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Biologicals
Introduction of Presenters
Opening Slide
Mariola B. Kopcinski Ph.D.
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Technical Panel Presenters

Dr. Adrian Percy

Adrian is the Executive Director of the N.C. Plant Sciences Initiative at North Carolina State University. The N.C. PSI seeks to deliver impact to the farm through mission-based science, public private partnerships and entrepreneurship. He is a Venture Partner at DYDX Capital, a technology and life sciences venture capital investor and serves on several boards, including those of Nufarm, BioLumic and FA Bio. He also hosts the AgTech360 podcast. Prior to joining NC State, Adrian served as the Chief Technology Officer of UPL Ltd and was previously the Head of Global Research and Development of Bayer Cropscience.

Dr. Kelly Smith, is the COO, Sable Fermentation, Inc. She has more than 20 years' experience building and leading research and development teams, as well as characterizing, registering, scaling and commercializing products in agricultural and industrial biotechnology. She has experience in R&D leadership, IP strategy, regulatory strategy, scale-up, commercialization and tech transfer for a variety of products and organizations. She has a BS in Chemical Engineering from Michigan State University and a MS and PhD in Environmental Engineering Science from Caltech.

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Dr. Natalie Breakfield is Chief Science Officer, NewLeaf Symbotics. In this position, she directs research programs for testing and validating products for sustainable agriculture made with pink pigmented facultative methylotrophs (PPFMs) technology. She obtained an M.S. in Molecular and Cellular Biology from University of Missouri - Kansas City, a Ph.D. in Genetics and Genomics from Duke University, and was a Ruth L. Kirschstein postdoctoral fellow at University of North Carolina - Chapel Hill. She has been a member of the board of directors of the International Alliance for Phytobiomes Research (Phytobiomes Alliance) since 2020. Natalie is passionate about bringing effective technologies to the market to benefit both people and the planet.

Joshua Arnie is Associate Director of Plant Toxicology & Biologics with 19 years of experience conducting ecotoxicology testing to support regulatory risk assessments. He became interested in toxicology while conducting his thesis on acquisition and retention of a conditioned response in Nile tilapia exposed to malathion at Washington College. He joined Wildlife International in May 2007 and in 2017 he transitioned to managing the aquatic and terrestrial plant testing program. In 2018, he joined the steering committee for the SETAC Global Plants Interest Group, which he currently co-chairs. Joshua has been working with MCPAs for the last decade, validating and analyzing test solution samples using plating methods.

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Biological Products are Extremely Diverse

BIOLOGICAL PRODUCTS

Source: DunhamTrimmer® LLC

BIOSTIMULANTS[1]

MICROBIALS

- NUTRIENT USE EFFICIENCY (NUE) (BIOFERTILIZERS)[2]
- PLANT GROWTH PROMOTION (PGP)

NON-MICROBIAL

- PLANT & SEAWEED EXTRACTS
- AMINO ACIDS
- ORGANIC ACIDS
- INORGANIC COMPOUNDS

[1] Biostimulants are products which elicit one or more of the following effects: 1) mitigate abiotic stress; 2) enhance crop quality; 3) improve nutrient assimilation. Their functions are typically classified as NUE (Nutrient Use Efficiency) or PGP (Plant Growth Promotion).

[2] Biofertilizers are Microbials used to enhance plant nutrient uptake from soil (NUE).

- N-fixing bacteria make up the largest segment.
- N-fixing bacteria for non leguminous crops make up the fastest growing segment.
- Other NUE microbials include mobilizers and solubilizers or chelators of specific nutrients such as P, K, S, Zn, Fe.

PGP Microbials target other biostimulant properties beyond NUE.

Non-microbial biostimulants may target either NUE or other PGP effects.

- Amino Acids and Seaweed Extracts are the fastest growing segments.
- Seaweed Extracts are a complex mixture of components including plant hormones, phenolic compounds, and other active substances.
- Amino Acid products include peptide fractions.
- Organic acids are mainly humic and fulvic acids used as soil amendments.

BIOCONTROLS

BIOPESTICIDES[3]

- BIOCHEMICALS[4]
  - PLANT EXTRACTS
  - ORGANIC ACIDS
  - PGRs
  - SEMIOCHEMICALS
- MICROBIALS[5]
  - BACTERIA
  - FUNGI
  - PROTOZOA
  - VIRUSES
  - YEASTS
  - OTHERS

[3] Biopesticides are derived from natural materials such as plants, bacteria and certain minerals. Biopesticides target specific pests and are inherently less toxic than synthetic pesticides.

[4] Biochemicals include Plant Extracts (largest by sales volume), Organic Acids, PGRs (plant hormones e.g. cytokinins, auxins, etc), and Semiochemicals (allelochemicals and pheromones).

MACROORGANISMS[6]

- INSECTS
- MITES
- NEMATODES

[5] Microbials refer to products based on bacteria, fungi, viruses, and protozoans. Microbials comprise the largest market of biopesticides.

- Bacteria, followed by fungi, make up the largest groups commercially (>90%).
- Biggest challenges relate to product formulation with regard to shelf-life, stability, and performance enhancement.

[6] Macroorganisms include insects, mites, and nematodes. Insects & mites are the largest groups.

- Unique in that the live organism is used in the form of eggs, larvae, pupae, or adults.
- The most important challenge in this category is logistics — shipping live organisms that require special care to survive.
- Normally not classified as Biopesticides but rather Biocontrols.

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