Chinese Transgenic Poplars Experiment

After decades of attempting to reforest the northern regions of China where (a) the top layer of soil is dry, (b) the climate is arid, (c) the winds are continuous, and (d) the pest species are voracious, the Chinese government–with funding from the United Nations Development Programme–introduced a poplar species (*Populus nigra*) with a *Bacillus thuriensis* (Bt) gene for insect resistance.[1] With the Great Leap Forward in the late 1950s, China wiped out a large portion of its forests, which resulted in disastrous floods in the mid-1990s and an increased demand for imported wood.[2] Logging is now banned in the headwaters of major rivers, and the government is aiming to establish a 2,800-mile-long shelterbelt of trees across northwestern China near the Gobi Desert.[3]

More than 1.4 million genetically engineered poplar saplings were planted between 1997 and 1999 in the northern region of Xinjiang near the border of China and Mongolia covering a 300- to 500-hectare area with the aim of covering more than 44 million hectares by 2012.[4] The transgenic species is a fast-growing poplar that establishes deep roots that are capable of tapping into the ample supply of groundwater while reducing soil erosion and providing fuelwood.

That reforestation effort is the only widespread use of a transgenic forest tree species planted in the world. Because very little information is available on the results of that reforestation, it is unclear what the effects have been on this arid ecosystem. Because the tree-planting program has been conducted over such a large area with the intention of promoting the maximum amount of forest cover, neither the government nor the scientists who produced the genetically engineered trees have any records of the exact location where those genetically engineered trees have been planted.[5]

Huoran Wang, the Chinese Academy of Forestry representative in Beijing who is on the United Nations Food and Agriculture Organization (UN FAO) Panel of Experts on Forest Gene Resources told the UN FAO that the "poplar trees are so widely planted in northern China that pollen and seed dispersal cannot be prevented."[6] There is currently no strategy in place to limit, isolate, or avoid vegetative spread or crossbreeding of genetically engineered poplar species with non-genetically engineered species.[7]

Discussion Questions

- What are some of the environmental and economic effects that genetically engineered trees may have on the region where they have been planted?

- In what ways will the Bt gene affect the insect population of that region, and what effects might the gene have on the survival of non-genetically engineered trees in the area?

Chinese Transgenic Poplars Experiment (continued)

- If the goal of the reforestation program in China was to reduce soil erosion and to provide a sustainable source of wood, would it be considered a positive or negative development if the genetically engineered poplars prospered enough to merge with and extend the existing forest?

- The genetically engineered poplar is a clone species in which all the trees have identical genetic material. How can this trait be a negative or positive feature for this particular situation?

Endnotes:

1. Chris Lang, "Genetically Modified Trees: The Ultimate Threat to Forests," World Rainforest Movement and Friends of the Earth, December 2004, www.wrm.org.uy/subjects/GMTrees/text.pdf.
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3. Ibid.
4. Clive Chan, "Supertrees to the Rescue," *Catalyst*, Spring 2005, www.carleton.ca/catalyst/2005/s7.html; Renner and others, "China's Wild Card on Genetic Tree Front"; Yang Zili, Zhou Shouyi, Zhang Weidong, and Yang Zixiang, "Poplar Genetic Resources in North China: the Challenge of Sustainable Forestry," Forest Genetic Resources No. 27, UN Food and Agricultural Organization, www.fao.org/docrep/008/x4133e/X4133E02.htm.
5. W. Lida, H. Yifan, and H. Jianjun, *Molecular Genetics and Breeding of Forest Trees*, ed. S. Kumar and M. Fladung, pp., 2005).
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7. Ibid.

Oregon Bentgrass Gene Escape Story

In 2003, the Scotts Company obtained permission from the U.S. Department of Agriculture to grow 2 hectares of transgenic creeping bentgrass (*Agrostis stolonifera*) in a bentgrass containment area in north central Oregon east of the Cascade Mountains. The Willamette Valley region west of the Cascade Mountains supports a $200 million annual export business of turf grass that is used on golf courses throughout the world.[1] The transgenic species of bentgrass would contain the CP4 EPSPS gene that would allow the grass to be sprayed with a glyphosate herbicide (commonly called Roundup®) that would kill all plants except the bentgrass.[2] Because this grass is used as turf on putting greens, the inclusion of that gene would help golf courses maintain weed-free greens more easily.

Bentgrass is a wind-pollinated perennial species of grass that can also grow from stolons (stems that run along the ground horizontally) or from seed. There are 34 species of bentgrass in North America, 14 of which are native to Oregon, and many of the species cross-pollinate. Although concern was expressed about the cross-pollination of the transgenic species with other species of invasive plants or bentgrass in neighboring fields, the transgenic species was not engineered to be sterile because the seeds were meant to be harvested for sale and export. Harvested seeds were transported in sealed containers, and machines that planted or harvested the genetically modified bentgrass were fumigated before leaving the control area.[3]

After the flowering season in 2003, bentgrass from as far as 21 kilometers outside the containment area was found to have herbicide resistance.[4] Because genetically modified organisms are not permitted in Europe or in Japan, the farmers of bentgrass in western Oregon were very concerned about the spread of the herbicide-resistant gene to plants in their own fields.[5] Ecologists were concerned about maintaining the genetic integrity of the 26 species of Agrostis that are native to North America.

In late 2003, the experimental bentgrass containment area was taken out of production, and a mitigation program to eliminate genetically modified organisms (GMOs) in the region was initiated. In a scientific study conducted in 2006, 62 percent of the 585 creeping bentgrass plants tested in the containment region were GMOs.[6]

Discussion Questions

- What concerns might farmers and scientists have voiced before the genetically engineered bentgrass was planted?

Oregon Bentgrass Gene Escape Story (continued)

- Which of the concerns actually occurred?

- What long-term economic and environmental effects might occur as a result of the genetically engineered bentgrass project in Oregon?

Endnotes:

1. Doug Tankersley, "Grass Seed Industry Unready for Roundup," *Oregon Magazine*, 2003, http://oregonmag.com/GMGrass.htm
2. J. R. Reichman and Lidia S. Watrud, "Identification of Escaped Transgenic Creeping Bentgrass in Oregon," *ISB News*, April 2007, www.isb.vt.edu/articles/apr0701.htm.
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