Cotton’s Biotech Future for Public Sector Scientists
Cotton’s Biotech Present

• Adoption of biotech cotton is huge - 81% of global cotton planting in < 20 years

• Hundreds of trait types being tested
  – fiber quality, oil quality, stress tolerance, salt tolerance, Cry and non-Cry proteins insect tolerance, fungal & viral tolerance, herbicide tolerance,

• But only two trait classes commercialized
  – Cry proteins for insects (Cry1A  Cry2A  Cry1F)
  – Tolerance to broad spectrum foliar herbicides
    • bromoxinil  glyphosate  glufosinate
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Near Term Biotech Challenges

• Regulatory not getting faster, nor cheaper
  – still regulated as a novel threat
• Biotech trait Intellectual Property not getting simpler
  – highly litigious space
  – many patents required
  – many claims overlapping
  – substantial uncertainty
  – cross licensing essential
Near Term Biotech Challenges

• Fewer trait providers of cotton planting seed
  – DuPont and Syngenta received approval for their cotton traits (AHAS & VIP) but did not commercialize
  – Globally, Monsanto, Dow and Bayer provide all of the cotton traits

• Cotton planting seed sales capped
  – US and Australia’s producers of 20% of global cotton bales pay >80% global biotech trait fees
  – Global hybrid corn seed sales is ~250 million acres compared with US & Australian cotton of 12 million acres
Near Term Biotech Challenges

• Most of the world’s cotton is grow in developing countries
• Unlikely that Pakistan, China, and Africa will strengthen their enforcement of Intellectual Property for seed
• Likely that India could loosen their effective Intellectual Property protection as machine harvesting dictates movement from hybrids to varietals
Near Term Biotech Challenges

• Detection of Low Level Presence continues to be more robust, while seed purity methods are hitting the “biological wall” of field seed production

• Global cotton production relies on 1 highly efficacious insecticidal gene, Cry1Ac, that is increasingly threatened by resistance as it use expands into corn, soybeans, sugarcane, eggplant, rice
Cause for future optimism

• Enabling technology patents do expire! The snails pace of deregulation may allow new traits providers

• Generic traits may become a reality in cotton. Since fiber & oil is generally not a biotech regulatory concern, and 99% of our cottonseed and meal stays in North America, we are less exposed to Asian regulatory restrictions than corn and soybeans
Cause for future optimism

- Science is feeding novel biotech ideas at a rapid pace
  - RNAi pest control strategies
  - mRNAs for plant growth
  - Ionomics for improved fertilizer efficiency
  - metabolic engineering of novel pathways
- Demand for higher quality food exploding (nutritious, more protein, improved flavor)
Cause for future optimism

• “non-biotech” opportunities expanding
  – Native traits
  – Introgression of exotic germplasm
  – Marker Assisted Breeding

• Genome editing will open novel FTO & traits
  – Mutagenesis,
  – Zinc finger nucleases
  – Meganucleases
  – Talen and Cas9

• Genome editing may fall outside of current biotech regulatory restrictions
Cotton has always let the way!

- Bt-cotton is the poster child for biotechnology and opened up doors to biotech crops in Mexico, South Africa, Burkina Faso, China, India, Pakistan
- Maybe a humanitarian use of Dr. Rathore’s Ultra Low Gossypol Cottonseed can open up doors in biotech consumer acceptance and demonstrate a lower cost path to market
Cotton’s Biotech Future for Public Sector Scientist

- Huge benefits, Huge challenges & Huge Optimism
- So, what is the role of public scientists in cotton biotechnology?
  - Training new scientists?
  - Evaluating new products?
  - Developing management guidelines?
  - Creating new genetic resources and new variety improvement tools?
  - Use biotechnology as a tool to advance basic plant knowledge in critical areas?
  - Building proof-of-principle novel traits where industry is reluctant to invest?
Thank You