

Insect Pest Management in High-Oil Corn

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Introduction

We measured the economic impact of insect pests on two quality-enhanced corns, high-oil and “waxy” corn. Both of these crops are cultivated using conventional corn production procedures but they bring a premium over traditional #2 yellow dent corn and that premium is based on the oil or wax content. The objective of this research was to determine whether the insect pests affected the qualitative characteristics of the crop and, consequently, whether different management procedures should be used for insect pests of these crops.

Two insects were particularly studied, corn leaf aphids and European corn borer. The corn leaf aphid affects pollination, which was a particular concern for high-oil corn, while the corn borer disrupts many aspects of the crop’s grain-producing capacity and is the most serious corn pest in Kentucky.

The research was conducted in a series of controlled field and greenhouse experiments during the 2000, 2001, and 2002 growing seasons in Central Kentucky and Princeton, KY. The high-oil hybrid was Beck’s 5405 while the waxy hybrid was Patriot’s WX4060, both agronomically good choices for Kentucky.

Results

The principal results were:

- Wax content in “waxy” corn was not affected by either type of insect. Both the concentration and quality of amylopectin were unaffected, although there was a quantitative yield loss that was not statistically different from traditional corn. Thus, traditional insect management guidelines can be used for this corn.
- For high-oil corn, seed oil content is sensitive to stalk-boring Lepidoptera such as the European corn borer but relatively less sensitive to foliage-feeding insects such as corn leaf aphids. High corn borer populations depleted oil content to below 6%, below the premium threshold.
- For TopCross® varieties, corn leaf aphids seriously interfered with pollination, reducing yield of these varieties much more than observed with conventionally-pollinated corns. For these varieties, the corn leaf aphid must be considered a significant pest, unlike with conventional corn varieties that are rarely impacted by this insect.
- There is a strong inverse relationship between corn leaf aphids and European corn borer on high-oil corn but not on waxy or conventional corn hybrids. Higher European corn borer populations apparently degrade phloem sap quality in the tassel, thereby limiting aphid reproduction. Plants with three or more corn borer galleries had, on average, about half as many aphids compared to plants with no corn borer galleries. The physiological basis of this interaction is unknown.
- Based on these studies, a new general economic threshold model was assembled. This threshold will make it possible to determine action thresholds for any crop

- that has a quality-based premium as a component of its valuation. This will be increasingly relevant as more quality-enhanced crops appear in the near future.
- New thresholds for these insect pests are about 25% lower for European corn borer and 50% lower for corn leaf aphids in high-oil corn. Based on historical records, high-oil corn producers can expect to require an insecticide application for corn borers nearly every year and an “over-the-top” application for corn leaf aphids about twice as frequently as they now experience. This increased management cost significantly increases the insect management expenses for this crop. Waxy corn producers can use existing treatment guidelines for dent corn and their insect management expenses will be unchanged.
 - Because of the increased management expenses on high-oil corn, TopCross® varieties should be avoided and the newer self-pollinating high-oil varieties used instead. These varieties may not have quite as high of an oil content but the aphid effects will be negligible and the insect management savings will offset the slight reduction in oil content.