro-rate treatment at the sugarbeet cotyledon, 2 true-leaf, and 4 true-leaf stages (Table 1). Sugarbeet was planted to stand in 22 inch rows at a rate of 56,000 seeds/A.

Table 2. Herbicide and cultivar effects on sugarbeet stand, injury, root yield, and sugar content. Research and Extension Centers, Torrington and Powell, WY, 2004.

Treatment effect	Num DF	Den DF	F	p > F
Stand[1]				
Herbicide	3	6	0.03	0.9915
Cultivar	36	284	2.56	<.0001
Herbicide x Cultivar	108	284	0.14	1.0000
Injury				
Herbicide	3	6	4.61	0.0531
Cultivar	36	284	2.71	<.0001
Herbicide x Cultivar	108	284	0.56	0.9997
Root yield[2]				
Herbicide	3	3	0.71	0.6085
Cultivar	36	144	2.19	0.0006
Herbicide x Cultivar	108	144	0.28	1.0000
Sugar content				
Herbicide	3	3	0.33	0.8084
Cultivar	36	144	5.94	<.0001
Herbicide x Cultivar	108	144	0.90	0.7244
Extractable sugar				
Herbicide	3	3	0.95	0.5148
Cultivar	36	144	2.19	0.0006
Herbicide x Cultivar	108	144	0.38	1.0000

[1]Stand and injury analysis based on three locations.

[2]Root yield, sugar content, and extractable sugar analysis based on two locations.

The experimental design was a split-block factorial with three replications at all three locations. Split-plots were 5.5 ft by 10 ft in size. Visual injury and sugarbeet stand were evaluated 14 days following final herbicide application at all three locations, and yield and sugar data were collected in early-October for two locations. All data was subject to ANOVA using the MIXED procedure in SAS (2001), treating location as a random effect. Where appropriate, mean separation was performed using Fisher's protected LSD.

RESULTS AND DISCUSSION. Neither main effect of herbicide treatment nor interaction effect of herbicide treatment by cultivar were significant (α=0.05) with respect to stand, injury, root yield, sugar content, or extractable sugar (Table 2). Although the herbicide effect on

sugarbeet injury was marginally significant (p=0.0531), no herbicide treatment caused greater than 3% injury when averaged over cultivars (data not shown), and therefore differences are not agronomically relevant. Differences between cultivars were present with respect to all parameters evaluated (Table 3). Visual crop injury was less than 6% for all cultivars and did not

TABLE 3. Sugarbeet stand, injury, root yield, and sugar content of 37 cultivars. Research and Extension Centers, Torrington and Powell, WY, 2004.

Cultivar	Stand[1]	Injury	Yield[2]	Sugar content	Extractable sugar
	plants/A	-%-	-T/A-	--%--	--lbs/A--
BETA 1775	23,700	4	31.1	18.4	11,445
BETA 2372	23,200	0	32.9	17.9	11,778
BETA 4546	24,200	3	28.6	18.2	10,410
BETA 4595R	21,600	3	29.4	18.1	10,643
BETA 4635R	24,000	3	28.3	16.3	9,226
BETA 4940R	24,500	2	28.7	18.1	10,389
BETA 7310R	25,400	2	33.3	16.7	11,122
BETA 8636	25,700	3	31.1	18.1	11,258
BETA 8749	24,900	5	35.3	17.4	12,284
CR 9104	24,100	2	29.3	16.9	9,903
CR 9906	22,200	2	30.4	17.5	10,640
CR 9941	24,900	2	31.0	17.8	11,036
CR 9942	25,700	2	33.9	18.8	12,746
CR C122	25,000	3	32.7	17.9	11,707
HH 130	23,200	3	30.6	16.9	10,343
HH ACCLAIM RZ	23,900	5	34.4	17.0	11,696
HM 1637	23,400	0	31.8	16.9	10,748
HM 1639 RZ	18,900	3	35.1	17.0	11,934
HM 1642	25,300	1	30.6	18.2	11,138
HM 1643	22,400	2	31.8	18.0	11,448
HM 1646 RZ	24,700	1	32.3	18.0	11,628
HM 1651 RZ	25,500	2	31.8	17.7	11,257
HM 1652	25,600	1	30.3	17.1	10,363
HM 1653 RZ	21,000	2	34.3	17.0	11,662
HM 9155	24,700	2	32.3	16.9	10,917
HM GEYSER	23,700	2	30.9	17.6	10,877
HM RH5	24,800	0	29.1	18.2	10,592
HM TREASURE	22,700	2	30.4	18.6	11,309
SX MONOHIKARI	24,700	4	28.7	17.6	10,102
SX ALLIANCE	26,800	3	30.4	17.8	10,822
SX BISON	24,100	1	29.4	17.4	10,231
SX BLAZER	22,000	0	31.0	16.8	10,416
SX CHARGER	23,700	2	29.5	17.6	10,384
SX CODY	23,400	0	28.0	17.6	9,856
SX EXCEL	22,500	3	29.2	18.1	10,570
SX PUMA	23,400	1	28.4	17.2	9,770
SX RANGER	23,100	3	32.0	16.4	10,496
LSD (0.05)	**1,900**	**1**	**2.2**	**0.6**	**821**

[1]Stand and injury analysis based on three locations.

[2]Root yield, sugar content, and extractable sugar analysis based on two locations.

correlate well with stand, root yield, or sugar content ($r < 0.27$). Similar to results of previous research, all sugarbeet cultivars were able to recover from these low injury levels by harvest.

The absence of herbicide by cultivar interaction effects indicates that the 37 sugarbeet cultivars responded similarly to all herbicide treatments. It is therefore concluded that differences between cultivars with respect to herbicide application are not dependent on the presence of clopyralid in the herbicide mixture. This result also indicates that all cultivars respond similarly to clopyralid whether it is applied at the 0.094 lb ai/A rate at the 2 or 4 true-leaf stage, or at the 0.02 lb ai/A rate as part of the micro-rate treatment.

For herbicide by cultivar interaction estimates of root yield and extractable sugar, 90% confidence intervals were constructed. The confidence intervals differed by as much as ±28% and ±38% of the point estimates for root yield and extractable sugar, respectively (data not shown). Wide confidence intervals such as these are often an indication of insufficient statistical power, a problem that is generally remedied by increasing sample size. However, a sample size much greater than that utilized in this project would be cost-prohibitive. As conducted, this study required 444 plots, and required over 72 man-hours to harvest. If it is of interest to elucidate whether differences between cultivars with respect to clopyralid tolerance exist, it is suggested that fewer cultivars be investigated to allow for increased sample size for each cultivar by herbicide treatment.

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