Transgenic Crops Get a Test in the Wild

Introduced alien species can wreak havoc: Kudzu vine smothered the American South, rice grass made Britain's salt marshes mushier, prickly pear blanketed parts of Australia. The invaders drive out native species, impoverish the landscape, and cost farmers dearly. No wonder, then, that citizens worry about genetically engineered plants rampaging across the country. Scientists, of course, have generally dismissed such fears as groundless, arguing that biotechnology is inherently no more dangerous than ordinary plant breeding and that crops are not invasive. But they've had a hard time convincing the alarmists. One reason: There has been no direct experimental proof that an engineered crop plant would not behave like kudzu because nobody has grown one in open fields and monitored how well it survives—until now.

A novel British research program called PROSAMO—Planned Release of Selected and Modified Organisms—has just produced its first batch of results on the ecological behavior of a genetically manipulated variety of oil seed rape (known to Americans as canola). As expected, the preliminary data, which have been shown to *Science*, indicate that these plants do not outgrow their competitors in the wild, nor is there any evidence that they pass on their foreign genes to other species. PROSAMO is moving on to test other crops with other foreign genes. If these results are as reassuring, scientists around the world will have solid evidence with which to soothe fears.

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—WILLY DE GREEF

PROSAMO started life about 3 years ago in Britain's Department of Trade and Industry (DTI), which is responsible for encouraging biotechnology. It is designed to provide scientific data on the fate of both engineered plants and microbes released into the environment. The microbial work is still firmly in the laboratory, but the plant program has just completed its first full growing season.

Nine companies at the last count—including big players such as DuPont (UK) Ltd. and Monsanto Europe as well as cutting-edge research companies like Plant Genetic Systems of Belgium and Advanced Technologies (Cambridge)—provide half the £1.5-million budget, with the balance coming from the DTI and the Agricultural and Food Research Council (AFRC). The basic plant experiment is being run by Michael Crawley, a plant ecologist at Imperial College in London. It pits Westar, a standard agricultural variety of oil seed rape (*Brassica napus ssp oleifera*), against identical plants engineered for resistance to Basta, a herbicide, or kanamycin, an antibiotic. There are three sites: one in the bleak Flow Country of northeast Scotland, one in the balmy climate of Cornwall in the southwest of England, and one at Imperial College's country station in Berkshire, west of London. At each site, transgenic seeds have been sown alongside control seeds in four habitats: wet and dry, sunny and shady. And at each habitat seeds were given full protection—spraying to eliminate insect pests and fungal diseases, a fence to keep out larger herbivores, and cultivation to remove plant competitors—or no protection, and all combinations in between.

This apparently complex experiment throws up an extremely simple conclusion: "Where you've got no cultivation and no fence, not a single seed sown, in a single site, in a single habitat, reproduced." Cosseted in a field, rape reproduces beautifully. But outside those special circumstances it is a lousy competitor in any climate, and being transgenic is apparently no help.

If the plant itself is safe, what about the foreign genes it carries? Could they be transferred to other species? Charlock (*Sinapis arvensis*) is a close relative of rape, as black nightshade (*Solanum nigrum*) is of potato; both are common agricultural weeds that would pose an even greater problem if they picked up genes for herbicide resistance from their engineered relatives. Philip Dale, a plant geneticist and deputy head of brassica and oil seeds research at the Cambridge Laboratory of the AFRC's John Innes Centre for Plant Science Research in Norwich, is responsible for PROSAMO's pollen program. He told *Science* that after many thousands of laboratory crosses between engineered potatoes and their relatives "we have no evidence of any hybrid being produced." With brassicas, such as oil seed rape, the story is slightly different: "If you try very hard and use sophisticated techniques of culturing embryos and culturing ovaries, then you can make hybrids," Dale said. Mimic nature more closely, putting oil seed rape plants and charlock plants next to each other and giving them the opportunity to cross pollinate, and they refuse. Hi-tech hybridization, although highly artificial, allows Dale to assess the consequences of a cross in the unlikely event that one occurs. Hybrids "tend to be sterile," Dale told *Science*, "which is another barrier to genetic spread."

Although these first experiments proved benign, much still needs to be done before releases become widely permitted and acceptable. What happens, for example, if you give plants resistance to insect predators, as many companies are trying to do? Based on experiments to date, Crawley does not anticipate much effect, because competition with other plants is by far the most important factor. Resistance to insect pests is unlikely to give engineered plants much of an edge, but the experiment is high on the list for next season.

Other crops are bound to differ from oil seed rape, perhaps in important ways. For example, sugar beet (*Beta vulgaris*) is wind pollinated, so its genes will travel much farther afield than the 12 meters or so measured for the movement of rape pollen, which is carried by honeybees. And beet has wild relatives with which it is known to hybridize. "Until we've done that," Crawley admits, "there's still a lot of scope for people saying you haven't scratched the surface of the difficulties." He hopes to examine maize (*Zea mays*) this year and sugar beet next, but at some stage the individual experiments on particular crops with particular foreign genes are going to have to give way to general principles governing the safety of environmental releases.

"If not that will be the end of agricultural biotech," says Willy de Greef, plant geneticist and product development manager at Plant Genetic Systems, in Belgium, the company that created the transgenic rape seeds. Individual examination of each crop/gene combination would be prohibitively expensive. Although the current PROSAMO program is due to end in 1992, Plant Genetic Systems, for one, would be happy to see it extended, but only after a review of the effect PROSAMO data has on regulators. "We're not generating data because we like to see data," says de Greef. "We want to see policy changes too." ■ JEREMY CHERFAS