

## Genetically Engineered Products

### Examples of Transgenic Products “in the Pipeline”

#### Input traits:

- ❖ Introduction of herbicide tolerance into sugar beet, wheat, alfalfa, sugarcane, potatoes, forestry products, specialty fruits and vegetables.
- ❖ Introduction of insect resistance into tomato, sugarcane, soybeans, rapeseed, peanuts, eggplants, poplar; includes using other Bt toxins with different specificities and developing other toxins that could alleviate the problems associated with development of resistance to Bt.
- ❖ Introduction of disease resistance (to viruses, fungi, and bacteria) in corn, potatoes, and a variety of fruits and vegetables.
- ❖ Introduction of genes for other agronomic traits, including drought tolerance, frost tolerance, enhanced photosynthesis, more efficient use of nitrogen, increased yield.
- ❖ Increasing use of “stacked” traits (herbicide tolerance and Bt resistance in one plant, for example).

#### Output traits

Feed quality, food quality, value-added traits, specialty chemical production

- ❖ Traits affecting quality of animal feed:
  - Low-phytate corn.
  - Soybeans and corn with altered protein or oil levels (nutritionally dense).
- ❖ Traits affecting food quality for human nutrition (nutraceuticals):
  - Canola and soybeans producing oils high in stearate or low in saturated fats.
  - Canola with high beta-carotene (antioxidant) content.
  - Tomatoes with elevated lycopene levels (anti-cancer agent).
  - Grains with optimized amino acid content.
  - Rice with elevated iron levels.
  - Increased vitamin content.
  - Production of “low-calorie sugar” (indigestible fructans) in sugar beets.
  - Increased sugar levels in corn, strawberries, for enhanced flavor.
- ❖ Traits that affect processing:
  - Colored cotton.
  - Cotton with improved fiber properties.
  - High-solids tomatoes and potatoes.
  - Delayed-ripening fruits and vegetables, such as melon, strawberries, raspberries.
  - Altered gluten levels in wheat to alter baking quality.
  - Naturally decaffeinated coffee.
- ❖ Production of specialty chemicals (plants as bioreactors):
  - Production of pharmaceuticals, antibodies, vaccines, industrial chemicals in transgenic plants; examples include diarrhea vaccines in bananas, blood proteins in potatoes, rabies vaccine in corn, monoclonal antibodies in corn.
- ❖ Transgenic livestock:
  - Pharmaceuticals produced in milk in cows, pigs, or sheep; examples include antithrombin III (a blood anticoagulant, currently in phase III clinical trials), alpha-1-antitrypsin (used to treat cystic fibrosis), alpha lactalbumin (a human milk protein to use as a nutritional supplement).
  - Livestock with more rapid growth, less fat, disease resistance; more long term.

Sources: Information Systems for Biotechnology website at Virginia Polytechnic Institute and State University ([www.isb.vt.edu](http://www.isb.vt.edu)); APHIS Agricultural Biotechnology website (<http://www.aphis.usda.gov/biotech/>); Biotechnology Industry Organization website ([www.bio.org](http://www.bio.org)); Monsanto website ([www.monsanto.com](http://www.monsanto.com)); OECD BioTrack Online website ([www.oecd.org//ehs/Service.htm](http://www.oecd.org//ehs/Service.htm)).