Biotechnology

Biotechnology has taken on various meanings to different people for a variety of uses. In essence, biotechnology is the application of the principles of engineering and technology to the life sciences—bioengineering.

Biotechnology is a set of powerful tools that employ living organisms (or part of organisms) to make or modify products, improve plants or animals, or develop microorganisms for specific uses. Early biotechnology includes traditional animal and plant breeding techniques, and the use of yeast in making bread, beer, wine, and cheese. Modern biotechnology includes the industrial use of recombinant DNA, cell fusion, novel bioprocessing techniques, and bioremediation.

- http://www.wabio.com/industry/definition_biotech.htm

Biotechnology refers to the use of microorganisms such as bacteria, or biological substances such as enzymes, to perform industrial or manufacturing processes. Although biotechnology seems new, it has been around for quite some time and has been used to produce drugs and synthesize hormones, such as insulin, or produce antibiotics. Biotechnology has also been used to genetically alter bacteria for use with the cleanup of oils spills (bioremediation).

Another area of biotechnology doesn't use living organisms at all. Examples include DNA micro arrays used in genetics and radioactive tracers used in medicine.

If we look at modern biotechnology that is based on the technology of recombinant DNA and its different usages, we can classify biotechnology in different fields such as medical biotechnology; ecological biotechnology; bioprocess, pharmaceutical and industrial biotechnology; and farming biotechnology.

Biotechnology in agriculture is essentially the science of DNA or cellular combinations through the use of living organisms (cells, bacteria, yeast, and others) or their parts or products as tools (for example, genes and enzymes).

One subset of biotechnology application is the development of plant-made pharmaceuticals, or "biopharm." Biopharming is the production of pharmaceutical proteins or other materials in genetically engineered plants and animals. This specific topic has created significant policy discussions in Oregon.

No major GMO crops are currently grown in Oregon. The few crops that do present GMO traits are confined to only a few acres. These include canola and alfalfa in Eastern Oregon, along with a small acreage of potatoes. An herbicide-resistant bentgrass variety was tested in Central Oregon but has yet to receive USDA approval for release (there have been concerns about pollen drift and crossing with native species). This does not eliminate the potential, however, for future developments in research or scaleable application of this technology to other crops grown in Oregon, especially as the technology becomes more accepted by consumers here and abroad.

BioPharm Recommendations

In the fall of 2005, the Oregon Department of Agriculture and the Oregon Department of Human Services convened a joint committee to develop a consensus policy recommendation to the governor regarding biopharmaceuticals produced in human food or animal feed crops.

The committee was chaired by a member of the State Board of Agriculture, Jim Rue. The Dean of the College of Agriculture at Oregon State University, Thayne Dutson, was a member. Katy Coba, ODA director and Gail Shibley, administrator for the Office of Public Health Systems, Department of Human Services, served as ex-officio members.

The committee met several times during 2006. The committee concluded that a case-by-case regulatory approach, rather than a wholesale prescriptive or prohibitory approach, is warranted because of the enormous diversity in safety and benefits from different biopharm products. The committee did not endorse or reject all forms of biopharm technology.

The Oregon biopharmaceutical committee made the following recommendations.

- The committee considered a number of formal recommendation options for the governor of Oregon, ranging from a complete ban of biopharm crops to unqualified endorsement. The committee chose "endorsement, moderate scope" to indicate that it supports wisely chosen and carefully studied applications of biopharm technology in Oregon. The "endorsement" of biopharming was based on the recognition that this technology has the potential to prevent or treat disease of public health significance. The "moderate scope" choice option, however, reflected the committee's interest in substantial State of Oregon involvement in federal regulatory decisions about where and how biopharm crops may be grown in Oregon; how specific farmers, products, and markets for state products may be impacted; substantial concerns over safety and/or legal risks should biopharm versions of food or feed crops be grown outdoors; limited public information on the benefits and safety of specific products; and because of the complexity of this technology, the importance of communication to the public about benefits and risks. "Endorsement, moderate scope" does not imply that the committee categorically endorses biopharmaceutical products in food or feed crops nor does it categorically endorse outdoor field trials.

The following additional recommendations are designed to ensure that this kind of technology would be developed in a safe manner for humans and the environment.

- Collaborate with the United States Department of Agriculture's Biotechnology Regulatory Services (BRS) in the review and determination of applications to grow biopharmaceuticals

in Oregon, including a formal memorandum of understanding (MOU) or contractual agreement that provides the state with the location, crop used, anticipated planting date, intended plant made pharmaceutical, and FDA's preliminary opinion on product safety for biopharm food crops before a trial permit is granted. Authorize the directors of Agriculture and Public Health to modify, restrict or veto a permit for field trials in the state if deemed appropriate.

- Encourage the use of non-food crops or animal feed crops for biopharmaceutical applications intended for outdoor environments. If food crops are proposed, greenhouse production should be utilized, if possible.
- Require that, upon permit approval for outdoor growth of biopharmaceutical food crops, applicants post a bond or demonstrate financial responsibility to cover potential damages incurred from contamination or harm as a result of inadvertent release or the adventitious presence of the biopharmaceutical products in the food supply or environment. In addition, require an outline of possible mitigation actions and an emergency response plan to address potential contamination or harm.
- Establish a public communications plan for biopharmaceuticals.

Other biotechnology

In 2005, 33 notifications and permits for transgenic plants were submitted for review to the Oregon Department of Agriculture. These include field trials for canola, corn, creeping bentgrass, Kentucky bluegrass, poplar trees, soybeans, sugarbeets, and sweetgum, as well as agro-bacterium. The traits incorporated into these crops include resistance to insects, bacteria, nematodes, fungus, and herbicide sprays; agronomic properties for yield and stand improvement; heat tolerance; and other expressions. Forty-six permits or notifications were issued in 2004 and 36 in 2003.

While none of these crops or applications is produced in any commercial quantities at the present and all still require review and approval by the FDA, EPA, and USDA, it is clear that Oregon fields are a good research ground for biotechnology. Many crops commonly grown today would not be approved if subjected to the same scrutiny as biotechnology crops. Peanuts, for example, would not pass the allergen concerns.

The first US commercial acres of genetically-modified crops were planted in 1996 and now occupy millions of acres. Over 90 percent of soybeans, 75 percent of cotton and more than half of the corn in the United States is genetically enhanced, primarily for disease or pest resistance, or to accommodate herbicide applications to weeds without affecting the crop.

Initial reaction to biotech crops ranged from tagging the plants as "Frankenfood" and

highlighting the risks associated with bioengineered agricultural products, to claims that they would be the saving factor for developing nations and curing of diseases.

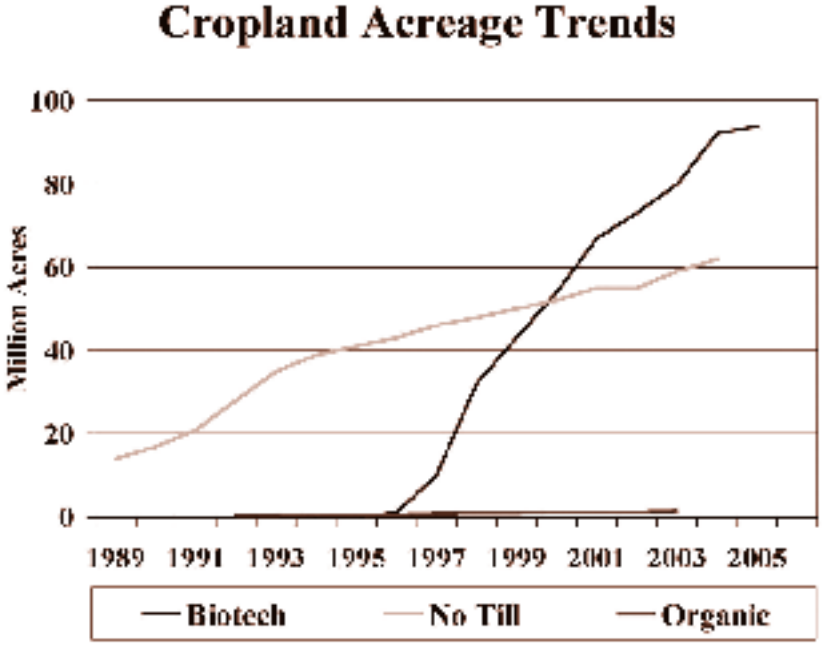
Now, 10 years after introduction, there is no scientific evidence of any significant negative environmental impacts or inability to coexist with other types of production, including conventional and organic. In fact, many growers have all three production systems on the same operation. Growers have learned the necessary practices for isolation distances, buffer zones, and production management in the major crops that have been under production for a decade.

Genetically engineered glyphosate-resistant crops allow direct application of the herbicide without causing damage to the crop. A concern about this technology is that glyphosate resistance is developing in certain weeds from the wide-scale use of this chemical in GMO crop production. For this reason, significant research is being directed toward strategic weed management under GMO cropping systems. However, this situation is not unique to GMO systems. Over time, repeated use of any one pesticide on conventional (non-GMO) crops can also lead to pest resistance. Growers have developed strategies such as crop rotation and varied weed control methods to avoid such problems.

The advantages of using GMO seed in production systems is evident by the rate at which this technology has been adopted by farmers in crops where it has been applied, primarily corn/maize, soybeans, cotton, and canola.

As noted by one observer: "They [biotech crops] have become conventional. Biotech is the changing face of agriculture..." ***(Frankenfood No More: The Bright Side of Genetically Modified Agriculture and the Future Ahead, Tina Butler, mongabay.com, May 15, 2005)***

A recent study concluded that the growth of biotech crop plantings have not impeded the development of the organic sector in North America. "The evidence to date shows that GM crops, which now account for the majority (60 percent) of total soybean, corn and canola grown in North America, have coexisted with conventional and organic crops without significant economic or commercial problems."



US adoption of various cropping methods, in acreage.

Source: CropLifeFoundation.org

Similar findings were evident in Spain and the UK. ***("Coexistence in North American agriculture: Can GM crops be grown with conventional and organic crops?" by Graham Brookes and Peter Barfoot, PG Economics Ltd, 2005.)***

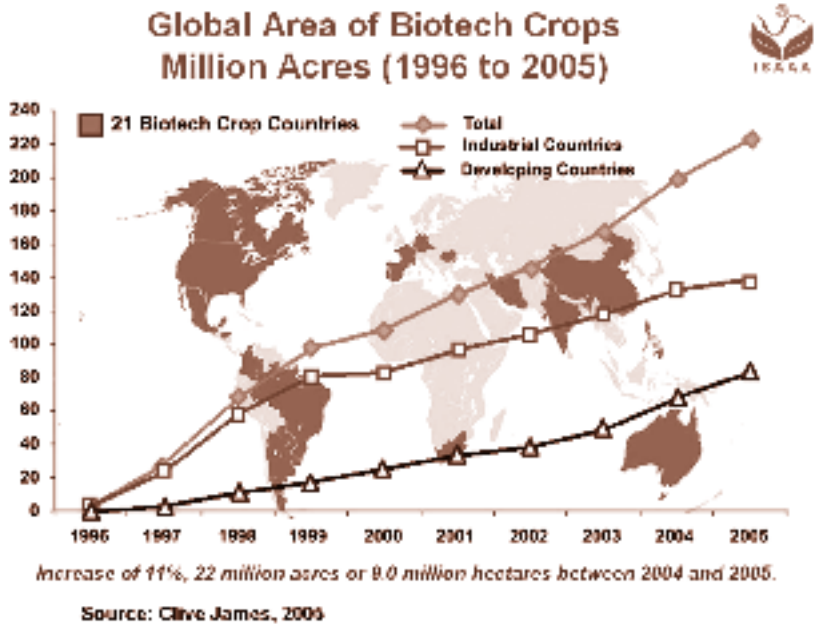
Biotech crops were planted in 18 countries in 2004. In the US and Canada, biotech crops accounted for 60 percent of the total plantings of soybeans, corn, and canola. Conventional varieties of these three crops had a 39.78 percent share, and the organic share was about 0.22 percent.

By 2010, it is projected that 15 million farmers will grow genetically modified crops on up to 375 million acres in 30 countries. It is arguable that no other technology in agriculture history has been adopted so widely in such a short period of time. Clearly, farmers see the benefit of biotechnology in farm production.

For example, Chinese farmers growing biotech cotton in 1999 reported that they sprayed 60 percent fewer times (eight times instead of the average 20), reducing their insecticide expenses by 82 percent. Their yields for 1999-2000 increased by an average of 10 percent.

Supporters of biotech crops also hold that such plants further protect the environment in the promotion of new farming techniques that preserve topsoil and use resources more effectively.

The main reason farmers till their soil is to control weeds that compete with their crops for space, nutrients, and water, and can interfere with harvesting equipment. Historically, farmers have plowed under emerged weeds before planting and tilled the soil in preparation for herbicides that prevent additional weeds from emerging. If herbicides failed due to weather conditions, farmers could use additional tillage as a rescue.



With herbicide-tolerant crops, farmers allow weeds to emerge with their crops. Then they apply herbicide over the top of their crop, removing the weeds without harming the crop, which has been modified through biotechnology to withstand the herbicide. This improvement in weed control gives increased confidence that weeds can be controlled economically without relying on tillage. It partially explains why no-till farming has been increasing significantly in crops where the technology is available. Many analyses have shown that conservation tillage provides economic benefits by saving time and reducing fuel and equipment costs.
(Conservation Technology Information Center)

Biotechnology has primarily focused on large-acreage crops such as corn, soybeans, and cotton.

These and other crops have increased acreage for ten consecutive years, with acreage increases of 15 percent in 2003, 20 percent in 2004, and 11 percent in 2005.