It is an honor to join you here today to discuss the greatest challenge of our time: how to feed the world without further destroying the environment.
Many farmers have rapidly adopted GE Crops

17.3 million farmers
170.3 million hectares (420 million acres)
28 countries
planted GE crops in 2012
6% increase from 2011

Last year - more farmers in developing countries grew GE crops than in developed countries

Currently the majority sold my US Companies. By 2015 majority by National institutions for their own consumers

WHY has there been such rapid adoption? Two examples
This papaya infected with papaya ringspot virus.

You can see the ring spot symptoms on fruits.

In the 1950’s, the entire papaya production on the Island of Oahu was decimated by papaya ringspot virus. There was no way to control the disease so farmers were forced to abandon the island.

In 1992, the virus was discovered in the papaya orchards on the island of Hawaii (by 1995 the disease was widespread), creating a crisis for Hawaiian papaya farmers. By 1998 papaya production had dropped to 26 million pounds.
Dennis Gonsalves, a local Hawaiian, is the hero in this story. In 1978, Gonsalves and coworkers initiated research to develop strategies to control the viral disease.

Gonsalves' group spliced a small snippet of DNA (made from viral RNA; called RNA interference; from a mild strain) into the papaya genome. Similar to human vaccinations against polio or smallpox, this treatment immunized the papaya plant against further infection.

Aerial view of transgenic field trial in Puna that was started in October 1995. The solid block of green papaya trees are 'UH-Rainbow' while the surrounding papaya trees that are nearly dead are nontransgenic papaya trees severely infected by PRSV.
Occurrence of PRSV drastically decreased; benefits organic growers. 20X increase in yield

Today 90% of all Hawaiian papaya is genetically engineered

This is an example of an appropriate technology, after nearly 20 years of cultivation, there is no other method, organic or conventional that can control this disease.
This is a cotton bollworm hatching from its egg.

Cotton uses approximately 25% of the world's insecticides to control this pest.

The Environmental Protection Agency considers seven of the top 15 pesticides used on cotton in 2000 in the United States as "possible," or "known" human carcinogens.

In the 1990s, varieties of cotton genetically engineered to protect itself against insects was developed. The plants carry a protein called Bt, a favorite insecticide of organic farmers because it kills pests but is nontoxic to mammals, birds, fish, and humans.

Today 70–90 percent of American, Indian, and Chinese farmers grow Bt cotton.
In Arizona, growers cut their insecticide use in half while maintaining the same yield as their neighbors. Insect biodiversity increased as measured by the diversity of beetles and ants in the field.

BT corn and cotton grown on a cumulative total of 200 million hectares worldwide, more than enough to cover the entire states of Texas, California and Iowa.
In India, yields increased 24 percent on small farm plots compared with neighboring plots growing conventional cotton.

India is now the biggest BT cotton producer in the world. Rapid adoption over time in India of BT cotton. 85% of total cotton area in 2008. 10 million farmers. Most farmers are small 1.5 Ha
In China, insecticide use fell by 156 million pounds and pesticide poisonings decreased after introduction of Bt cotton


By adopting Bt cotton, growers found they could spray far less insecticide over their fields. Within four years they had reduced their annual use of the poisonous chemicals by 156 million pounds - almost as much as is used in the entire state of California each year. Cotton yields in the region climbed, and production costs fell. Strikingly, the number of insecticide-related illnesses among farmers in the region dropped to a quarter of their previous level.
Despite these successes in reducing pesticide use, most farmers know that no matter how powerful the seed technology, it is just one element of an effective strategy. Although Bt-cotton has effectively controlled cotton bollworm in China, other pests not controlled by BT have re-emerged. This points to the need to integrate Bt crops with other pest control tactics to manage the diverse spectrum of diseases and pests that attack a crop.

The key to Bt cotton’s continued efficacy may depend on increased crop diversity and crop rotation and other integrated pest management strategies.

What are such strategies?
I have showed you examples of benefits of GE crops to consumers, farmers and the environment. But are they safe to eat?

What do the scientists say?
"The main conclusion to be drawn from the efforts of more than 130 research projects, covering a period of more than 25 years of research, and involving more than 500 independent research groups, is that biotechnology, and in particular GE crops, are not per se more risky than e.g. conventional plant breeding technologies."

Directorate-General for Research and Innovation Biotechnologies, Agriculture, Food: EUR 24473 EN
Scientific Consensus

- 93%+ billion acres, 20 years of GE crops planted.
- Not a single case of adverse health or environmental impacts. Clear environmental benefits. Predicted health benefits.
- No scientific basis for ruling out GE as a tool for crop improvement.
- All processes of genetic alteration (conventional and modern) present risks of unintended consequences.
- Each GE crop must be evaluated on a case-by-case basis.

Each agricultural technology must be evaluated on a case-by-case basis. It is not informative to group all “GMOs” together without regard to the purpose of the engineering, the needs of the farmer, or the social, environmental, economic, or nutritional benefits.
To advance sustainable agriculture, we need to use the most appropriate technologies. Raoul and I believe that the discussions about agriculture must be framed in the context of the environmental, economic, and social impacts of agriculture—the three pillars of sustainable agriculture. Rather than focusing on how a seed variety was developed, we must ask what most enhances local food security and can provide safe, abundant and nutritious food to consumers. We must ask if rural communities can thrive and if farmers can make a profit. We must be sure that consumers can afford the food. And finally we must minimize environmental degradation. This includes conserving land and water, enhancing farm biodiversity and soil fertility, reducing erosion and minimizing harmful inputs.

These goals are increasingly important as we confront the challenges we already face today. As consumers you can support choices that enhance sustainable agriculture, but to be informed you need science and ag-based knowledge.

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