# ECONOMIC ANALYSIS OF GLYPHOSATE-TOLERANT SUGARBEET

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## ABSTRACT

Agronomic and production aspects of glyphosate-tolerant sugarbeet have been well documented in recent years. However, few studies have compared the economic impact of glyphosate-tolerant sugarbeet with conventional weed management strategies. Previously generated agronomic data from the Rocky Mountain sugarbeet growing region were assembled, and an economic analysis was conducted. The purpose of the analysis was to compare the profitability of glyphosate-tolerant sugarbeet to conventional weed management systems used in the growing region. As glyphosate-tolerant sugarbeet have not yet been sold commercially, it is unclear how costly the anticipated technology fee will be. Breakeven estimates for the technology fee were calculated from net economic returns. It is estimated that a producer could afford to pay over \$300 ha<sup>-1</sup> more for most glyphosate-tolerant sugarbeet seed compared to similar conventional varieties without decreasing profitability.

#### INTRODUCTION

Sugarbeet production requires intense management in order to achieve acceptable yields. Weed control is a costly but necessary part of sugarbeet production. Current weed control programs rely heavily on tank mixtures of several different herbicides applied two to five times over the growing season. The introduction of transgenic sugarbeet tolerant to an otherwise non-selective herbicide gives producers the capability of broad-spectrum weed control using only one postemergence herbicide, applied two to three times during the growing season.

Glyphosate-tolerant sugarbeet varieties have been registered by the United States government, but are not grown due to lack of sugar company accep-

tance. Glyphosate-tolerant systems in commercially available crops such as soybean and corn produce higher or similar net economic returns as conventional systems (Gianessi et al. 2002; Johnson et al. 2000; Nolte and Young 2002a, 2002b; Reddy and Whiting 2000). Since glyphosate-tolerant sugarbeet are not yet sold commercially, there is no established figure on what the technology fee will cost producers once they become available. "Farmers will adopt a biotechnology variety when the value of the cost reduction plus the increase in yield is greater than the price differential between the varieties" (Demont and Tollens 2001).

The objectives of this research were to compare economic aspects of glyphosate applied to glyphosate-tolerant sugarbeet varieties to that of conventional herbicide programs applied to non-glyphosate-tolerant conventional varieties.

# MATERIALS AND METHODS

Economic returns were calculated from yield data assembled from field experiments conducted in Wyoming and Nebraska. In Nebraska, glyphosate-tolerant varieties 'HM 1640RR' and 'Beta 4546RR' were compared to near equivalent 'HM 1640' and 'Beta 4546'. In Wyoming, glyphosate-tolerant 'HM 1605RR' and 'HM 130RR' were compared to conventional 'Monohikari' and 'Ranger'. Gross economic returns were calculated for each plot based on the Western Sugar grower contract payment schedule. Price per ton is dependent on the sucrose content for each plot and the average price of sugar from the payment schedule.

All costs of production other than weed control were derived from Economics of Sugarbeet Production (Burgener 2001) and were equal across treatments. Additional costs for hauling sugarbeet roots to the pile were calculated by multiplying the fresh weight by the custom charge for hauling. Weed control costs were calculated using herbicide prices listed in the Guide for Weed Management in Nebraska (Univ. of Nebraska 2002). Costs of production including weed management and hauling were subtracted from gross returns to obtain net return for each plot.

When combining data, the MIXED procedure in SAS<sup>®</sup> (SAS 2000) was used, treating years as fixed and locations as random effects. Fisher's protected LSD was utilized to separate means. Single degree of freedom contrasts were constructed to compare groups of glyphosate treatments with groups of conventional herbicide treatments. In addition, the estimates associated with these contrasts are offered as estimates for the breakeven cost of the anticipated technology fee.

# RESULTS

In Nebraska, glyphosate applied to Beta 4546RR resulted in greater net returns than any herbicide treatment applied to Beta 4546 (Table 1). Only a portion of this difference is explained by differences in treatment costs. Differences in net returns were not evident between herbicide treatments applied to HM 1640 or HM 1640RR.

When averaged over varieties, greater net return resulted from glyphosate treatments than any conventional or micro-rate program in Wyoming (Table 2).

It is estimated that a producer could afford to pay \$348 ha<sup>-1</sup> more for glyphosate-tolerant varieties when compared to conventional varieties (Table 3). However, individual varieties such as HM 1640RR would not allow a producer to pay this amount.

Table 1. Treatment costs and gross and net economic return as influenced by herbicide treatment and sugarbeet variety averaged over four sites near Scottsbluff, NE, 2001 and 2002.

Treatment <sup>a b</sup>	Variety	Cost	Net return
Glyphosate 2	Beta 4546RR	69	717 a <sup>c</sup>
Glyphosate 3	Beta 4546RR	104	836 a
PRE + Conventional 2	Beta 4546	232	164 b
PRE + Micro-rate 3	Beta 4546	250	282 b
Conventional 3	Beta 4546	255	75 b
Glyphosate 2	HM 1640RR	69	381 A
Glyphosate 3	HM 1640RR	104	413 A
PRE + Conventional 2	HM 1640	232	144 A
PRE + Micro-rate 3	HM 1640	250	151 A
Conventional 3	HM 1640	255	153 A

*«* Treatments: Glyphosate, glyphosate applied at 0.84 kg/ha ae; PRU, ethofumesate applied preemergence at 1.12 kg/ha ai; Conventional, phenmedipham + desmedipham + triflusulfuron + clopyralid at 0.19 + 0.19 + 0.02 + 0.10 kg/ha ai; Micro-rate, phenmedipham + desmedipham + triflusulfuron + clopyralid at 0.048 + 0.048 + 0.005 + 0.025 kg/ha ai + methylated seed oil at 1.5% V/V.

<sup>b</sup> Numbers following treatment names correspond to the number of postemergence applications.

• Least square means within a column followed by the same letter are not significantly different (0.05). Lowercase letters should be used to compare Beta 4546 and Beta4546RR, while uppercase letters should be used to compare HM 1640 and HM 1640RR.

#### SESSION AGRONOMY

Table 2. Treatment costs and gross and net economic return as influenced by herbicide treatment and sugarbeet variety averaged over varieties and two sites near Torrington and Powell, WY, in 2000.

Treatment <sup>a b c</sup>	Variety	Treatment cost	Net return
Glyphosate 2	(HM 1605RR or HM 130RR)	69	518 a <sup>d</sup>
Glyphosate 3	(HM 1605RR or HM 130RR)	104	536 a
PRE + Conventional 2	(Monohikari or Ranger)	232	129 b
Micro-rate 3	(Monohikari or Ranger)	188	92 b
Conventional 3	(Monohikari or Ranger)	255	106 b

<sup>a</sup> Glyphosate treatments were applied to sugarbeet varieties 'HM1605RR' and 'HM 130RR' while non-glyphosate treatments were applied to 'Monohikari' and 'Ranger'. Data is averaged over varieties.

<sup>b</sup> Treatments: Glyphosate, glyphosate applied at 0.84 kg/ha ac; PRE, ethofumesate applied preemergence at 1.12 kg/ha ai; Conventional, phenmedipham + desmedipham + triflusulfuron + clopyralid at 0.19 + 0.19 + 0.02 + 0.10 kg/ha ai; Micro-rate, phenmedipham + desmedipham + triflusulfuron + clopyralid at 0.048 + 0.048 + 0.005 + 0.025 kg/ha ai + methylated seed oil at 1.5% V/V.

<sup>c</sup> Numbers following treatment names correspond to the number of postemergence applications.

<sup>d</sup> Least square means within a column followed by the same letter are not significantly different (0.05).

« Comparisons include additional herbicide treatments evaluated but not presented in previous tables.

\* Denotes significant comparison (0.05).

## CONCLUSIONS

On average, if the technology fee costs producers less than \$348 ha<sup>-1</sup>, adoption of the glyphosate-tolerant sugarbeet will increase producer profitability. The economics of glyphosate-tolerant sugarbeet are highly dependent on variety selection as evidenced by the large differences in net returns between Beta 4546RR and HM 1640RR (Table 1), and the subsequent differences in breakeven estimates for the two varieties (Table 3). Selection of glyphosate-tolerant varieties that are adapted to local conditions should be a top priority. It should be noted that the breakeven estimates presented do not account for risk or a producer's willingness to pay.

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