Opportunities and Challenges for Specialty Crops: Will they sell if developed?

Roger N. Beachy
Progress in GM specialty crops is slow: Will it improve?

CP-MR in tomato from 1985
Coat Protein Mediated Resistance first described in December, 1986. Fewer than six public sector transgenic crops have reached market. Why not more success? What steps can be taken to enhance contributions of public sector scientists to food production (and economy) in the future?

In 1987 Dr. Roger Beachy, foreground at right, joins scientists to test the first genetically modified plants in a field trial in Jerseyville, IL.
Consider . . .

• Opportunities and challenges in biotechnology of specialty crops
• Are there solutions to the challenges?
• Looking for a trend(s) . . And goals for a brighter future
Looking Backward and Forward

• Technologies developed in the 80s are durable and reproducible
• Products have brought value to producers and (arguably) to consumers; environmental benefits realized;
• Progress in specialty crops has been limited
  – Issues are not technical but regulatory and social
• Challenges in speciality crops are magnified by
  – Value of smaller acreage crops
  – Heightened consumer concerns of ‘GM crops’
The Effort Continues

• Public sector researchers continue to create products with potential for value
  – Resistance to fungi, bacteria, viruses, insects and parasites in specialty crops
  – Enhanced nutrient content in tomato, rice, maize and others
  – Virus resistance traits in many specialty crops
Looking Backward and Forward

Will the potential for applications to specialty crops be realized?
Projecting Forward - A Longterm View is Necessary

• Who is defining the (long term?) future of U.S. agriculture in competition with BRIC nations and other emerging economies?
  – What will be impact of increased productivity of commodity crops in E. Europe and S. America on US agriculture?
  – Over what time from will changes be made?

• In context of increasing focus on health and nutrition from foods; on capturing new value from agriculture products; on farm economies in an era of high land values: Will the role of specialty crops in US economy change?
Need for Biotechnology in Specialty Crops

Biotechnology can reduce the use of agrichemicals on vegetables and fruits, improve quality and yields and reduce post-harvest losses, enhance climate resilience, increase nutrient value and economic returns.
The World’s most efficient Natural Rubber production system.

- The Right Crop at the Right Time
- The Right Technology
- The Right Process

Dan Swiger, CEO  dan@kultevat.com
TKS rubber for multiple uses

Road tests

Courtesy Apollo Vredestein
Opportunities in Specialty Crops

- Creating new technologies for specialty crops
  - Resilience to changes in climate and weather
  - Increased efficiency in use of fertilizers
  - New crops for new industries (i.e., TKS) and applications of synthetic biology
- Beyond 1st generation genetic modification
  - Single nucleotide modifications
  - Excising genes; site specific insertion, etc
Opportunities through New/Emerging Technologies

- High-frequency mutagenesis to create variability; select desired changes in target gene(s)
- Directed nucleotide changes in target genes to recapitulate known/desired variations
- Site-specific gene insertion
- Artificial chromosomes to carry multiple genes
- Delete/inactivate non-desired gene(s) via meganucleases
- Non-transgenic progeny via segregation in breeding
- Gene inactivation by RNAi based approaches, including directed methylation, KO
Opportunities as patents expire – generics and more?

Generic IP and implications for future of GE crops

• Farmers looking for relief; generic traits offer opportunity
• Tech providers are stacking traits, better germplasm; keeping customers satisfied
• New crops may benefit from generic traits and off-patent technologies
• Increased opportunities for innovators, including academics; high potential for specialty crops
• Key challenge remains around regulation of traits and genes; and in accessing industry investments in gaining regulatory approval for first generation crops/traits
Conclusion and a Query

C: Many opportunities for relevant and valuable traits in specialty crops

Q: What challenges lie ahead?
Threats and Challenges

- Reduced investments in discovery research
- Weak history of innovation and entrepreneurship upon which to build new enterprise/refresh new products; weak pipeline of new technologies
- Weak regulatory process in US and globally and delays in release of new products
- Lack of harmonized and synchronous approval processes slow innovation
- Local/global weak acceptance of new products, in particular those developed by MNCs
Constraints to Regulatory Approval and Release of Products Continue

- Process in U.S.D.A. improved (modestly) while new products lag; EPA and NEPA continue to represent substantial barriers to new product release
- Global approval processes continue to be slowed by variety of factors: negative impact on releases in US
- Consumer concerns grow in some regions and are relaxed in others
Deregulation of Proven Technologies would Speed Development

- Agrobacterium-mediated transformation
- Selected B.t. genes
- Resistance to Round-up and other herbicide
- Pathogen derived resistance to viruses
Impacts of Regulatory Processes and Costs on Innovation

• Many new technologies are developed in public sector and small companies

• Processes for approval are poorly defined; costs are high (local vs global approval)
  – ~$1.5 mil papaya(?); $3.5 mil Phaseolus beans
  – Up to $50 mil for new trait in maize, soya, cotton

• Discourages innovation, investment and product development by small and large companies
Threats (cont.)

• Limited/irregular commitment of policy makers to develop long term policies for the agri-food sector, including regulatory policies for new technologies

• Limited understanding of how to achieve customer acceptance of biotechnology, e.g., concerns of food and environmental safety, IPR, availability
Threats (cont.)

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Executive summary and conclusions
This study presents the findings of research into the global socio-economic and environmental impact of biotech crops in the fourteen years since they were first commercially planted on a significant area. It focuses on the farm level economic effects, the production effects, the environmental impact resulting from changes in the use of insecticides and herbicides, and the contribution towards reducing greenhouse gas (GHG) emissions.
A Global Citizens Report on the State of GMOs
Synthesis Report - 2011

Vandana Shiva, Navdanya
Debbie Barker, Centre for Food Safety
Caroline Lockhart, Navdanya International
Getting the Message Right
Getting the Message Out

• Private sector has yet to learn how to message agriculture biotechnology to the public
  – MNCs; control; biodiversity; environment, food safety
• Increasing transparency at all stages of process may be helpful(?)
• Public sector voices for support of science in regulatory/biosafety may offset voices that seek to restrict use of modern genetic tools in agric, including in current labeling initiatives in the U.S.

The message is not effective to date: why not?
Specialty Crops Are Key to Global Security in Food and Nutrition

• To feed another 2 billion people with sufficient calories and nutrition, high safety, acceptable cost
• In a world that is richer and more urban;
• On (essentially) the land area now used, with less water, fertilizers chemical inputs
• Increase food production 70%: grain production by 43%, and meat production by 75%;
• Specialty crops offer more nutrition and high value for small holder farmers and large producers alike
Opportunities and Challenges for Specialty Crops:
If developed will it sell?

Roger N. Beachy

rnbeachy@danforthcenter.org  RogerBeachy@WUSTL.edu
SUPPORTERS OF AGRICULTURE RESEARCH

A broad based coalition to advocate for increased competitive grant-based funding for research for food and agriculture; focus on AFRI at NIFA/USDA. Goals include achieving full funding for AFRI through information for the public and advocacy with members of Congress.

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www.supportagresearch.org