

Environmental Case Study

Terminator Genes

Research in biotechnology and genetic engineering is very expensive. Monsanto is reported to have spent \$500 million developing Roundup Ready genes, or about as much as the entire annual USDA research budget. Naturally, they want to protect potential profits from this valuable property. Farmers who buy Monsanto seeds are required to sign a contract that stipulates what kinds of pesticides can be used on fields as well as an agreement not to save seed or allow patented crops to cross with other varieties. Seed sleuths investigate to ensure that contracts are fulfilled. By inserting unique hidden sequences in their synthetic genes, forensic molecular biologists can detect the presence of patented genetic material in fields for which royalties weren't paid. Already Monsanto has taken legal action against more than 300 farmers for replanting proprietary seeds. Farmers claim they can't prevent transgenic pollen from blowing onto their fields and introducing genes against their will. A whole new set of legal precedents is likely to be established by these suits.

A new weapon has recently been introduced in this struggle that many people regard as quite sinister. Using genetic research of a USDA scientist, a small company called Delta and Pine Land developed genetic material officially entitled "gene protection technology" but commonly known as "terminator" genes. The terminator complex includes a toxic gene from a noncrop plant stitched together with two other bits of coding that keep the killer gene dormant until late in the crop's development, when the toxin affects only the forming seeds. Thus, although the crop yield is about normal, there is no subsequent generation and no worry about farmers saving and replanting. They have to buy new seed every year. Delta was quickly purchased by Monsanto for \$1 billion, or hundreds of times the small company's book value. This may have been the only time a whole company was purchased just to get a gene complex.

Engineered sterility is not uncommon; it is widely used in producing hybrid crops such as maize. What is unusual about this gene-set is that it can be moved easily from one species to another, and it can be packaged in every seed sold by the parent company. It's also unique to deliberately introduce a toxin into the part that people eat. So what's wrong with a company trying to protect its research investment? For one thing, there's a worry that the toxins might be harmful to consumers, even though toxicity tests so far show no danger. Furthermore these genes may escape. What if some of our major crops become self-sterile and can no longer reproduce? A more immediate concern is the economic effects in developing countries. While seed saving is not common on farms in most developed countries, it is customary and economically necessary in many poorer parts of the world. Melvin Oliver, the principal inventor of the terminator genes, admits that "the technology primarily targets Second and Third World markets"-in effect, guaranteeing intellectual property rights even in countries where patent protection is weak or nonexistent.

Large corporations like Monsanto argue that without patent protection, they can't afford to do the research needed to provide further advances in biotechnology. Critics charge that these companies make enough profit in developed countries to pay back their costs. Targeting less-developed countries and introducing something as potentially dangerous as the terminator gene, they claim is immoral. International protests caused Monsanto to announce in 1999 that it was suspending plans to release crops with terminator genes "for the time being." Still, biotechnology research continues at a furious pace and other genetically-modified organisms are sure to be available soon. What do you think? Are those who protest this technology simply afraid of things that are new and unfamiliar, or are there legitimate reasons for concern? How can we assess risks in a novel and unknown technologies such as these?