PLANT BREEDING INNOVATION:
PERSPECTIVE FROM THE SEED SECTOR

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The Goals of Plant Breeders Remain the Same
MILESTONES IN PLANT BREEDING

CROP DOMESTICATION
Farmers select the best wild species to create crops

10,000 BC
Domestication of wheat

HYBRID BREEDING
Crossing two genetically different individuals to develop better performing hybrid

More vigorous hybrid corn

PLANT BREEDING BASED ON CROSS BREEDING
Development of improved varieties by combining good characteristics from two parents

1940
Blast-resistant rice

1926

MUTAGENESIS
Developing new genetic diversity by exposing crop plants to chemical agents or radiation

1926
Insect-resistant cotton

GMO
Introducing foreign genes into the DNA of a plant

1994
Barley resistant to yellow dwarf virus

MARKER-ASSISTED SELECTION
Locating desirable traits in a plant for efficient selection and breeding

1994
Waxy corn

TARGETED BREEDING
Using modern tools such as genome editing for more targeted breeding

2000

PLANT BREEDING BASED ON GENETIC INFORMATION
Development of improved varieties by working directly with the DNA

Future

now
Important to Plant Breeders

• Gene editing methods can be used across all agriculturally important crops

• Efficient and precise
  – Can reduce R&D and breeding time
  – Important for plants with long generation times
  – Important for crops with complex genomes
Why We Care: Some Examples

• Crops with high disease pressure
• Genetically complex, consumer focused characteristics
• Water Use efficiency
• Nitrogen, phosphorous, potassium use efficiency
• Improved photosynthetic capacity (higher yields in less space)
Impact of Public Policy

• Regulatory policy will determine utilization of methods across companies and across crops

• Unnecessarily high regulatory burden
  – Limit utilization to largest companies
  – Limit utilization to highest value crops (e.g., corn, soybeans) and to limited number of traits (e.g., herbicide tolerance)
Global Seed Flows

- Corn
- Soy
- Cotton
- Canola
- Sorghum
Tomato Example
Plant Breeding Innovation: Goals of Global Seed Sector

- The seed sector and agriculture are global—what is needed?
  - Clear government policy
  - Facilitation of innovation, collaboration and trade
  - Consistent, risk-based policies across countries
International Goals

- Question is not whether plant varieties are regulated
  - Real question is: Should there be a pre-market review & approval?
- It is key that governments and international organizations work together to avoid creating new trade barriers or disruptions due to inconsistent policies and practices.

Goal: Consistent approach to the scope of regulatory oversight for products of plant breeding innovation
Underlying Principle

Plant varieties developed through the latest breeding methods should not be differentially regulated if they are similar or indistinguishable from varieties that could have been produced through earlier breeding methods.
Genome Editing: A Continuum

- **Targeted deletion mutation**
- **Targeted gene editing**
- **Targeted gene insertion**

**Allele silencing through small nucleotide deletion or addition**

**Recreate an allele (e.g. from wild relative)**

**“Cis-genic” insert gene from plants gene pool**

**Targeted Transgenic**
Some Observations

• Not just about gene editing
  • Precedent for future innovation

• Impact on research
  • Research grants & public/private collaborations

• Plant breeding practices remain the same
  • Quality management practices fundamental to breeding

• Communication is key!
  • Public, value chain and policy makers
Public-Facing Resources: Check out ASTA’s microsite!

- FAQs
- Breeder profiles
- Blog
- Videos
- One-pagers
- News articles
- Infographics

www.SeedingInnovation.org
QUESTIONS & ANSWERS