Insect Resistant Field Corn (2)

Cutworms are among the major soil insects of field corn. Black cutworms do not overwinter in most of the Midwest. Black cutworm larvae overwinter in southern Gulf states and migrate northward primarily in April and May as adults. Black cutworm larvae are pests of seedling corn. They kill plants and reduce yields by reducing plant stands. On younger, small-stemmed corn plants, larvae cut the plant off at or near soil level. The feeding larva then often attempts to pull the plant into the soil for further feeding, leaving part of the dismembered plant sticking out of the soil. One larva can cut several seedlings, moving quickly down a planted row. A single cutworm is capable of cutting four to six plants during its lifetime. Corn plants that are too large for larvae to cut through may have a hole bored into the stem. Large populations can decimate an entire field of corn seedlings. In a study of simulated damage to BCW, yield losses varied from 0 to 24% and 0 to 81% when plants were damaged at the 3 and 5 leaf stages, respectively. A survey of Extension Specialists indicated that yield losses to uncontrolled BCW could be as high as 25%.

Fall armyworm (FAW) is native to the tropics. In the United States, FAW overwinters only in Florida and southern Texas. Southeastern states experience annual FAW infestations although the economic impact of those infestations varies from year to year. Larval feeding throughout the tightly coiled blades results in the unfurled blades being riddled with holes, possibly leading to reduced production by the plant. Older larvae are capable of eating all the leaf tissue, leaving only the center vein. In high infestations, FAW larvae may eat all available food and crawl en masse in “armies” to adjoining fields. FAW damage estimates are available for field corn in Georgia. From 1991 to 1997, annual control cost and damages attributed to FAW in Georgia ranged from $184,000 to $325,000. The average yield loss to FAW on untreated acreage was estimated at 10%.

In the southern tier of states in the North Central States area, there are three corn earworm flights, the last in September and October. In that region, CEW usually destroys from 1 to 4 % of the crop each year. Not only does this pest cause direct loss by feeding on the kernels but also provides opening in the husks for entry of disease organisms and birds. CEW damage estimates are available for field corn in Georgia. From 1991 to 1997, annual control cost and damages attributed to CEW in Georgia ranged from $192,000 to $872,000. Average yield losses to CEW on untreated acreage was estimated at 6%.

Many growers scout their cornfields, looking for the presence of cutworms, fall armyworms, earworms and their injury, and apply a foliar insecticide if the numbers of worms found exceed established economic thresholds. Foliar insecticides registered and recommended for FAW, BCW and CEW management include carbaryl, chlorpyrifos, esfenvalerate, lambdacyhalothrin, methomyl, methyl parathion, and permethrin.

A type of Bt field corn was developed using genetic material from Bacillus thuringiensis var. aizawai. The insecticidal protein in this type of Bt corn is referred to as Cry1F. Field corn genetically engineered to express the Cry1F Bt protein controls the European Corn Borer (ECB) and Southwestern Corn Borer (SWCB), and provides intermediate suppression of corn earworm, similar to the Cry1Ab Bt field corn varieties currently marketed. In addition Cry1F provides protection against black cutworm (BCW) and fall armyworm (FAW).

Cry1F field corn is most appropriate in corn growing areas where black cutworm, fall armyworm, corn earworm and southwestern corn borer are consistently problematic. The impacts of Cry1F field corn are estimated as incremental to those provided by Cry1A(b) field corn. For example, in areas where growers find currently marketed varieties of Bt field corn to be beneficial for control of ECB and/or SWCB, only the additional benefits of controlling black cutworm and fall armyworm are estimated. On acreage that is currently treated, it is assumed that the impact would be a reduction in insecticide use and related costs. It is assumed that growers would adopt the technology on all cutworm infested acreage, based on the value of the technology in terms of increased yields (+10%) being higher than the technology fee ($8.50/acre), which is assumed to be lower than insecticide cost ($10/acre). The benefits of Cry1F for FAW and CEW control are estimated for Georgia.

Impacts of Insect Resistant Transgenic Field Corn (2)

| Change in pesticide use: | 237,000 lbs/yr reduction |
| Change in production value: | increase of $26 million/yr |

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Full Report: The Potential for Biotechnology to Improve Crop Pest Management in the U. S.: 40 Case Studies by Leonard P. Gianessi, Cressida S. Silvers, Sujatha Sankula and Janet Carpenter
National Center for Food and Agricultural Policy, June 2002.
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