Fighting against resistance

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BASEL - Resistance to insecticide expressing transgenic plants is a major problem in modern agriculture. But lately, leading scientists are honing in on new biotechnological solutions.

Professor David Corbin (Chesterfield, MO) and Professor Charles Romano (Medfield, MA) developed a new patented method to produce transgenic plants that synthesize a new variant of the B. thuringiensis .delta.(Bt) endotoxin, called Cry2A.

This new patented toxin represents a first step in preventing the development of insect resistance by reducing the target group and increasing toxin levels expressed in transgenic plants using this system. As a result, their new invention leads to a more effective control of susceptible target pests, and therefore lower probability for the development of resistance.

Until now, transgenic cotton, corn and potatoes expressing the Bt-endotoxin have been shown to be effectively protected against major insect pests. Since the transgenic plants express the toxin themselves, growers have been able to significantly reduce the application of costly, toxic and sometimes ineffective topical chemical insecticides. Due to these advantages, transgenic plants expressing the Bt-endotoxin are planted on a large scale.

Bt-endotoxins are toxic to a variety of insects when ingested. The effected insect orders are the lepidopteran (butterflies, moths, skippers), the coleopteran (beetles, weevils) and the dipteran (two-winged or “true” flies). The ingested Bt-endotoxin is transformed in the midgut of the insect into the active form of the toxin, which in turn lyses the midgut wall and eventually leads to the mortality of the insect.

However, scientists now dread the development of resistant insects strains. Resistance can evolve if the toxin is expressed in insufficient quantities by the plant, or if insects acquire a resistance from similar toxins applied as foliar sprays.

This is the point where Corbin and Romano’s invention comes into play. Even though the Cry2A toxin comes from the same bacterium as the “classically” used Bt endotoxin, they are not homologous. Thus, resistance against one insecticide does not mean resistance against both.

Furthermore, the Cry2A toxin is non-toxic to dipterans (two-winged insects), and is more prevalently expressed in plants compared to existing Bt transgenic plant systems. Since a lot of commonly cultivated plants are not damaged by dipterans, the restriction of the target pest group is a welcomed environmental-friendly benefit. The second benefit of this new patent, the higher level of Cry2A prevalence in the plant, translates into a reduced likelihood of insect resistance.

One set back with current Bt transgenic crops is that if Bt expression is not high enough throughout the plant, then farmers often have to spray with insecticides. This occasional need to spray is significantly reduced in compared to the amount of insecticide spraying non-Bt crops require, but with Cry2A the need to spray insecticides is rare, if not eliminated. This benefit reduces insecticide use in the environment, while also cutting costs for farmers.

The overall assessment of this new invention is that it leads to an improved control of susceptible insects, a minimization of resistance development and therefore a lasting protection from pathogens. These benefits have shown to translate into larger yields for farmers.