Reducing Hunger Though Agricultural Biotechnology

By James Kleidon

Given the anticipated population growth during the coming decades, tremendous strains will be placed on global food production. With nearly 1.5 billion people in developing nations already suffering, the rate of hunger is expected to increase. However, advances in the field of biotechnology may offset many of the challenges to the global food supply. Specifically, the use of agricultural biotechnology to improve crop production has the potential to reduce hunger and malnutrition in developing nations.

Over the last 30 years, genetic researchers have probed the habitats, reproductive traits, and immunities of a wide range of crops such as soybeans, corn, and fruits. Using DNA splicing and genome techniques, breakthroughs in biotechnology have enabled researchers to tailor the genetic characteristics of crops. The result is a genetically altered, or transgenic plant.

A transgenic plant is created by artificially inserting a gene sequence (transgene) into a host plant from either an unrelated plant or an entirely different species. The hybrid plant has a modified genetic structure that contains the traits of the original plus selected traits from the donor. Genetic modification allows researchers to target specific attributes such as increased yields, improved growth, and pest immunities.

Several nations already utilize transgenic crops on a large scale. Currently, the United States leads the world in the adoption of transgenic crops followed by Argentina and Canada. According to the Department of Soil and Crop Sciences at Colorado State University, soybeans comprise the largest acreage of transgenic crops followed by corn, cotton, and canola (7). Colorado State University also reports that nearly 50% of the US soybean crop and 25% of the corn crop are transgenic species (7). The widespread use of agricultural biotechnology in the U.S. demonstrates that transgenic crops have been deployed successfully on a large scale.

There are several varieties of transgenic crops currently in production. Herbicide tolerant crops are the most widely used since weed control is one of the most difficult farming challenges. Dan Ferber reports that 69.4 million acres of herbicide tolerant crops were planted worldwide in 1999 (1663). The proliferation of weeds within a planting can choke out the crop, drastically reducing yield and quality. Without transgenic herbicide crops, chemical-based herbicides are the only other solution for weed control. Unfortunately, chemical herbicides build up toxins in the soil and leach into rivers and lakes, poisoning aquatic life.

At 22 million acres, Bacillus Thuringiensis (Bt) insect resistant crops are the second most prevalent transgenic variety (Ferber 1663). Colorado State University describes Bt as a soil bacterium that when ingested by pest insects, releases a toxin that “creates pores in the intestinal lining, resulting in ion imbalance, paralysis of the digestive system, and after a few days, death” (8). Bt-hybrid corn has been developed to control the highly destructive European corn borer and corn rootworm. Corn rootworm stunts the plant’s growth by damaging the roots and reducing the stability of the adult plant.

Before the introduction of Bt-hybrids, toxic insecticides were the only way to minimize the impact of rootworms and borers. Controlling corn rootworm through insecticides requires direct application to the soil at the base of the stalk. In fact, rootworm insecticides account for the majority of toxins applied to U.S cornfields. Ferber points out that Bt-hybrid varieties have significantly reduced the use of chemical pesticides, especially on cotton crops (1662). The impact has been directly measured. As Ferber explains, “In 1999 U.S. farmers used 450,000 kg fewer pesticides on Bt-cotton than conventional varieties” (1663). Crops in developing nations suffer from the same pests as the U.S., but do not have an equivalent insecticide deployment infrastructure. Instead, larger plantings are required to compensate for expected pest degradation, further reducing productivity per acre.

Reducing the use of chemical herbicides and insecticides are not the only benefits of transgenic crops. Researchers have developed ways to enhance the nutritional values of select plants. A recent multinational research team has produced a beta-carotene hybrid called Golden Rice. Beta-carotene is an essential nutrient easily converted to vitamin A within humans. In addition, another variety of rice has been developed containing high levels of human digestible iron. Conko and Prakash note that more than 3 billion people in developing countries do not ingest enough nutrients such as vitamin A and Iron (4). Without these nutrients, chronic anemia, degraded learning abilities, and blindness can result. On the other hand, widespread use of Golden Rice can help reduce nutrient deficiencies in the developing world.

To reduce global hunger there are many other varieties of transgenic crops currently under study. One example is a strain that grows faster because the plant can photosynthesize carbon dioxide and sunlight more efficiently. Once deployed, accelerated growth crops will have shorter maturity and ripening cycles, thereby increasing the number of harvests per season. Also, less irrigation will be required, freeing up precious fresh water resources.

Critics claim that transgenic crops are products created only to enrich multinational corporations. However, the evidence proves otherwise. As Conko and Prakash observe, aid agencies such as the U.N. Children's Fund and the World Health organization are collaborating with bioengineering corporations to combat global hunger (4). Furthermore, researchers are working with developing nations such as the Philippines and South Africa to field solutions targeted at regional hunger challenges. Golden Rice, for example, is being provided to poor farmers in Asia and Africa at little or no cost. To help improve nutrition in sub-Saharan Africa, researchers have created a derivative of native sweet potatoes that have elevated levels of dietary protein.

Even though significant progress has been made in regards to transgenic research and deployment, critics of bioengineering are vocal and organized. One claim is that transgenic produce could cause allergic and other potentially dangerous reactions in humans. Yet after continuous testing, the United Kingdom's Royal Society states: "There is at present no evidence that GM foods cause allergic reactions" (15). In fact, the report concludes that genetically modified plants do not demonstrate an allergenic risk greater than conventional crops.

Of course, some concerns about bioengineering are not without merit. For example, select transgenic varieties have been verified to mutate a native crop, reducing its ability to reproduce. There is also concern that Bt-hybrids may cause the target insects to mutate and become immune. As a result, the mutated insects could adapt to Bt-hybrids and insecticides, rendering both ineffective. James Hancock has proposed a data gathering and interpretation methodology that attempts to reduce real and perceived risks of transgenic crop deployment (512).

Within the general public there lingers a fear of transgenic crops. Anti-bioengineering groups are well organized and have created, as Conko and Prakash argue, "Scare stories that have led to the adoption of restrictive policies" (5). Conko and Prakash emphasize that fears promoted by the anti-bioengineering groups are "simply not supported by the scores of peer-reviewed scientific reports or the data from tens of thousands of individual field trials" (5).

Opponents of transgenic crops fail to point out that farmers have been genetically altering plants though selective breeding and cross-pollination for millennia. Most of this crop mutation was performed long before techniques of scientific rigor, yet farmers identified methods to prevent harmful crops from entering the food chain. Hancock insists that the practices used to ensure the safety of traditional crops and transgenic varieties are similar (1664).

As with any technological development, agricultural biotechnology must proceed with proper scientific rigor and caution. Nevertheless, the European Union has been increasing resistance to transgenic crop deployment. According to Conko and Prakash, the United Nations report: "Strict legal requirements in European member nations have held back the adoption of transgenic crops in underdeveloped nations that need them" (6). Still, many developing nations such as South Africa, Argentina, Mexico, Brazil, and India are boosting transgenic crop deployment annually.

When properly researched, categorized, and deployed, transgenic crops can help increase yields, improve pest tolerance, and reduce global hunger. Developed nations such as the European Union should not place unfounded restrictions on transgenic crop deployment within developing nations to protect or promote corporate interests. Only the merits and proper risk assessment of individual transgenic crops should be the deciding factor. To ensure proper awareness, it is crucial that governments and the general population seek accurate information about agricultural biotechnology.

References

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