WHEN DOES IT PAY TO PLANT RW Bt CORN IN WISCONSIN?

Carsten D. Croff and Paul D. Mitchell [1/]

Corn rootworm (CRW) is commonly referred to as "the billion dollar bug" as it costs U.S. growers a billion dollars a year in reduced yields and treatment costs (Burchett, 2001). Traditionally, two-year crop rotations were sufficient to control for CRW. However, in recent years a behavioral variant of the western CRW has moved into Wisconsin cornfields. The variant has adapted to traditional crop rotation by laying its eggs in soybeans and other rotated crops, so that economic damage is caused in corn planted the following year. Soil insecticides were commonly used to control CRW in first year corn, but in 2003, rootworm Bt corn became available for western corn rootworm larval control.

Many studies show that, based on measures of root damage, Bt corn provides better control than soil insecticides, but has a higher cost as well. Under moderate or high rootworm pressure, the value of the additional yield saved with Bt corn usually exceeds the higher treatment cost, making Bt corn the more economical of the two treatments. However, many factors affect the economics of using Bt corn. Among the most important, rootworm pressure can vary greatly from year to year, potential yield of fields and regions differ, corn prices and treatment costs also vary. Fields where the rootworm pressure is high will be at greater risk for economic damage from CRW. Likewise, fields that have higher potential yields will suffer larger economic losses under the same CRW pressure than fields with lower potential yields. Higher corn prices will increase the yield value, which will also significantly increase the amount of economic damage caused by CRW. The cost of Bt corn is not as variable as the previous three factors but still has important implications for the economics of Bt corn.

Estimating rootworm pressure relies heavily on surveying methods conducted the previous year. Local and regional rootworm pressure may be estimated, such as using data from surveys conducted by the Wisconsin DATCP (2006). However, CRW pressure varies greatly over landscapes and even within fields. Hence the most accurate method to predict rootworm pressure is to survey each specific field the previous year, either following set scouting protocols or using traps for adults in later summer.

Surveys for the western variant CRW conducted by Cullen (2005) show that the western variant CRW pressure is predominately in the southeastern part of the state, but it varies from field to field and year to year. The most common method of integrated pest management (IPM) consists of using Pherecon AM sticky traps to measure CRW pressure, and then using Bt corn the following year if the CRW trap count as beetles/trap/day (BTD) exceeds the treatment threshold. The alternative is to apply a CRW treatment without measuring the CRW pressure, which may lead to unnecessary treatment, and so excessive cost and profit loss, in years with low CRW pressure. Using UW survey data (Cullen, 2005) and following the conventional yield damage function presented in (Mitchell, 2004), we estimate the profit maximizing CRW threshold (BTD for Pherecon AM traps) for the use of Bt corn, plus the net benefit of Bt corn when using this optimal threshold. Table 1 reports the results of the economic analysis.

[1/] Research Asistant and Assistant Professor, Agricultural and Applied Economics, Univ. of Wisconsin-Madison.

Table 1. Optimal Bt corn treatment threshold (BTD) and net benefit for Bt corn.

	Corn price ($/bushel)			
	$2.00	$2.50	$3.00	$3.50
Optimal threshold (BTD) to indicate use of Bt corn	6.06	4.25	2.20	2.20
Net benefit of Bt corn ($/acre) when using threshold	$1.40	$3.12	$5.25	$7.46
Standard deviation ($/acre) of net benefit	$21.08	$30.73	$42.98	$50.40
Percent years use Bt corn when using threshold	23%	31%	42%	42%

In the analysis we assumed a mean yield of 150 bu/acre with a coefficient of variation of 30%, as well as a Bt corn technology fee of $19.20/acre. Higher average yield will decrease the threshold slightly and increase the net benefit. Under all corn prices the average net benefit of using Bt corn under the IPM practice is positive, but we find a tremendous amount of variation around this average. In our simulation growers who always treated their fields regardless of rootworm pressure experienced negative net returns on average from Bt corn, though they do decrease the risk of large negative losses. Finally, we note that, as with all such analyses, many factors are missing. For example, the benefit of reduced lodging is not included for Bt corn, as modeling lodging is difficult, since factors other than CRW are important contributors. Also, the control of other insect pests by Bt corn is not included.

The presentation will focus on the implications of these results, but it seems clear that for many Wisconsin farmers in the current climate of high corn prices, Bt corn should provide higher returns as well mitigate the risk of large yield losses. However, considering just the value of the root damage prevented by Bt corn, Bt corn will not be profitable in fields with low rootworm pressure. IPM scouting methods can be used to estimate rootworm pressure and to indicate when the cost of treatment is justified.

References

Burchett, A. 2001. Operation rootworm: Can biotechnology beat the billion dollar bug? Farm J. 125(11):16-18.

Cullen, E. 2005. 2005 Variant Western Corn Rootworm Survey. Wisconsin Crop Manager.

Cullen, E. 2005. Unpublished Field Data. Department of Entomology, University of Wisconsin-Madison, Madison, WI.

Mitchell, P.D., Grey, M.E. and Steffey, K.L. 2005. A Composed-Error Model for Estimating Pest-Damage Functions and the Impact of the Western Corn Rootworm Soybean variant in Illinois. Am. J. Agric. Econ. 68:332-344.

Wisconsin DATCP. 2006. Corn rootworm beetle survey. Wis. Pest Bull. 51(19):Nov. 3, 2006.