

Transgenic Plants

By

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Introduction

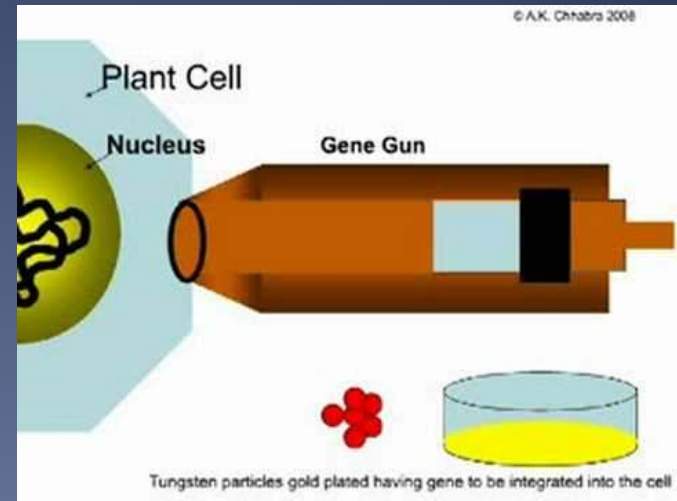
- A transgenic crop plant contains a gene or genes which have been artificially inserted to the plant genome.
- The inserted gene sequence (known as the **transgene**) may come from another unrelated plant, or from a completely different species: transgenic Bt corn, for example, which produces its own insecticide, contains a gene from a bacterium.
- Plants containing transgenes are often called **genetically modified** or **GM crops**.

Method for production of Transgenic Plants

- 1. **Selection of gene of interest** enhance yield potential, improve stress tolerance, modify chemical properties of the harvested product, or otherwise affect plant characters.
- 2. **Designing Genes for Insertion**
 - 2.1. A **promoter sequence** must be added for the gene to be correctly expressed (i.e., translated into a protein product). The promoter is the on/off switch that controls when and where in the plant the gene will be expressed.
 - 2.2. transgene

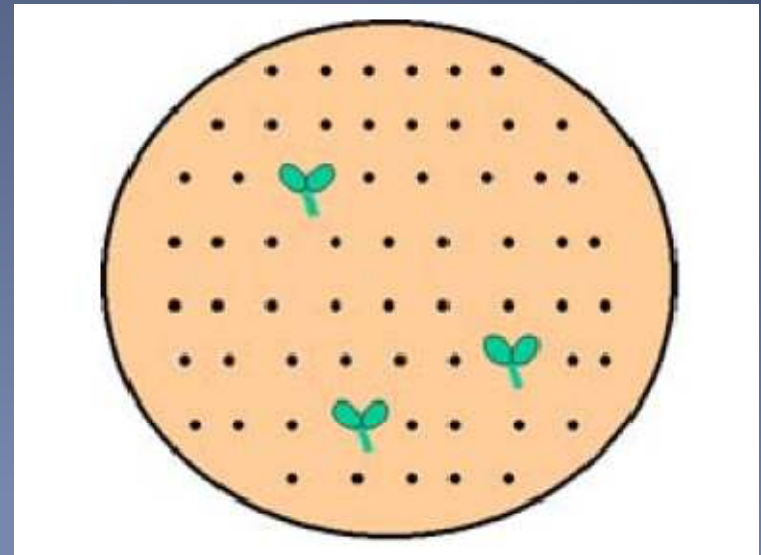
Method for production of Transgenic Plants

- 2.3 A selectable marker gene is added to the gene "construct" in order to identify Plant cells or tissues that have successfully integrated the transgene.
- 3. **Transforming Plants**
- Transformation is the heritable change in a cell or organism brought about by the uptake and establishment of introduced DNA. There are two main methods of transforming plant cells and tissues:
 - 1. The "Gene Gun"
 - 2. Agrobacterium – Ti Plasmid
 - 3. Microinjection



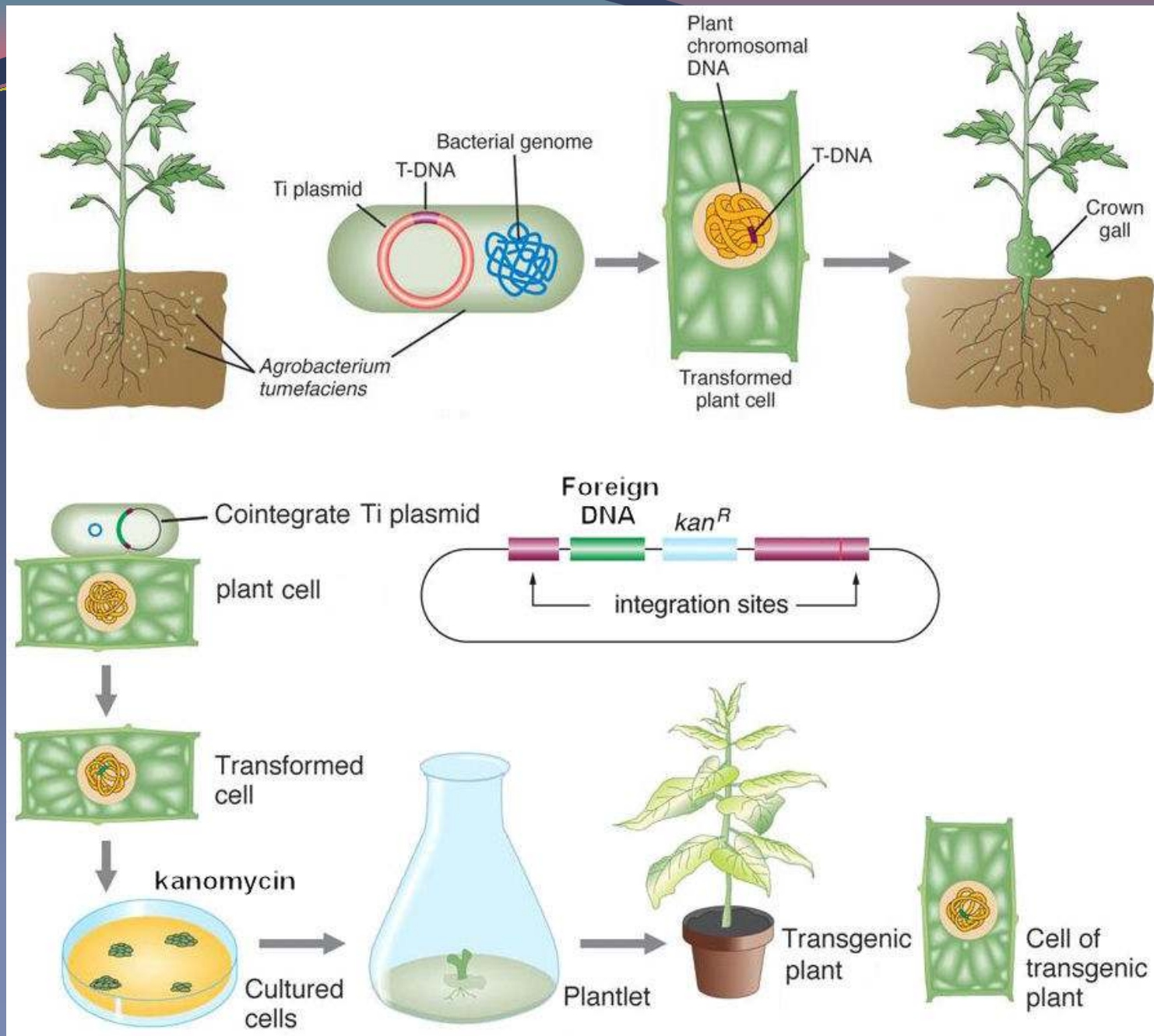
Method for production of Transgenic Plants

- **4. Selection and Regeneration**
- Following the gene insertion process, plant tissues are transferred to a selective medium containing an antibiotic or herbicide, depending on which selectable marker was used. Only plants expressing the selectable marker gene will survive.



Method for production of Transgenic Plants

- **5. Regeneration of whole plants-** To obtain whole plants from transgenic tissues such as immature embryos, they are grown under controlled environmental conditions in a series of media containing nutrients and hormones, a process known as tissue culture.



Applications

Improved Nutritional Quality

- Milled rice is the staple food for a large fraction of the world's human population.
- The synthesis of beta-carotene requires a number of enzyme-catalyzed steps. In January 2000, a group of European researchers reported that they had succeeded in incorporating three transgenes into rice that enabled the plants to manufacture beta-carotene in their endosperm.

HOW TO MAKE GOLDEN RICE

A four-step process to feed the poor

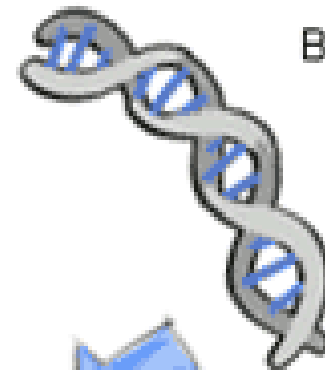


Insect Resistance

- *Bacillus thuringiensis* is a bacterium that is pathogenic for a number of insect pests. Its lethal effect is mediated by a protein toxin it produces.
- Through recombinant DNA methods, the toxin gene can be introduced directly into the genome of the plant where it is expressed and provides protection against insect pests of the plant.



*bacillus
thuringiensis*



Bt Gene is
inserted
into crop



Crop is infected by
European corn borer

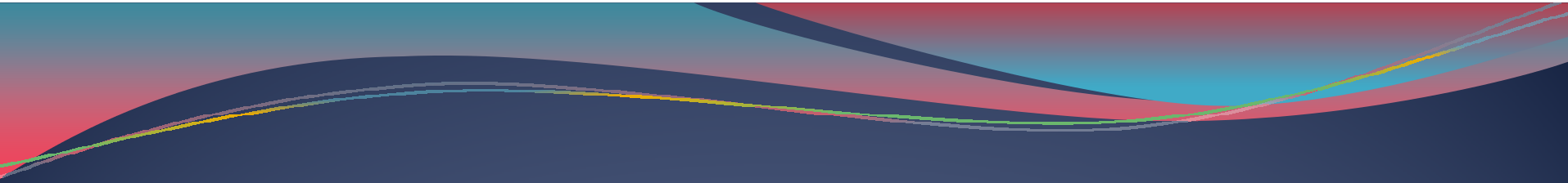


Pest dies when feeding on
any plant part

Disease Resistance

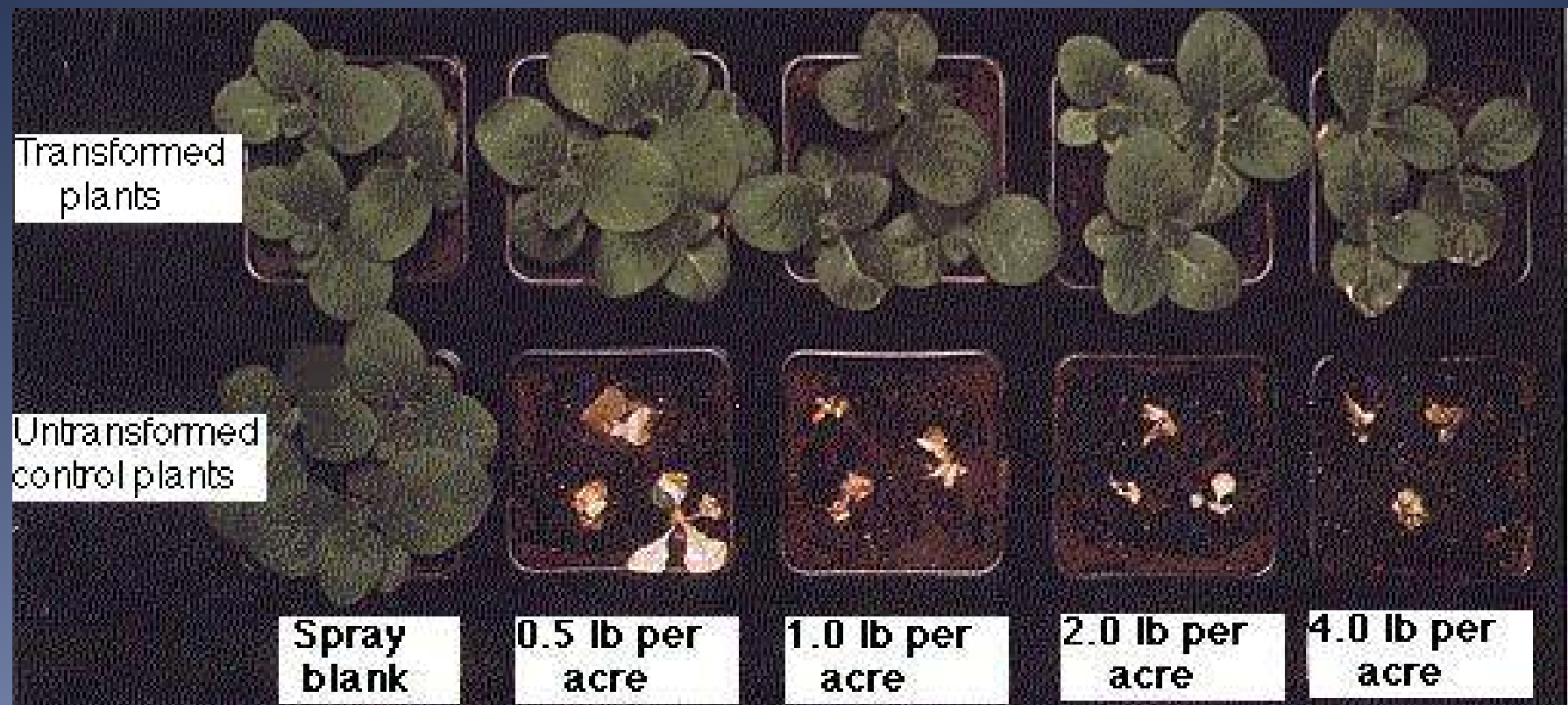
- Genes that provide resistance against plant viruses have been successfully introduced into such crop plants as tobacco, tomatoes, and potatoes.
- Tomato plants infected with tobacco mosaic virus (which attacks tomato plants as well as tobacco). The plants in the back row carry an introduced gene conferring resistance to the virus. The resistant plants produced three times as much fruit as the sensitive plants (front row) and the same as control plants. (Courtesy Monsanto Company.)

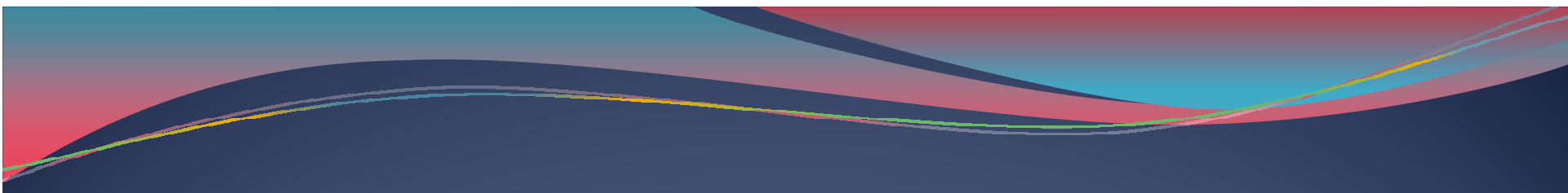




Herbicide Resistance

- Questions have been raised about the safety — both to humans and to the environment — of some of the broad-leaved weed killers like 2,4-D. Alternatives are available, but they may damage the crop as well as the weeds growing in it. However, genes for resistance to some of the newer herbicides have been introduced into some crop plants and enable them to thrive even when exposed to the weed killer.





Salt Tolerance

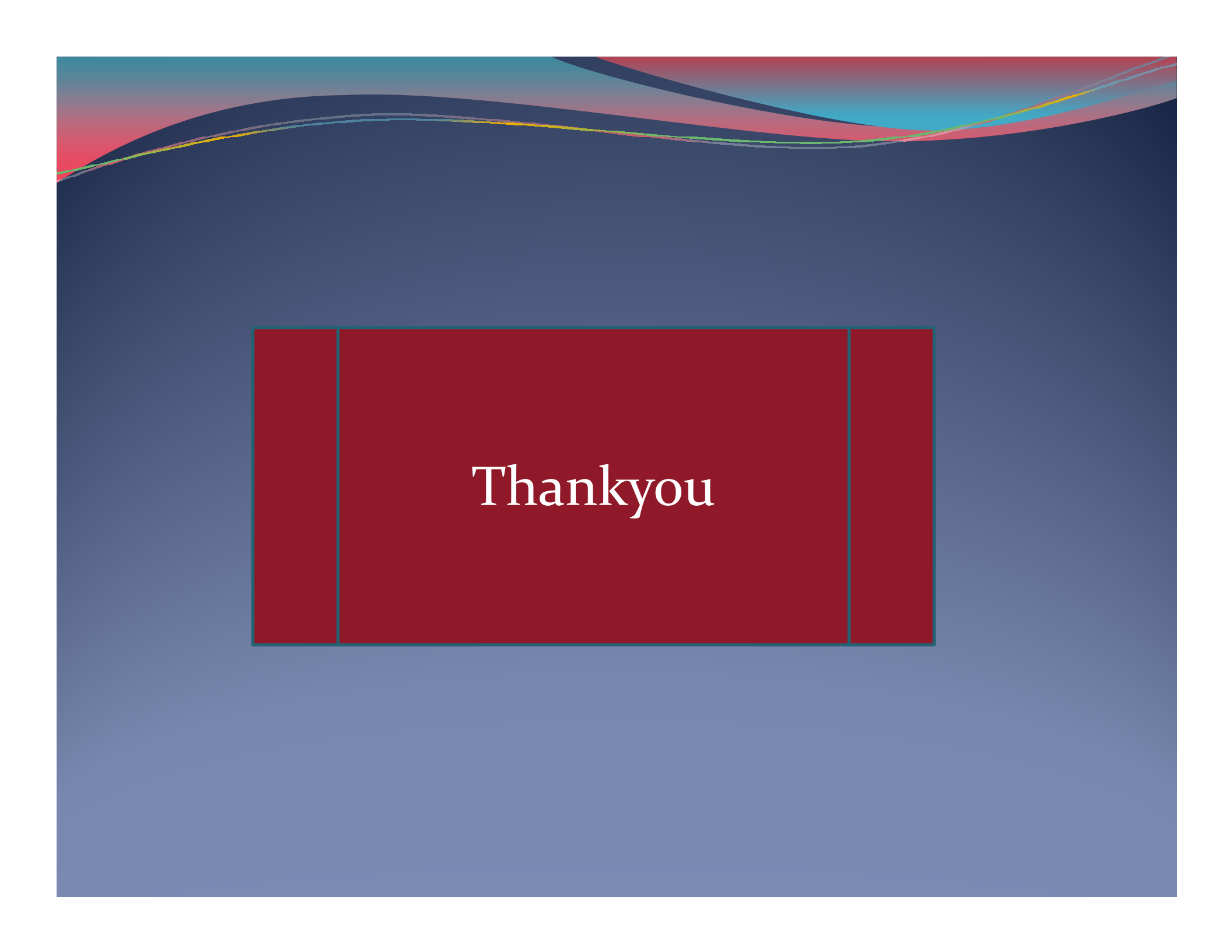
- A large fraction of the world's irrigated crop land is so laden with salt that it cannot be used to grow most important crops.
- However, researchers at the University of California Davis campus have created transgenic tomatoes that grow well in saline soils.



Extent of worldwide use of GM crops [\[edit\]](#)

Country ↕	2010– planted area (million hectares) ^[96] ↕	2009 – Agriculture area (million hectares) ^[97] ↕	Percentage of agriculture area with GM crops ↕	Biotech crops ↕
USA	66.8	403	16.56%	Soybean, Maize, Cotton, Canola, Squash, Papaya, Alfalfa, Sugarbeet
Brazil	25.4	265	9.60%	Soybean, Maize, Cotton
Argentina	22.9	141	16.30%	Soybean, Maize, Cotton
India	9.4	180	5.22%	Cotton
Canada	8.8	68	13.02%	Maize, Soybean, Canola, Sugarbeet
Rest of the world	14.7	3,883	0.38%	----

Transgenic trait	Crops
Insect resistance	Corn, Cotton, Potato, Tomato
Herbicide tolerance	Corn, Soybean, Cotton, Canola, Sugarbeet, Rice, Flax
Virus resistance	Papaya, Squash, Potato
Altered oil composition	Canola, Soybean
Delayed fruit ripening	Tomato
Male sterility and restorer system (used to facilitate plant breeding)	Chicory, Corn



Thankyou