

crops is introduction of an antisense RNA.² The sequence of antisense RNA is complementary to the endogenous mRNA produced in plants. Therefore, the production of certain undesirable proteins in the plant may possibly be inhibited by the formation of double-stranded RNA.

Several species of GM crops have been successfully produced, such as tomato, soybean, carrot, rice, corn, canola, and cotton, etc. Generally speaking, these crops have improved production efficiency, enhanced environmental conservation, and increased nutrition values, so these crops possess the properties of controlled ripening, herbicide tolerance, pest resistance, growth enhancement, or nutrient enrichment.³ For example, the Flavr SavrTM tomato, the first commercial GM food developed by Calgene Fresh Inc., has a longer storage life.⁴ Normally, tomatoes become softened when ripe after harvesting because the pectin in their cell wall is broken down by the enzyme polygalacturonase (PG). Antisense RNA for PG has been introduced into the Flavr SavrTM tomatoes, so that the synthesis of the PG protein will be inhibited and the degradation of pectin will be prevented. Therefore, the shelf life of the Flavr SavrTM tomatoes is prolonged. The nutritional values of a crop can be increased. However, when a foreign gene is introduced, the safety of these GM crops is suspect.

Besides Flavr SavrTM tomatoes, hundreds of projects are now underway to develop genetically engineered plants.⁵⁻⁷ Some research groups are trying to improve tomatoes for processing into catsup, soups, pastes, or sauces by genetic engineering to make the tomatoes contain more solids, to be thicker, and to contain more lycopene, which provides the red color and a health contribution. Genetically modified potatoes with more starch and less water content may prevent damage by mechanical harvesting and may absorb less oil when they are fried, producing healthier french fries. Some genetically developed squash and cantaloupe varieties are designed to resist viruses. Flavor-rich melon and peach varieties have been transgenetically produced during the main crop season. Genetically modified crops such as cotton, corn, and soybeans have also been designed to reduce the saturated fat content and have given farmers the choice of using fewer chemical applications and using more environmentally friendly herbicides. Not surprisingly, many GM crops

have silently been introduced to supermarkets and even local and traditional markets.

BENEFITS OF GM CROPS

Researchers imagine many excellent uses of biotechnology in food production. Some skills are more technical than others, and the consequences are easier to achieve. Nevertheless, the wisest way to consider the benefits of biotechnology is to consider actual applications for human welfare. This helps maintain a perspective on today's reality and tomorrow's vision.

Enjoyed Benefits in the 20th Century

Nutritious and Healthy Food

Biotechnology has made foods healthier and more nutritious.⁸ For example, better methods have been developed to identify and locate toxins, pathogens, or contaminants in food. Biotechnology also brings accuracy, efficiency, and speed to food protective methods. Transgenic rice species have eliminated allergy-causing proteins that cause high rates of rice allergy in Asian nations. Fruits and vegetables contain higher levels of certain nutrients such as vitamins C and E, and beta-carotene, which may help reduce risk of some cancers and heart disease. Crops, such as rice and corn, with an improved protein profile to include higher levels of essential amino acids may help reduce malnutrition of children in Third World countries caused by the limited amino acid content in foods.

Environmental Protection

Environmental stresses from frost to insects to plant diseases all demand responses from crops. There is little alternative but to use harsh chemical products to prevent dramatic crop losses. Biotechnology has increased the ability of many crops to withstand challenges from nature. Crops have been developed which resist destructive insects and plant disease, resulting in reduced use of pesticides. Breeding more herbicide-, insecticide-, and fungicide-tolerant crops allowed more selective application of agricultural chemicals.