Biotechnology

• 1st: Why are we interested in new technology for vegetable production
• What is biotechnology
  – Tissue Culture
  – Somaclonal variation/Mutation breeding
  – Protoplast fusion
  – Molecular markers
  – Genetic engineering

Why do we need Biotechnology?

Malthusian Theory:
"...human populations, unless checked by wars or disaster, increase until hunger takes control."
The world’s population will increase at a geometric rate, while the world’s food supply will increase at an arithmetic rate.
Britain will be in disaster by the mid-nineteenth century.

Thomas Malthus, 1798

Is This a Flawed Theory?

• Wars, Diseases, Politics, etc…, have prevented population growth from being purely geometric
• Modern Agriculture has increased production beyond linear increases:
  – Mendelian Genetics and use of hybrid cultivars (1900 - 1920's)
  – Chemical Agriculture (1940’s – 1950’s)
  – “Green Revolution” (1960’s)
Modern Agriculture has not been readily accepted

➢ LUTHER BURBANK

“We have recently advanced our knowledge of genetics to the point where we can manipulate life in a way never intended by nature.”

“We must proceed with the utmost caution in the application of this new found knowledge.”

• 1906

Resistance to the Green Revolution

• India resisted the importing of “exotic” wheat in 1965:
  – These varieties would “destroy Indian agriculture” warned scientists.

• The Minister of Agriculture allowed for the use of the new varieties because of the crisis facing Indian agriculture:
  – Predictions gave the country two years before wide-spread famine engulfed the country.

• Within two years, a bumper crop helped feed the nation

(http://www.observerindia.com/news/200011/24/commentary03.htm)
Resistance to Chemical Agriculture

- No References to resistance prior to widespread use (acceptance)
- Indiscriminate use of Chemical Agriculture probably poses the greatest risk to public health of all modern farming practices

World's Food Supply vs. Increasing Population

Biotechnology

- The application of biological science to solve economically and socially important problems
- Includes:
  - Tissue Culture
    - Micropropagation
    - Meristem culture
    - Embryo culture
    - Protoplast fusion
  - Molecular markers
  - Genetic engineering
Regenerating Whole Plants in Tissue Culture

Embryo Rescue

Meristem Culture
Selecting Mutations in Cell Culture

Protoplast Fusion from two different genetically distinct plant cells

Molecular Markers