

---

**ABIC 2013**

***It's Time to "Get Real" in Investing  
in AgBiotech and the BioEconomy***

***Facing the Realities of the Science,  
the Marketplace, and Transparency***

**Calgary TELUS Convention Centre  
Calgary, Alberta, Canada**

**September 18, 2013**

**Sano M. Shimoda**



# Background

---

## Sano M. Shimoda, President and Founder, BioScience Securities



- **BioScience Securities, a boutique strategic corporate advisory/investment banking firm, located in Venice, CA, was founded in 1993 (San Francisco Bay area) to focus on the strategic impact agricultural biotechnology would play in redefining agriculture's growth and value creation**
- **An equity analyst by training, Sano has over 35 years of Wall Street experience, focusing on agbio/seed, ag chemicals, agriculture (especially Midwest agriculture), and the new BioEconomy (biofuels)**

- **BioScience Securities provides corporate advisory/investment banking services to companies focused on agbio/seeds, crop protection, and other related areas in agriculture's supply chain to the farm gate**
- **M.B.A., University of California, Berkeley (1972), and B.S. in Business Administration (magna cum laude), Lehigh University (1968)**
- **Member of the Advisory Board to the Seed Science Center at Iowa State University; and former member of the Advisory Board to Iowa Corn Opportunities, LLC (venture capital - Iowa Corn Growers Assn.)**



# Sano Shimoda – Recognized for Forwarding Looking Views on the Future of Agriculture and the Role AgBiotech Will Play

- Sano is well recognized (media and company/industry presentations) for his forward looking, independent, views on the future of agriculture
- In January 2004, Sano had the distinct privilege of being pictured on the cover (first and only non-farmer in the history of the magazine) of Farm Journal's "Top Producer" magazine, a major agribusiness publication, as well as authoring the lead story in a multi-part article, entitled "Future Vision"

Reproduction - Permission granted by  
Top Producer magazine



**BioScience  
Securities, Inc.**

*The Power of BioInnovation*

## **Business Philosophy - Before We Get to the Real Story**

---

***From the outset, starting as a Wall Street analyst in the 1970's, and, especially, when I started BioScience Securities in 1993 to focus solely on the commercial development of AgBiotech, I have tried to adhere to a core business philosophy...I focus on “what I don't know, not what I do know”, with respect to key issues, and, most importantly, try to take an independent-oriented “balanced” view, whether my conclusions are positive/negative...***

***I am a business person, not a science person, by training... however, I have spent a lot of time over the years focusing on some of the key scientific/technology issues pertaining to the AgBiotech industry...textbooks, peer-reviewed scientific papers, and discussions with scientists...***

***Over the past two years, I have focused on a number of the critical science/technology issues in the AgBiotech industry, which has provided background for many of my comments in this presentation...***



# Investing in the Future of AgBiotech – Approaching a Crossroad

---

## Perspective - Need for a “Balanced View” in a Polarized World – Pro-GMO vs. Anti-GMO

- **Development of AgBiotech from a scientific perspective**  
**30+ years old**
- **Commercialization of genetically modified (“GM”) crops**  
**Approaching 20 years old (Calgene’s Flavr Savr tomato - 1994)**
- **Future commercial development of GM crops will depend on the AgBiotech industry facing three key strategic challenges**
  - o **Realities of the Science/Technology**
  - o **Realities of the Marketplace**
  - o **Need for Transparency**
- **Strategic/financial outlook for companies - current players, today’s new players, and tomorrow’s new players – will depend on AgBiotech industries’ ability to structurally “reboot” itself**
- **Bottom Line – Time for the Industry to “Get Real”**  
**AgBiotech industry faces potential strategic/financial risks**



# AgBiotech – Faces Good News and Some Not So Good News

---

## GM Crop Trait Adoption Continues to Grow – But Warnings Signs

- **Good News** – Continued acreage growth in global biotech traits (largely HT/IR) adoption due to farmers' enhanced yield/productivity
  - o 100-fold growth - 1.7MM hectares in 1996 to 170.3MM hectares in 2012 (30 countries) (6% growth in 2012) (a)
  - o Biotech acres concentrated – 90% of acres in 5 countries (U.S., Brazil, Argentina, Canada, India) (a)
- **Bad (Old) News** – Ban on GM crop adoption continues in many parts of Europe/Asia due to consumer preference/anti-GMO attitudes
- **Bad (New) News** - Increasing glyphosate weed resistance and developing IR-CRW (MON863) tolerance/resistance in U.S. – Increasing use of herbicides/insecticides and farmers' costs
- **Bad (New) News** – Growing number of scientific studies suggest GM technology (along with related technologies) are creating negative health/safety indications and adverse ag productivity

(a) Global Status of Commercialized Biotech/GM Crops: 2012 (Brief No. 44), ISAAA



# Global Adoption of Biotech Crops – 2012 (Source - ISAAA)

## Biotech Trait Adoption is Highly Concentrated – Creates Risks

Rank	Country	Area (MM Hectares)	% of Total	Biotech Crops
1	US	69.5	40.8%	Corn, soybean, cotton, canola, sugar beet, alfalfa, papaya, squash
2	Brazil	36.6	21.5%	Soybean, corn, cotton
3	Argentina	23.9	14.0%	Soybean, corn, cotton
4	Canada	11.6	6.8%	Canola, corn, soybean, sugar beet
5	India	10.8	6.3%	Cotton
6	China	4.0	2.4%	Cotton, papaya, popular, tomato, sweet pepper
7	Paraguay	3.4	2.0%	Soybean, corn, cotton
8	South Africa	2.9	1.7%	Corn, soybean, cotton
9	Pakistan	2.8	1.7%	Cotton
10	Uruguay	1.4	0.8%	Soybean, corn
11-30	Other (a)	3.4	2.0%	Corn, cotton, soybean, canola
<b>Total</b>		<b>170.3</b>	<b>100.0%</b>	

(a) Bolivia, Philippines, Australia, Burkina Faso, Myanmar, Mexico, Spain, Chile, Colombia, Honduras, Sudan, Portugal, Czech Republic, Cuba, Egypt, Costa Rica, Romania, Slovakia



**BioScience  
Securities, Inc.**

The Power of BioInnovation

# GM Crop Trait Development – Slowed/Limited Scope

---

## Commercialization of GM Traits in U.S. – Success and Failure

- **Early days (1990's) – Optimistic outlook based on a pipeline of a broad spectrum of GM traits in a broad diversity of crops**
  - (1) **Input Traits (Crops/Produce) – HT/IR/DR**  
Market driver - Farm benefits
  - (2) **Agronomic Traits (Crops) – Yield/Drought/Stress/Nitrogen**  
Market driver - Farm benefits
  - (3) **Output Traits (Crops/Produce) – Consumer/health**  
Market driver – Consumer benefits (taste/functional foods)
- **Breadth of biotech trait pipeline – Limited in scope**
  - o Largely HT/IR traits/stacks in major crops
  - o Agronomic/output traits limited
- **Breakthroughs in the understanding of plant genetics has resulted in new technologies (e.g., RNA interference - RNAi) that is creating new traits (e.g. insect resistance) - Regulatory?**



# AgBiotech Problem – Farmers and Consumers Are NOT Aligned

---

## GM Crops Creating a Growing Global Battle, including the U.S. Key Problem - Farmers vs. Consumers

- **Farmers (U.S. and GM-friendly production areas) – Pro-GM traits due to bottom line benefits – yield/cost + farmer productivity**
- **Consumers (Europe/other foreign markets and a growing U.S. minority) – Pro-organic/non-GMO conventional foods – Issue of “consumer choice”**
  - Boosted by concerns over “GMOs” and “food safety”
  - “Consumer Perception”- Huge driver of consumer demand
- **Strategic issue (from day 1) – Farmers’ bottom line (supply side) and consumers’ bottom line (demand side) are NOT aligned**
  - GM trait derived crops/derived food have generated limited definable “consumer benefits” that would drive demand
  - If only Calgene’s Flavr Savr tomato was successful – Consumers’ GMO attitudes might be very **different today**



# GM Crops Creating Concerns from Core Farm Constituency

---

## GM Crops Creating Growing Complexity/Costs for Farmers

- GM trait/seed producers face three developing trends that are creating concerns from their core constituency – Farmers
  - o Growing glyphosate weed resistance - Reduced value of glyphosate tolerant trait combined with new HT stacked traits are/will force farmers to use greater herbicide volumes (reversing a recognized benefit – reduced pesticide usage)/ greater complexity in farm management/increasing costs
  - o Developing pockets of Bt-CRW (MON863) insect resistance – Scientific validation of localized CRW tolerance/resistance (corn/corn) in U.S. Midwest/increasing insecticide use with IR traits
  - o Some farmers would like to go back to conventional non-GM seed, but seed availability is limited – Limited amount of conventional elite seed hybrids/varieties (at least now)



# AgBio Industry Faces Reality – Complexity of Biological Systems

---

## GM Trait Development Facing Complexity of Plant Genomes and the Challenge of Multi-Genic Traits

- Compared to optimistic expectations of potential broad traits, commercialization has been limited by a number of factors:
  - Growing recognition of the complexity of plant genomes
  - Current traits (HT/IR) are largely “qualitative traits” – Influenced by a single gene
  - Many trait targets – agronomic (drought/stress), complex input (disease), and output traits are largely “quantitative traits” – Influenced by the interaction of multiple genes/microRNAs and their interaction with the environment

**Breeding: Genotype (G) x Environment (E) = Phenotype (P)**

- Why is all this important? – Given current knowledge of plant genomes, genetic complexity and biotechnology techniques, the ability to develop many commercial GM multi-genic trait targets are out of reach (based on today’s technologies)



# Companies Increasingly Recognize Nature's Power

---

## If You Can't Fight the Plant (Developing Complex Traits), You May Win by Joining Them – Harnessing Nature's Power/Diversity

- AgBiotech companies have been placing increased emphasis on advanced breeding technologies to improve yield gains, as well create non-GM traits focused on complex trait targets
  - Marker assisted selection (“MAS”) to identify specific genes – Recognition of the complexity of gene targets
  - Molecular breeding through MAS – Using genomic tools
  - Power of global germplasm diversity – Harnessing genetic variation with many desirable characteristics - Natural selection
- Advanced breeding is a broad long-term value driver - Applicable to a broad number of crops globally and localized market needs
- Trend is evidenced by the non-GM (advanced breeding) traits in current development pipelines of major agbio/seed companies
  - Disease resistance – Corn, cotton, soybeans, vegetables
  - Drought tolerance – Corn (commercial)



# Technology Could Redefine Consumers' Attitudes Toward AgBio

---

**Opportunity to Harness Native Traits/Advanced Breeding Using Diverse Germplasm – Potential Consumer-Driven Benefits Could Be the Bridge to Growing Consumer Acceptance of GM Technology**

- **Non-GM trait benefits in crops and produce (fruits/vegetables) - Expands direct value to conventional markets**
  - o Advanced breeding/native trait-based products could have identifiable value to the consumer
- **Consumer driven demand for native trait-based products could ALIGN farmers (supply) and consumer (demand) – Ultimately, could blur the distinction between GM-based traits and native traits**
- **Potential success of consumer-oriented native-trait based products could be the bridge for ultimate consumer acceptance/demand of GM-trait based products (remember Calgene's Flavr Savr tomato)**

**IF THE INDUSTRY CAN “REBOOT”**



# AgBiotech Industry - At a Strategic Crossroad

---

**Key Strategic Question – Business as Normal, or Can the AgBiotech Industry “Reboot” in Time to Effectively Deal with Three Strategic Issues**

- (1) Growing global CONFLICTING scientific evidence of adverse health/safety and ag productivity effects from GM/related technologies - Has to be scientifically/unequivocally substantiated or dismissed**
- (2) A structural transformation of the process (corporate/regulatory) to evaluate the health/safety of GM/related technologies**
- (3) Need for total transparency of health/safety studies and derived data for public/independent analysis in order to build confidence in GM technology from a market standpoint, from the perspective of consumers, food companies, and regulatory authorities**

**While the anti-GMO vs. pro-GMO battle has been waged from day 1, the confrontation could metastasize in key pro-GMO markets, most notably the U.S., and limited acceptance markets, such as Europe – The outcome could become destructive to GM markets**



# **AgBiotech Industry Could Have Minimized the Risks it Faces**

---

## **AgBiotech Industry Made Three Strategic Mistakes - From the Beginning**

- **Minimized consumer benefits to build market acceptance** - Focus on GM benefits to farmers/ag industry, without balancing development of GM benefits directly for the consumer
- **Scientific recognition of what was not known, as well as what was known about plant genetics in the late 1980's-early 1990's, when the first major GM crops were being developed (RR soybeans, B.t. corn, B.t. cotton, and RR corn – commercialized in 1996-1997)**
  - o Recognition of what was scientifically not known about plant genetics/molecular biology at the time of development, combined with broadening scientific knowledge, should have triggered corporate decisions/regulatory actions to undertake re-evaluations to insure no unintended adverse consequences
- **A lesson from history – Calgene's Flavr Savr tomato (with improved ripening qualities)** - First GM food to go through the FDA regulatory process and the first to be commercialized in 1994



# A Critical Lesson from History – Calgene’s Flavr Savr Tomato

---

## Strategic Insight - Calgene’s Corporate Mindset – Value of a Rigorous Safety Review and Market Transparency

- Calgene’s regulatory experience - AgBiotech industry failed to learn important lessons from Calgene’s corporate mindset and experience
- Calgene’s focus on food safety and total transparency – Calgene’s key decisions during FDA’s regulatory review were focused on total transparency in order to assure the public that the Flavr Savr tomato was safe to eat, as well as build consumer acceptance
  - o Focused on total market transparency through the FDA review process, with all analysis, data and documents open to public scrutiny
  - o Voluntarily requested an FDA Food Additive Petition approval process (food safety review), including a voluntary toxicity test
- **Judgment – If the AgBiotech industry would have duplicated Calgene’s transparent process, with an emphasis on food safety, consumer confidence in GM crops would have been enhanced.**

# **Regulatory Framework for GM Food Safety Assessment – Largely Based on Self-Regulation**

---

## **Regulatory Framework for GM Crops Largely Unchanged Over Last 20+ Years (Established in the Late 1980's-Early 1990's)**

- **Agbiotech industry influenced the development of the regulatory framework for GM crops/food** - Largely based on self-regulation, limited regulation, and limited food safety studies (lack of long-term acute toxicity/carcinogenic/epidemiological studies)
- **Regulatory authority was divided between existing U.S. government agencies, utilizing existing regulatory frameworks** – USDA-GM trait review, EPA-pesticide related, and FDA-food safety
- **Regulatory framework was heavily influenced by the Bush (GHW) administration** - Desire to promote the biotechnology industry
- **Biotech industry heavily influenced the regulatory framework of “substantial equivalence”** - Based on the concept that food derived from GM crops is no different from food derived from conventionally bred crops and would not be subject to regulation

Continued on Following Page



## Regulatory Framework for GM Food Safety Assessment – Largely Based on Self-Regulation (continued)

---

### Regulatory Framework for GM Crops Largely Unchanged Over Last 20+ Years (Established in the Late 1980's-Early 1990's) (continued)

- FDA's transgenic food regulatory framework, published in the Federal Register in May 1992 - Established a regulatory framework that was largely voluntary
  - Companies voluntarily “consult” with the FDA over the commercial release of GM crops
  - Food safety studies (including data submitted) are determined by the companies, and are not published for public review
- Following Calgene's Flavr Savr safety approval, most GM crops have undergone the FDA “consultation process”, without the need for a more rigorous safety assessment of a Food Additive Petition
- Bottom Line – FDA does NOT approve the safety of GM crops, does NOT have mandatory testing protocols for the safety assessment of GM derived food, and does NOT require long-term safety testing



# Progress of Scientific Understanding – An Inconvenient Truth

---

## Regulatory Framework for GM Food - Obsoleted by the Progress of Scientific Understanding of Plant/Human Genetics/Molecular Biology

- **FDA's food safety regulatory framework was created at a time when the understanding of both plant and human genetics was much simpler**, as compared to today's complexity, with many areas still unknown, or partially understood.
- In 1953, Francis Crick and James Watson described the ground breaking theory on the molecular structure of DNA (double helix), and in 1957 Crick elucidated how genes function to create all organisms (including bacteria, plants, humans, and animals)  
**Simple Linear Model – DNA (Genes) to RNA (messenger) to Proteins**
- This simple, but elegant view of gene function, which is still discussed today in general literature (including FDA consumer information) is **deceptive**, given the dramatic development of scientific knowledge (including continued uncertainties) over genetic complexity and role played by genetic networks



# Scientific Knowledge Today – Realization that Genetics is Much More Complex Than Anyone Could Have Expected

---

## Scientific Breakthroughs Over the Last 15 Years Have Structurally Changed the Paradigm of Scientific Understanding of Genetics

- Understanding of the genetics/molecular biology of organisms, plants, and humans has undergone dramatic transformational change, due to significant breakthroughs in scientific understanding
- RNA Interference (RNAi) Discovery (1998) – RNAi is a process that modulates, or regulates gene activity through a broad group of (non-coding) microRNAs molecules
- Human Genome Project (2002) – Compared to expectations that the human genome had 100,000 protein-coding genes, the HGP showed that humans had less than 25,000 genes (now about 21,500 genes) with the remaining 99% of the human genome accounted by non-protein coding DNA, originally called “junk DNA”
- ENCODE Project (2012) – Determined that the majority (over 80%) of the “junk DNA” in the human genome is transcribed into RNA that influences gene activity and has genomic function

Continued on Following Page



BioScience  
Securities, Inc.

The Power of BioInnovation

# Scientific Knowledge Today – Realization that Genetics is Much More Complex Than Anyone Could Have Expected (Cont'd)

---

## Scientific Breakthroughs Over the Last 15 Years Have Structurally Changed the Paradigm of Scientific Understanding of Genetics (cont'd)

- Epigenetic Changes – Heritable genetic activity that is transferred generationally, is affected by epigenetic changes to DNA, without changing the DNA of protein coding genes
- Complex Gene Networks – Organisms, plants, and humans/animals are comprised of a complex network of interacting genes that determine the genotype (genetic structure) to phenotype (individual characteristics of living organism) relationships
- All of the above newly discovered scientific breakthroughs in genetic understanding pertain to plants, in varying degrees
- Many plant genomes have a large number of protein coding genes, (compared with the human genome) due to a large number of duplicate copies of genes, which increases genome complexity

Human: Genome size (3.3 billion base pairs) – ~21,500 protein coding genes

Corn: Genome size (2.3 billion base pairs) – ~32,000+ protein coding genes

Soybeans: Genome size (1.0 billion base pairs) – ~42,000 protein coding genes



BioScience  
Securities, Inc.

The Power of BioInnovation

# **Genetic Complexity and More Complex Genome Interaction Has Increased the Risk of Unintended Consequences**

---

## **Growing Number of Scientific Studies Suggest Potential Real Risks From GM Crops (and Related Technologies)**

### **Agronomic Perspective**

#### **➤ Growing number of scientific studies suggest adverse impacts on crop/ag productivity**

- o Dramatic increase in glyphosate tolerant traits has dramatically increased glyphosate usage**
- o Significant increase in glyphosate usage has had negative effects on soil micro-organisms (microbes) in the root rhizosphere (area adjoining plant roots) which adversely affects important plant/microbe symbiotic relationships, which has resulted in**
  - Adverse plant growth (interference with nutrient uptake)**
  - Increased plant diseases (due to soil microbe damage)**

**(Note: Micro-organisms in the rhizosphere have a shikimate pathway, which is the target of glyphosate/Roundup)**



# **Genetic Complexity and More Complex Genome Interaction Has Increased the Risk of Unintended Consequences (Cont'd)**

---

## **Growing Number of Scientific Studies Suggest Potential Risks from GM Crops (and Related Technologies) (Continued)**

### **Human Health/Safety Risk Perspective**

- **Typical argument – “No evidence that GM food products have made people sick, therefore, they are safe”** – But there are a limited number of long-term acute toxicity/carcinogenic/epidemiological studies – **Issue is long-term health effects/risks**
- **Growing number of scientific studies suggest potential risk of adverse human health/safety effects**
  - **Plant transformation process creates unintended effects in plant DNA** - Integration of the gene construct in the plant genome is random and not precise, resulting in phenotypic changes and potential biosafety risks
  - **Transgenic crops are prone to genetic instability** - Creates unintended up/down regulation of proteins, which create potential human/animal health/safety issues



# **Genetic Complexity and More Complex Genome Interaction Has Increased the Risk of Unintended Consequences (Cont'd)**

---

## **Growing Number of Scientific Studies Suggest Potential Risks from GM Crops (and Related Technologies) (continued)**

### **Human Health Risk Perspective (continued)**

- **Growing number of scientific studies suggest potential risk of adverse human health/safety effects (continued)**
  - o **Horizontal transfer of plant transgenes can survive digestion and impact bacteria in the human gut microbiome**
  - o **Ingested plant microRNA through food can survive digestion and regulate human gene activity**
  - o **Humans'/animals' gut microbiome subject to potential health risks from glyphosate/Roundup residue in GM crops/food ingredients - Glyphosate/Roundup do not pose direct risks since humans/animals lack the shikimate pathway (critical to production of critical aromatic amino acids). However, it appears that human/animal gut bacteria (some prokaryotes), critical for many biological/metabolic processes, could be susceptible, since they have a shikimate pathway**



## **Negative for GMO Market Acceptance – Corporate Influence**

---

**Market Acceptance of GM Foods is Increasingly Being Influenced by a Backlash to the Growing Recognition of the Impact of Corporate Influence and the “Politics” of Pro-GM Technology**

- **Research on agbiotech and GM food related research has shifted to the private sector, given funding and patentability issues – In the U.S., university research, is heavily influenced directly/indirectly by corporate funding by the agbiotech corporate sector**
- **Validity of peer reviewed scientific research in scientific journals, whether the conclusions are positive or negative, is being questioned, given concerns about biased reviews and direct/indirect conflicts of interest**
- **Adverse scientific findings in respected peer reviewed scientific journals are met by professional vilification and personal attacks, and the “politics” of pro-GMO scientists**



# **Case in Point - Seralini Rat Study Creates a Firestorm, But EFSA Has Decided to Duplicate the Study**

---

## **Scientific Study Catalyzes a Firestorm of Controversy – But the European Food Safety Authority (EFSA) Will Reduplicate the Study**

- **In September 2012, a scientific study “Long Term Toxicity of a Roundup Herbicide and a Roundup-Tolerant Genetically Modified Maize,’ by Giles-Eric Seralini from the University of Caen, France (and a seven person scientific team), was published on-line, and subsequently in the peer reviewed journal, Food and Chemical Toxicology, in November 2012**
- **This scientific paper’s bottom line, based on a long-term 2-year feeding study suggested that rats fed either Roundup, Roundup and GM corn (Monsanto’s NK603), and GM corn by itself, developed above-average organ damage, tumors, and premature death (Note: I have no opinion on the validity of the study, which will require reduplication to validate results)**
- **This study created a firestorm of critical comments by many well recognized pro-GMO oriented scientists, with many calling for the Seralini study to be retracted (which has not occurred)**
- **What is interesting is that the EFSA, at the end of July 2013, made the decision to undertake a long-term safety study which would duplicate the Seralini study, whose scientific framework will include many of the scientific protocols, which were severely criticized**



# Growing Evidence of Potential Health Risks Tied to GM Crops Versus a Scientific “Consensus” - GM Crops are Safe

---

## Scientific “Consensus” that GM Crops are Safe is an Illusion

- AgBiotech industry strongly supports the view that there is a scientific “consensus” that GM does not create any health risks – Reality is that there has never been a scientific consensus
- Scientific results (positive and negative) do not make it FACT – A scientific finding requires validation in multiple replicated trials
  - o Need to demonstrate evidence based causation/mechanism and not a correlation (between GM food and health issues)
  - o Scientific “evidence” (collaborated through replicated results) can dramatically change scientific understanding
  - o History of medical oriented peer-reviewed scientific papers has shown that many scientific results cannot be replicated
- Key issue - Conflicting studies on GMO safety - Growing number of scientific studies, indicating potential health/safety risks



## “Consensus Science” – A Perspective

---

### “Consensus Science and the Peer Review” – Editorial

Jorge R. Barrio, Editor-in-Chief, Molecular Imaging and Biology (peer reviewed scientific journal), April 28, 2009

“I am quite certain that most of us have been – in one way or another - exposed to the concept (and consequences) of ‘consensus science’. In fact, scientific reviewers of journal articles or grant applications – typically in biomedical research - may use the term (e.g., ‘....it is the consensus in the field...’) often as a justification for shutting down ideas not associated with their beliefs.”

“...Michael Crichton explains it the best when he said ‘I regard consensus science as an extremely pernicious development that ought to be stopped cold in its tracks. Historically, the claim of consensus has been the first refuge of scoundrels; it is a way to avoid debate by claiming that the matter is already settled. Whenever you hear the consensus of scientists agrees on something or other, reach for your wallet, because you’re being had... Let’s be clear: the work of science has nothing whatever to do with consensus. Consensus is the business of politics. Science, on the contrary, requires only one investigator who happens to be right, which means that he or she has results that are verifiable by reference to the real world. In science consensus is irrelevant. What are relevant are reproducible results.’ ” (Note: underlined words have been added for emphasis) (Michael Crichton - physician, producer, and writer – Lecture, California Institute of Technology, January 17, 2003)



# Anti-GMO Movement Is Metastasizing into a Growing Mainstream Marketplace Force

---

## Anti-GMO Movement is Moving into the Mainstream, Including the U.S.

- Anti-GMO movement has been a reality from day one, especially in many European countries – Anti-GMO attitudes were largely activist/NGO driven, based on food philosophy/consumer choice
- Growing anti-GMO movement, including the U.S., has been catalyzed by publicity given to a growing number of scientific studies demonstrating adverse health effects - Impact has been magnified by
  - o GMO issue have moved into mainstream media
  - o Internet and social media effects on the global access to information and rapid “news” dissemination
  - o Growing number of anti-GMO organizations have been catalyzed at the grassroots’ consumer level (even in the U.S.)
- Anti-GMO movement has metastasized, including the U.S., from a “philosophical” movement into a growing marketplace force – Consumers’ food choices and food companies’ marketing strategies
- Make no mistake, many of the anti-GMO organizations, like corporate ag biotech players, are businesses



# Anti-GMO Food Movement in the U.S. Has Moved into Politics

---

## Broad GMO Labeling is Only a Matter of Time in the U.S.

- GMO labeling is expected to gain growing traction in state initiatives, reflecting consumers' right to know – Response to growing concerns about potential long-term human health/safety risks
- Consumer sentiment in the U.S. broadly favors GMO labeling - Recent article in the New York Times (7/28/13) indicated that 93% of the people surveyed in a poll (January 2013) favor GMO labeling, “with most of them worried about the effects on people’s health”
- Defeat of California’s GMO labeling initiative (Proposition 37) in 2012 was a watershed event, which has created a national backlash – Prop. 37 failed (by a small margin), in large part due to the \$46MM spent by major companies, most of which were agbiotech companies (For what it is worth, I voted NO because of the technical language)
- GMO labeling law initiatives are picking up steam in the U.S. - GMO labeling laws subsequently passed in CT and ME and it is reported that there are 20+ states with GMO labeling state initiatives



# Potential Problem – Growing GM Food Concerns Creates Potential Market “Action-Reaction” Risks

---

## AgBiotech Industry Faces Growing Marketplace Risk

- AgBiotech industry faces the American consumer and the risk that “consumer perceptions” (of GM food safety risks) could create (marketplace) “reality” - Accelerating consumer demand for food with no GMO ingredients, beyond “organic food”
- Food companies would rather not deal with the GMO issue and would like it to go away – Key issue in the short-/intermediate-term is the inability to switch from GM feed/food ingredients - Large portion of major U.S. crops (i.e., corn/soybeans) are grown from GM seed, as well as the limited availability of non-GM seed
- Agbio industry has initiated a new campaign to boost support for GM crops, as well as persuade consumers that GMO labeling is not necessary. This effort is centered around a new website (GMOanswers.com) to improve consumer communication, especially health/safety aspects (website is expected to include food safety studies – Key problem is that there is a growing number of conflicting studies on GMO safety)



# Challenge for the AgBiotech Industry – A Dramatic “Reboot”

---

## AgBiotech Industry Needs to Take Aggressive Action to Restore its Credibility in the Marketplace – U.S./Global Consumers

- AgBio industry faces the dramatic need to redefine its credibility, from a consumer perspective, in order to create a FUTURE for GM and related trait technologies – Given that the development of scientific knowledge about plant genetics is still in its early days, the industry must take aggressive actions to ENSURE ITS FUTURE
- Need for a dramatic change in regulatory approval process to ensure transparent, long-term food safety studies, in order to enhance consumer/food companies/regulators’ trust/confidence
  - o Food safety studies should be subject to mandatory pre-market review by the FDA, or an independent self regulatory body (subject to FDA oversight) - Similar to CFTC (Commodity Futures Trading Association) and FINRA (Financial Industry Regulatory Authority), both subject to oversight by the SEC (Securities and Exchange Commission)



# Challenge for the AgBiotech Industry – A Dramatic “Reboot”

---

## AgBiotech Industry Needs to Take Aggressive Action to Restore its Credibility in the Marketplace – U.S./Global Consumers (cont'd)

- AgBio industry could consider new (mandatory) health/safety testing protocols, similar to the concept of double blind studies (gold standard in drug testing) to enhance credibility – To minimize bias, the actual testing and analysis could be separated
- AgBio industry and the regulatory process have to redefine its framework to reflect short-term/long-term RISK/BENEFIT analysis of the GM technologies - Health risks (ST/LT) have to be viewed on a risk/reward basis, as is the case with the approval of drugs
- Safety testing process and results should be totally transparent (including potential retesting of existing traits) – All testing analyses, including all data, would be available to the public
- New “balanced” outreach programs to the consumer – Based on multi-disciplinary approach, including plant/human scientists, agriculture, social scientists, consumers, and regulators



# **Growing Debate on GM Food Safety – Creates “Wild Card” Risks**

---

## **Broadening Consumer Actions to Shift to Non-GMO Derived Food Could Create a “Waterfall” of Unintended Effects – HYPOTHETICAL**

- **Consumers Act** - Growing consumer concern over GM food safety could develop in U.S., as well as expand globally, triggering broad actions to avoid food that directly/indirectly use GM food ingredients
- **Food Companies React** - Food companies take actions to develop non-GM food sources reflecting changing consumer demand, as well as take advantage of competitive strategies
- **Farmers/Agriculture Respond** - Growing market demand creates incentives for farmers to go back to non-GM seed, utilizing new farm management practices to enhance farm productivity
- **Seed Companies React** - Potential for seed companies to shift mix towards conventional seed from GM seed or eliminate GM seed - Emphasis would focus on MAS-driven advanced breeding
- **All of the Above Shifts Are Not Simple and Would Take Time - Key Would be a Change in Strategic Direction**



# “Today’s Story” – Could Risks Become Reality?

---

## AgBiotech Industry/Companies Could Face Financial/Strategic Risks

- 1- Industry Risk/Reward – A shift in marketplace momentum from GM seed to conventional seed, in response to consumer and food company marketplace actions, could create different risks/rewards for agbiotech seed companies, depending on market strategies
- 2- Company Risk/Reward – Depending on a company’s business portfolios mix, and business strategies, individual companies could be hurt or could take advantage of a strategic shift, from a market position and sales/profit perspective
- 3- Valuation Risk/Reward – Growing market uncertainty could adversely affect company valuations in the short-term, as marketplace actions impact short-/long-term demand/visibility and sales/profit trait/seed mix shifts – But company valuations could go up or down in the intermediate-/long-term, depending on changing strategic actions, market position, and competitive actions

**Impact – Potential Competitive/Structural Disequilibrium  
Could Create Winners/Losers and Tomorrow’s “New Story”**



BioScience  
Securities, Inc.

The Power of BiInnovation

# Important Notes

---

## Copyright and General Information

Copyright 2013 BioScience Securities, Inc. All rights reserved.

This presentation has been prepared by BioScience Securities (“BSI”), based on public information. The information included in this presentation was obtained from various sources, and BSI does not guarantee its accuracy.

Reflecting BioScience Securities, Inc.’s corporate policy, BSI and its principal, do not have securities holdings in any of the companies (or related companies) mentioned in this presentation.

BioScience Securities, Inc. provides corporate advisory/investment banking services and seeks to do business with companies, including those covered in this presentation.

BioScience Securities, Inc., within the last three years, has not provided corporate advisory services to any of the companies mentioned in this presentation.

**Sano M. Shimoda**  
**BioScience Securities, Inc.**

**PO Box 2669**  
**Venice, CA 90294-2669**

**Tel: 310.452.8783**  
**Cell: 510.220.7487**  
**(San Francisco Bay**  
**area telephone**  
**area code)**

**e-mail: [sano@bioscience-securities.com](mailto:sano@bioscience-securities.com)**  
**[www.bioscience-securities.com](http://www.bioscience-securities.com)**



**BioScience  
Securities, Inc.**

*The Power of BioInnovation*