

Introduction

The world's population will nearly double by 2050. Growers will increasingly have to grow more on fewer acres. Malnutrition and disease prevention will continue to be problematic, particularly in developing nations.

Meeting the challenges of today and tomorrow is something biotechnology holds great promise in. By identifying a particular trait (gene) in one organism and placing it in another, the demands of agriculture, medicine, the environment and society can be met almost immediately. Biotech's wide variety of beneficial impacts have already made their way into fields and pharmacies around the world. This document outlines four key areas where biotechnology is making a difference.

Insect and Disease Resistance

The benefits of biotechnology in farming impact both the grower and the plant health professional. Foremost is the ability to provide built-in insect and disease protection in plants. By identifying and inserting a particular gene that is resistant to an insect or disease, a plant that was formerly susceptible to a pest is no longer so.

Examples of both insect and disease resistant plants now being grown include:

- Cotton: the use of B.t. cotton (cotton inserted with *Bacillus thuringiensis*, a common soil bacterium) has enabled plants to be resistant to bollworm infestation
- Corn: DeKalB.t. corn has added protection against the European corn borer
- Potato: the NewLeaf® potato also utilizes a variety of B.t. bacteria for protection against the Colorado potato beetle

Products currently being researched for release into the market within the next five to six years include:

- Sunflowers, Soybeans, Canola and Wheat: B.t. will be utilized in these crops to provide protection against caterpillar and beetle pests
- Strawberries: Research is focusing on adding several different genes to resist disease and prolong shelf life

By adding insect and disease resistance to plants, growers and plant health professionals are given additional tools to manage farms. Today, growers often use Integrated Pest Management (IPM), incorporating a number of techniques to grow their crops. IPM involves a complex mix of traditional growing methods, beneficial insects (i.e., ladybugs), secondary crops (i.e., beans, which produce nitrogen), and other techniques that enable a grower to produce a crop that is

economically and environmentally viable. Biotechnology has fast become another tool in the IPM toolbox.

Finally, such benefits are not limited to agriculturally rich nations. Food production is especially difficult in developing countries, where resources are scarce. In a 1999 report from John R. Block, former U.S. Secretary of Agriculture, biotechnology was estimated to increase food production in developing nations by as much as 25 percent.

Natural Resource Conservation, Cleanup and Preservation

California is increasingly an urbanized state. Growers are being asked to produce as much or more on fewer and fewer acres. Biotechnology is helping to solve this ag resource “crunch” through crops that reduce the overall acreage required to grow a particular commodity, as well as decrease the requirements for tillage and irrigation. Examples include:

- Corn: high pH-tolerant corn hybrids are now capable of growing successfully on severely alkaline soils that characterize the western U.S. corn belt

Additionally, biotech crops are also being developed that enable a plant to grow under harsh conditions, including drought or deficient soils. This is of particular benefit to regions like California, where urbanization is taking up valuable farmland.

A significant contribution of biotechnology is environmental cleanup. Crops are currently being researched that may eventually help ameliorate environmental pollution and preserve endangered species. For example, genetic engineering is being used to help save trees threatened by disease, including the American chestnut, a hardwood destroyed by a blight that killed 3.5 billion trees in the early 20th century.

“Harvest on the Horizon,” a 2001 report issued by the Pew Initiative on Food and Biotechnology, also noted the following advances:

“Researchers are also are creating TNT-sensitive bacteria that could be useful in landmine detection as well as engineering zebra fish that can detect pollutants such as dioxin or PCBs. Scientists are also working with a number of plants to enhance their natural ability to absorb and store toxic and hazardous substances that could assist in the cleanup of contaminated soils and chemical leaks.”

Medicinal Benefits

The benefits of biotech are not limited to agriculture. Proteins that can fight infection and disease are being replicated at a cheaper, faster rate. With biotechnology, proteins that serve as the basis for medicine can be replicated within a plant, and created more efficiently. The result? Possibly greater access to medicine at a cheaper cost. Examples of pharmaceutical-based biotechnology include:

Treatment for

- Rheumatoid arthritis
- Colon Cancer
- Leukemia
- Paralysis
- Tooth decay

Cheaper creation of

- Vaccinations – plants involved include corn, spinach, tobacco, lettuce, tomato, soybeans and potatoes, where a person may actually be able to ingest the product and receive the vaccination as an added benefit
- Vaccines for diphtheria, measles, tetanus and other maladies are only a few of the areas researchers are exploring
- Blood proteins
- Monoclonal antibodies
- Hormones

Societal Benefits

The benefits of biotech medicines, crops and resource conservation clearly have a positive impact on society as a whole. Biotech advances are not limited, however, to fields and pharmacies. Consumers with special needs have much to gain from the world of biotechnology.

Malnutrition in the world has reached epidemic proportions. According to the Gordon Conway, president of the Rockefeller Foundation, more than 800 million people are chronically malnourished. Through a variety of products, biotechnology is addressing these needs on a global level.

Foods with higher protein levels, minerals and vitamins, and lower in saturated fats are slowly making their way from the lab to the marketplace. Examples of these products include:

- “Golden rice,” richer in beta-carotene and iron – work is being done to provide the technology behind the product free of charge to developing nations
- Peanuts that no longer contain a common allergen
- Tomatoes, raspberries, strawberries, bananas and pineapples with longer shelf-lives, preventing spoilage
- Sunflowers that produce oil lower in trans-fatty acids
- Salmon, tilapia, trout and flounder that can grow faster and decrease the time from egg to market (in some cases, from three years to one and a half) – would help minimize “over-fishing” of wild species, such as salmon
- Lignin that is easier to remove from cellulose, a primary paper ingredient – would require less energy and bleaching in the papermaking process

Summary

Biotechnology products hold great promise for consumers, growers and the environment. Encouraging continued research in the field is a primary concern for the California Plant Health Association and its members. For more information, please contact CPHA at www.cpha.net.