Arctic Apple - Introduction of an Innovative Product

Presentation to
Centre for Organizational Governance in Agriculture

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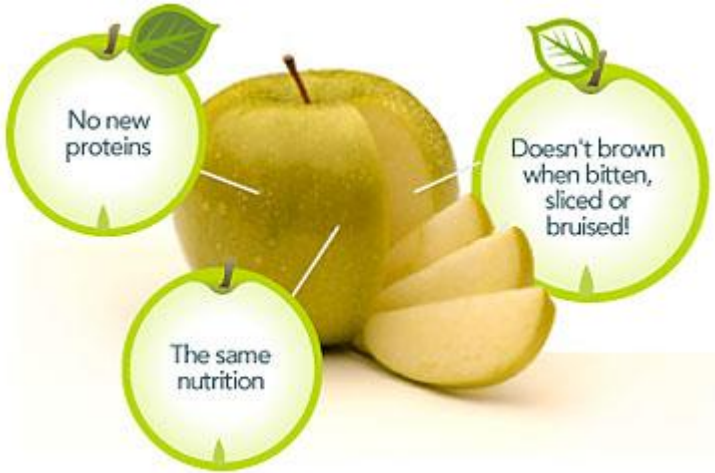
Outline

- What is Arctic Apple?
  - Experience
- Grower Concerns
- History of GMO Products
- The Next Big Thing: Gene Drive
- Summary

Sample of Arctic Apple promotion



What is Arctic Apple?

A group of apple varieties

Genetically modified to reduce browning

e.g. Arctic Golden, Arctic Granny,

Arctic Fuji

Gene modification technology

- Browning gene is replaced
- Lab selects for successful ‘take’ using antibiotic to eliminate unmodified plasmid/cells
- Reduces browning to 10% of normal
- Browning occurs when damaged cells manufacture browning enzyme

Who owns it?

Okanagan Specialty Fruits developed the technology from 1997 to 2015.

Intrexon (NYSE:XON) purchased OSF in 2015.

- $31 million stock
- $10 million cash

Main XON business

- Cloning pets
- Modified bacteria to produce therapeutic proteins

Intrexon Corporation (XON)

NasdaqGS - NasdaqGS Real Time Price. Currency in USD

5.53 -0.11 (-1.95%)
At close: 4:00PM EST

5.53 0.00 (0.00%)
After hours: 4:00PM EST

Indicators | Comparison | Events | Date Range | 1D | 5D | 1M | 3M | 6M | YTD | 1Y | 2Y | **5Y** | Max | Interval 1W | Line | Draw

Arctic Apple Introduction

Okanagan Specialty Fruits (OSF)

Strong investment in marketing/public relations

- Strong internet search placement:
  - top 3 search results: OSF web pages
- Problems:
  - For-profit motive vs. public good
  - Aligning with Public Trust

Long Time to market (tree fruits)

- 2015 approval: Arctic Golden and Arctic Granny
- First round of planting now maturing
- 2019 will be initial commercial test: 600 acres
- Planned a further 900 acres in 2019

Horticulture Sector Research Priorities - not GMO

Apple	Berry	Greenhouse	Vegetable
Maximizing Quality & Minimizing Losses	Integrated Pest Management	Pest Management	Optimize Production Practices
Technology, Mechanization, Automation & Efficiencies	Cultivar Development	Labour	Improve Pest & Disease Management Practices
Sustainable Practices	Product-Market Development	Energy and Efficiency	Optimize Post-Harvest & Storage Practices
Variety & Rootstock Development & Evaluation	Health Research	Production Outcomes	Plant Breeding, Variety Development & Evaluation
Broad Marketing Strategy	Production	Consumer Preferences	Research on the Health Benefits of Vegetables

History of GMO Products

Early introductions:

- rBST (1989)
- Flavr Savr tomato (1994)

Adoption

- Market successes: soy, canola, corn, cotton, virus-resistant plants (Papaya, Peach)
- Still working on it: salmon, Golden rice, yeast, arctic apple
- Failures: Flavr Savr tomato, rBST, NewLeaf potato, wheat, alfalfa

rBST - First out of the Gate

The phone started ringing early on Monday morning. The calls continued, 250-300 a day, for almost 2 weeks. Tom Low, communications manager of BC's largest dairy processor [Dairyland Foods], explains: "We had consumers phoning us in tears." Some callers were hysterical. They'd read in weekend newspapers how milk, full of steroids, was being sold to the public.

"I've never, ever seen such an explosion," says Low. Explanations that the reports were wrong didn't help. "We could not satisfy a single caller." On the afternoon of the first day, his company announced it was no longer buying milk from research cows treated with the growth hormone bovine somatotropin (BST) [sic - should be rBST].

Country Guide, vol. 108, no. 1, January, 1989, p.13

Grower Concerns

The current outlook:

- Continued low consumer acceptance
- Large retail chains and processors are risk averse
- Non-GMO Project, circumventing government

Labeling laws

- US states: patchwork. Federal unified 2016.
- US Mandatory - effective Jan. 1, 2022
- Canada - no mandatory labelling

Gene Drive - The next Big Thing that is Not Recombinant GMO

- For genes with two versions (e.g. male/female), gene drive will copy one gene (e.g. male offspring) over the other gene (e.g. female offspring). Individuals with the gene drive produce only males.
- The result is a population which will, through several generations, assume the one trait (e.g. “daughterless mice”), and eventual extinction.
- Not “recombinant” - Unregulated.
- Browning-resistant mushroom is first - controversy
- First ethical targets:
  - Malaria
  - Invasive mammals (NZ)
  - Spotted Wing Drosophila

Genetic Biocontrol of Invasive Rodents (GBIRd) program.

- reduced risk due to better targeting of pests compared to traditional pest control.
- Risks: eliminating invasive pests could wipe out native populations.
- Possible risk of hybridization with different specie, which would then be eliminated.

The GBIRd proposes: a deliberate, step-wise process that will only proceed with public alignment.

e.g. avoid public controversy.

In Summary

When introducing a new product with science that is not easily understood:

- Public Trust in the food system is paramount.
- Public Relations approach to GMO does not seem to work well.
- Recommend “Public alignment”:
    - Safeguards vs Labelling.
    - Ethics vs Government Regulation.
    - Public Good vs. Profit Motive.

In summary: it is not good for agriculture when food is controversial. Public alignment should promote Public Trust, based on Public Good, Safeguards, and Ethics.