ENGINEERED TOBACCO TAKES TO THE FIELD

Ciba-Geigy's first recombinant field tests of over 5,400 tobacco plants near Research Triangle Park, NC. The plants have been engineered to tolerate the herbicide atrazine by the insertion of a gene coding for glutathione-S-transferase, a detoxifying enzyme. The presence of surviving plants in the wake of the destruction caused by heavy atrazine application indicates that some may have the desired resistance. Next Ciba-Geigy researchers, led by senior scientist Georgia L. Helmer, will analyze lab-grown offspring of the survivors to check their genetic make-up. The company is using tobacco only as a model system, but it hopes eventually to transfer atrazine-tolerance into soybeans. Long-term goals include resistance to disease and environmental stress.

INTERNATIONAL CONGRESS OF MICROBIOLOGY

TWO ROUTES TO BETTER MUSHROOM PRODUCTION

MANCHESTER, U.K.—Yields of Britain's most valuable protected crop, the cultivated mushroom *Agaricus bisporus*, could be boosted considerably as a result of progress in biological control reported here during the 14th International Congress of Microbiology. Jim Lynch and colleagues from the Glasshouse Crops Research Institute (GCRI) at Littlehamptom in Sussex said that U.K. production of the mushroom was some 90,000 tonnes (with a wholesale value over £100 million). But 5–10 percent of this amount was lost and a further 10 percent downgraded in market price as a result of infestation with blotching. The disease is caused by *Pseudomonas tolaasii*, but this biotype of *P. fluorescens* is itself antagonized by other fluorescent pseudomonads. Using exclusive zone assays and tests with sections of freshly excised mushroom cap, the Littlehampton researchers identified several such isolates that inhibited *P. tolaasii* not only in the laboratory but also under commercial cropping conditions. Just one application of certain pseudomonads, applied in aqueous suspension, reduced the incidence of blotch disease by up to 50 percent. The bacteria were non-phytotoxic and did not lower mushroom yield.

GCRI researchers are also working on another potential method of increasing the production of *A. bisporus*. D. A. Wood and collaborators are attempting to heighten conversion of the lignocelluloses upon which edible basidiomycetes are cultivated by seeking mutants with increased enzyme activities. The scientists have worked with *Coprinus bilanatus*, which although not a cultivated mushroom is used as a genetic model for *A. bisporus* and has a similar breeding system. After UV-irradiating the fungus, they have used appropriate substrates to screen for mutants with altered cellulase, xylanase, and other activities. Those isolated so far have had pleiotropic effects on enzyme production, although none of these changes have been sufficiently large to be of practical value.

Continuing this work, the Littlehampton team is also studying changes that occur with the onset of fruiting. Cellulase levels rise as the breakdown of cellulose and hemicellulose begins, while levels of laccase (a polyphenol oxidase) drop because most lignin degradation takes place during vegetative growth. Studying laccase before and after fruiting, Wood and his group have determined that the loss of protein is less than the fall in enzyme activity, indicating the existence of an inactivation system, possibly controlled by hydrolases on the hyphal surfaces. They hope that further investigation of this system and of enzyme mutants may lead to an improved understanding of fruiting and even indicate a way of modifying or controlling the process.

With the annual world production of edible mushrooms estimated at 1.5 million tonnes (of which about two-thirds is *A. bisporus*), reducing disease and increasing production could have important economic consequences.

—Bernard Dixon