

Biologicals into The Future

Positioning and Trends for Biologicals 3.0

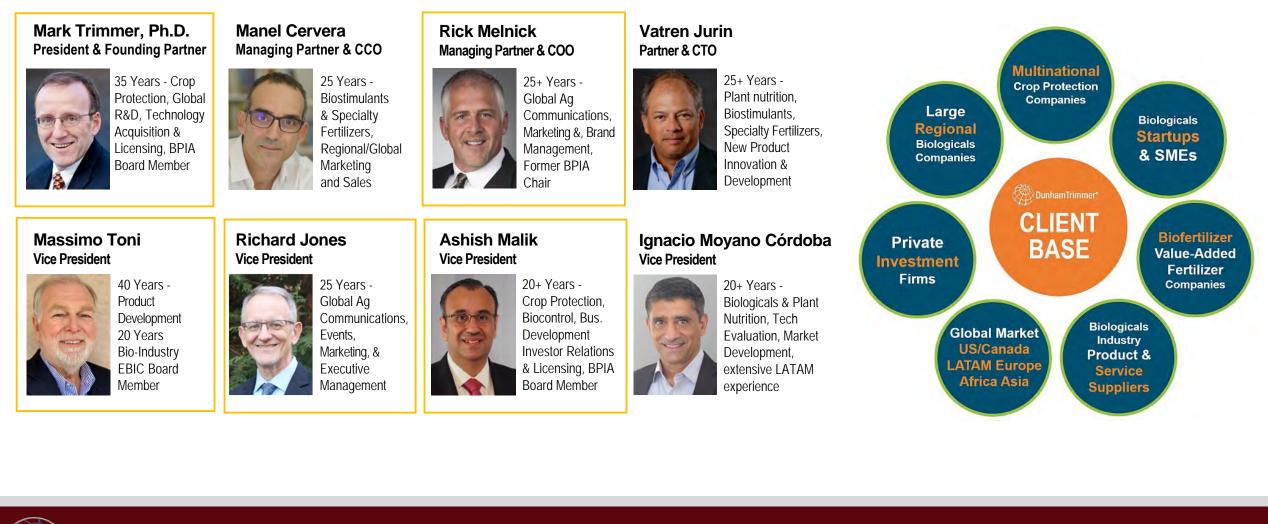
April 2, 2025 BPIA Annual Meeting Sacramento, CA

Rick Melnick, DunhamTrimmer COO & Managing Partner





The Biological Products Industry's Premier Strategic Business Consulting & Market Research Firm



<u>AGENDA</u>

INTRODUCTION GLOBAL BIOLOGICALS MARKET OVERVIEW MARKET DRIVERS MARKET PLAYERS MARKET TRENDS LOOKING AHEAD





BIOLOGICAL PRODUCTS INDUSTRY ALLIANCE

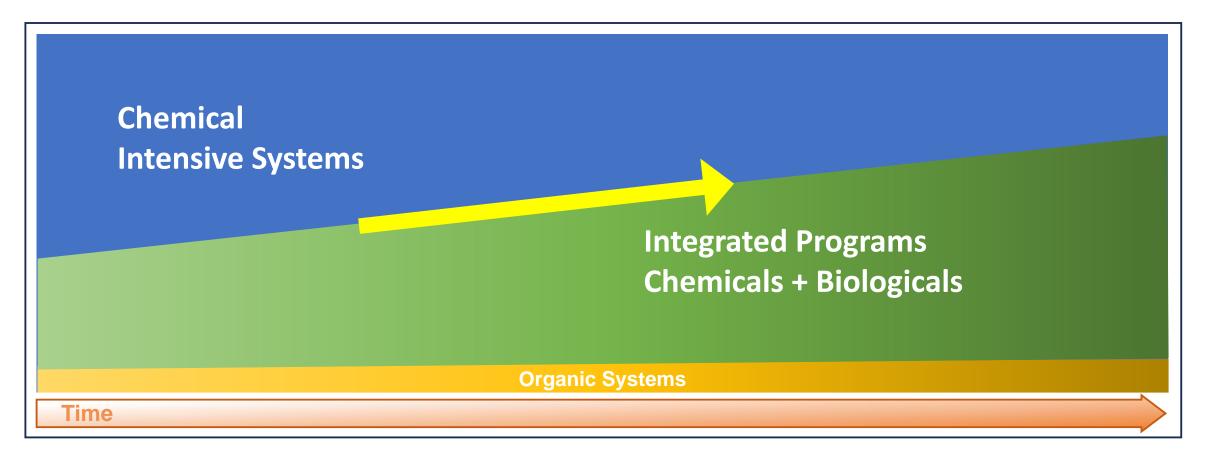




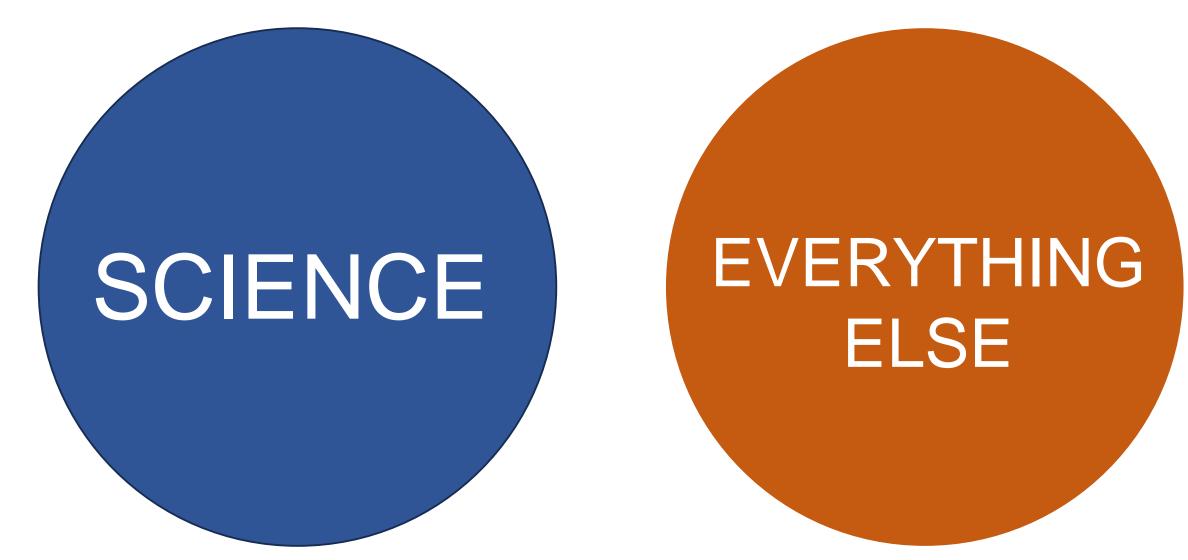


Biologicals Markets: What's Happening

Evolution toward integrated crop management systems









BIOLOGICAL PRODUCTS

Source: DunhamTrimmer®, LLC

BIOSTIMULANTS¹				BIOCONTROLS						
MICROBIALS		NON-MICROBIAL		BIOPESTICIDES³			MACROORGANISMS ⁶			
NUTRIENT USE PLANT GROWTH		PLANT & SEAWEED EXTRACTS	AMINO ACIDS	BIOCHEMICALS⁴		MICROBIALS ⁵		INSECTS	MITES	NEMATODES
(NUE) (BIOFERTILIZERS) ²	PROMOTION (PGP)	ORGANIC ACIDS	INORGANIC COMPOUNDS	PLANT EXTRACTS BACTERIA FUNGI		5 Microbials refer to products based on bacteria, fungi, viruses, and protozoans.				
	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).			ORGANIC ACIDS	PGRs	PROTOZOA	VIRUS	Microbials comprise the largest market of biopesticides. • Bacteria, followed by fungi, make up the		
				SEMIOCHEMICALS YEASTS OTHERS		 largest groups commercially (>90%). Biggest challenges relate to product formulation with regard to shelf-life, stability, and performance enhancement. 				
enhance plant nutr	2 Biofertilizers are Microbials used to enhance plant nutrient uptake from soil Non-microbial biostimulants may target either NUE or other PGP effects.		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.							
 (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. 		 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. 				 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. 				
				4 Biochemicals include Plant Extracts (largest by sales volume), Organic Acids, PGRs (plant hormones e.g. cytokinins, auxins, etc), and Semiochemicals (allelochemicals and pheromones).						



BIOLOGICAL PRODUCTS

Source: DunhamTrimmer®, LLC

BIOSTIMULANTS¹

BIOCONTROLS



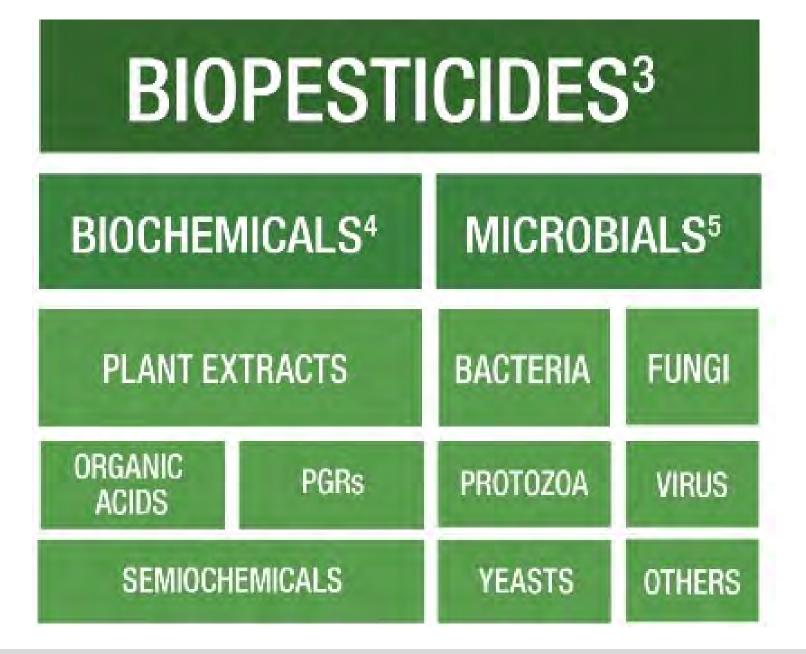
BIOCONTROLS

BIOPESTICIDES³

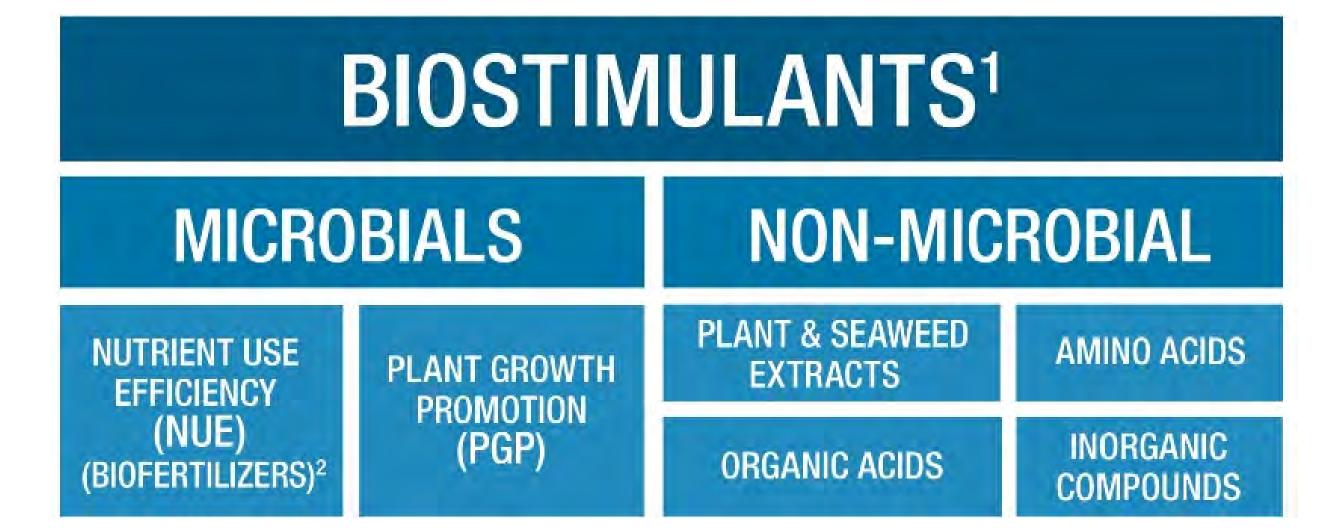
MACROORGANISMS⁶

BIOCHEMICALS⁴		MICROBIALS ⁵		INSECTS	MITES	NEMATODES		
PLANT EXTRACTS		BACTERIA	FUNGI	5 Microbials refer to products based on bacteria, fungi, viruses, and protozoans.				
ORGANIC ACIDS	PGRs	PROTOZOA	VIRUS	Microbials comprise the largest market of biopesticides. • Bacteria, followed by fungi, make up the				
SEMIOCHEMICALS YEASTS OTHERS			largest groups commercially (>90%).Biggest challenges relate to product					
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.			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 					
4 Biochemicals include Plant Extracts (largest by sales volume), Organic Acids, PGRs (plant hormones e.g. cytokinins, auxins, etc), and Semiochemicals (allelochemicals and pheromones).			 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. 					

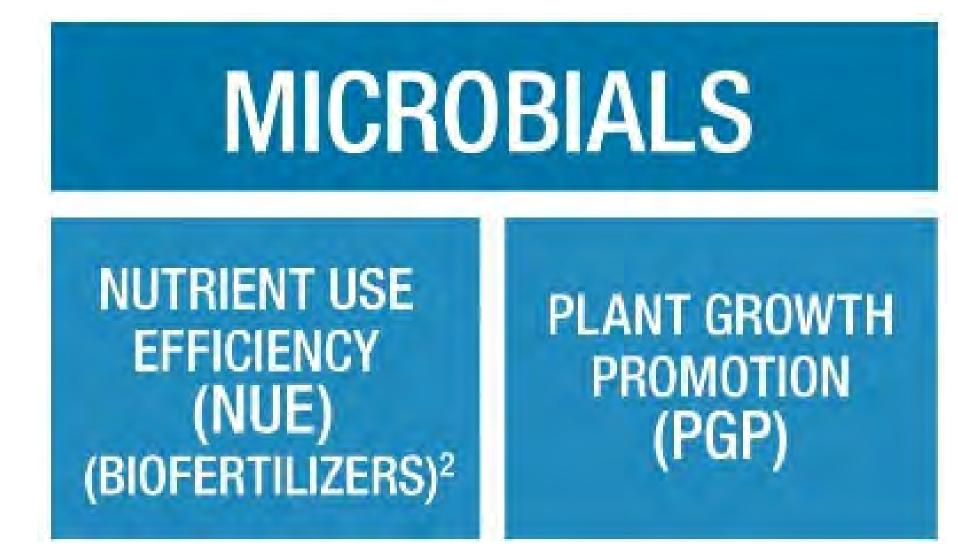




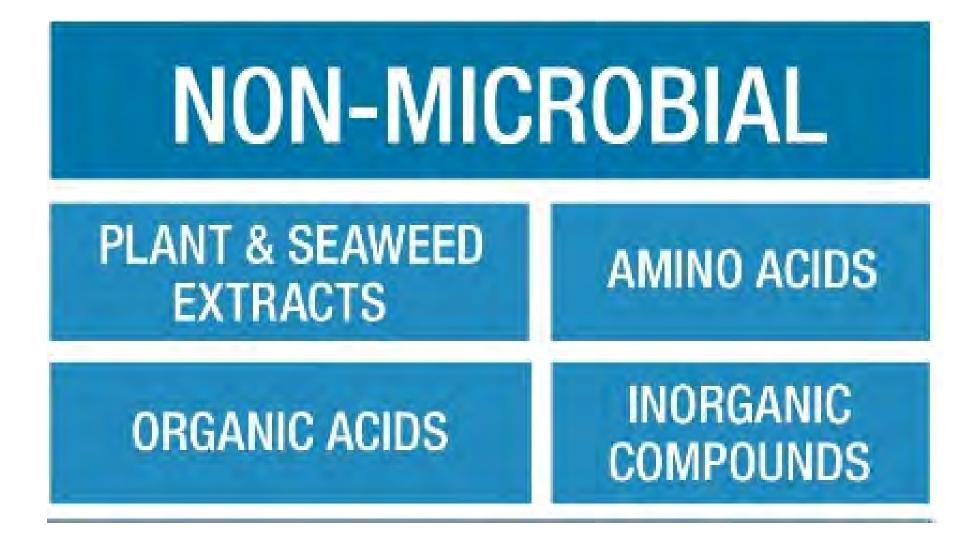






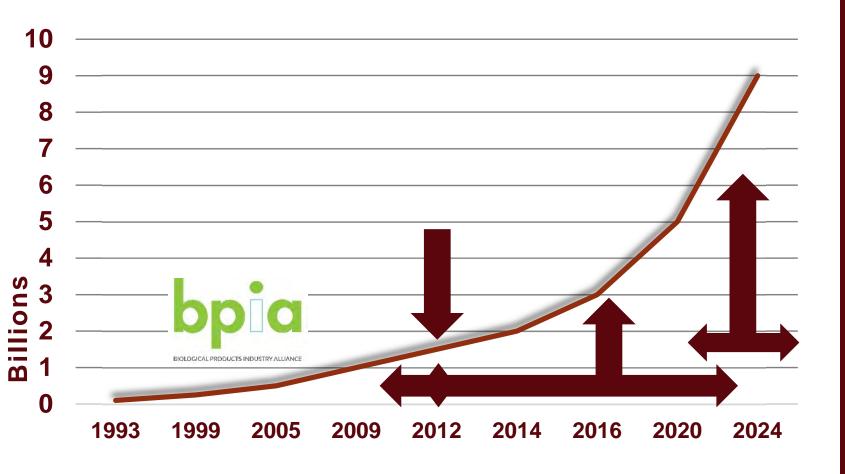








Global Biocontrol Market (Bn USD)



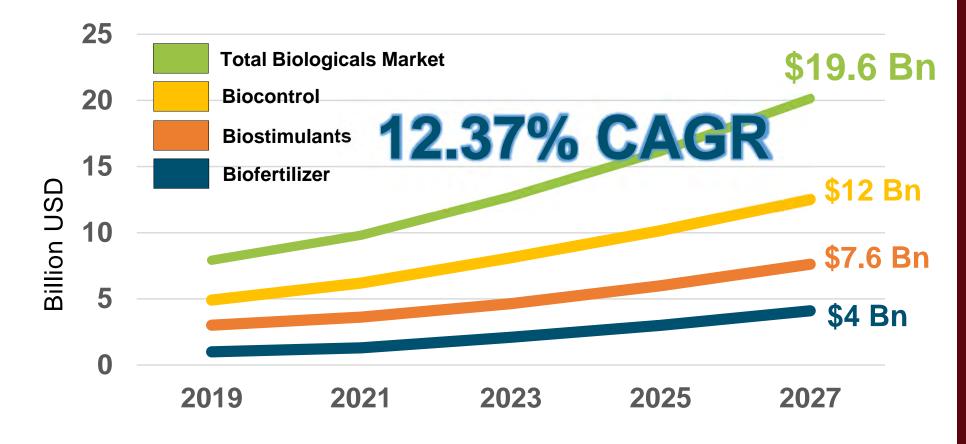
Market grew slowly until early 2000s BPIA formed in 2001 and became a legal entity in 2003 **2012** – Entry of global companies 2010-2021 - Positive investment climate 2020-2024 – Expansion

into row crops

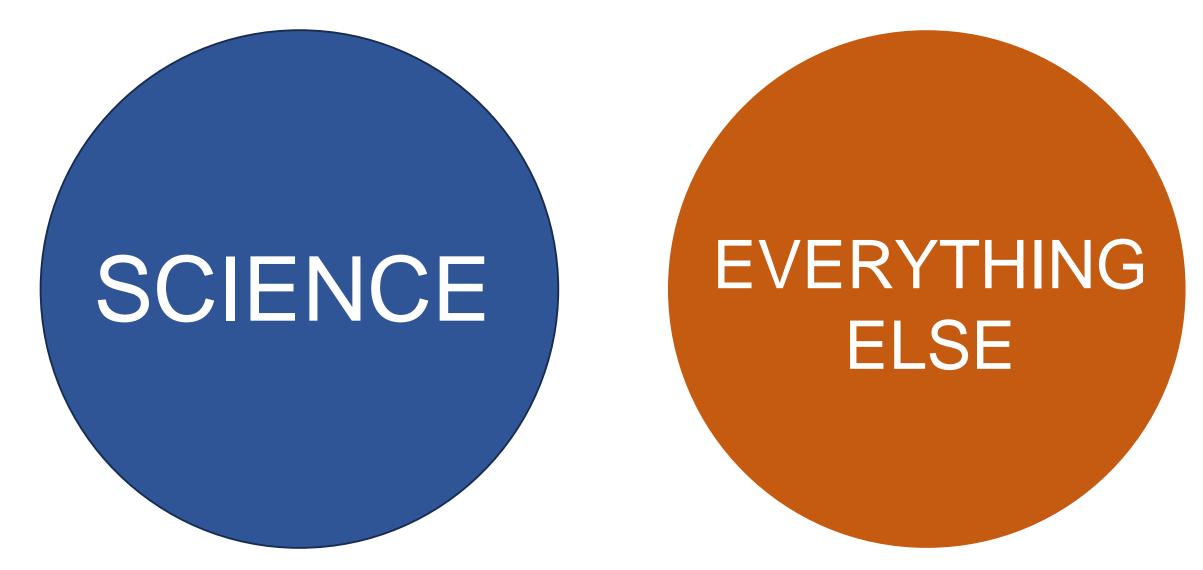
DunhamTrimmer® International Bio Intelligence

Rapid Growth of Biologicals Markets

Global Biologicals Markets Landscape



- Global Biocontrol Market will eclipse \$12 Billion in 2027
- Total Global Biostimulant Market will increase from \$4.6 Billion in 2023 to \$7.6 Billion in 2027
- Total Global Biofertilizer Market will double from \$2 Billion to \$4 Billion by 2027
- Total Global Biologicals Market estimated \$12.75 Billion in 2023
- Total Biologicals Market will surpass \$19.5 Billion in 2027











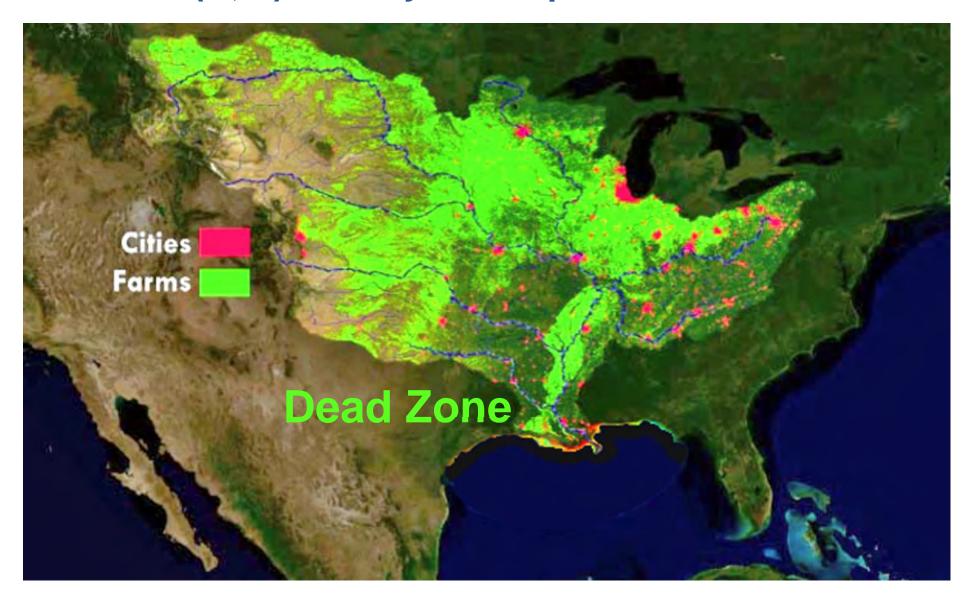


CONSUMER

Today's consumer generation Has more information available Wants to be involved Wants to have a voice Wants to have an impact Wants quality stuff Is made up of a rising middle-class with money and a willingness to pay for what they want



The Gulf of Mexico Nutrient loss (N, P) is a Major Disruptor of the Environment



N, P, and Pesticide Pollution in the Gulf of Mexico



EVERYTHING ELSE









This is happening all around the world

Food safety Food security Climate change Environmental Impact Regulatory System



ING

CONSUMER

Biakitjara Govering Patversportzil

SUSTAINABLE GOALS

- Financial Incentives
- **o Educational Programs**
- Commercial Development
- **o** Regulatory Framework















ING



Biologicals Innovation is Tied Directly to Regulatory

- Time and expense to required to register new products can be a major barrier to entry for new companies and new technologies
- Much of the innovation in this space still coming from smaller companies
 - The predictability of these processes is of supreme importance to business planning, especially for pre-revenue companies



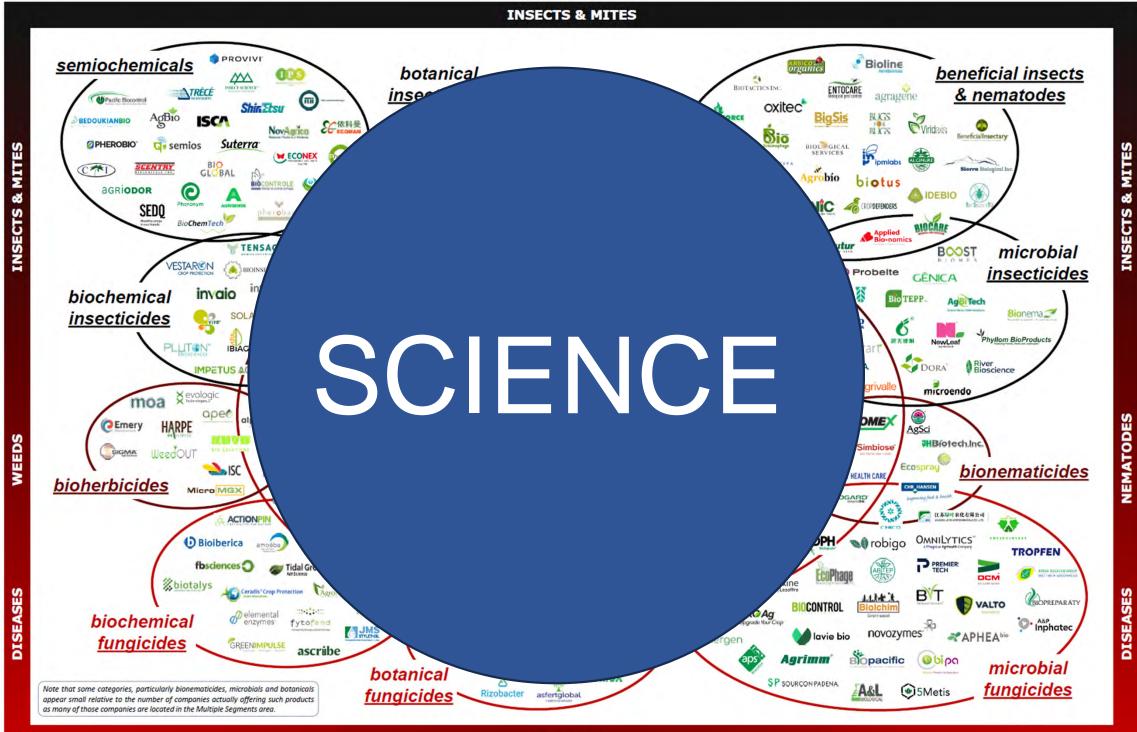


The Effect of the Multinationals Entering the Market

- Entry of the Multinationals boosted the credibility of the category (2012)
- Tons of activity over the last 5 years: parnterships, research agreements, mergers and acquisitions
- All of these new entrants infuse the industry with significant resources
- Many of these companies still depend upon smaller companies for the real innovation



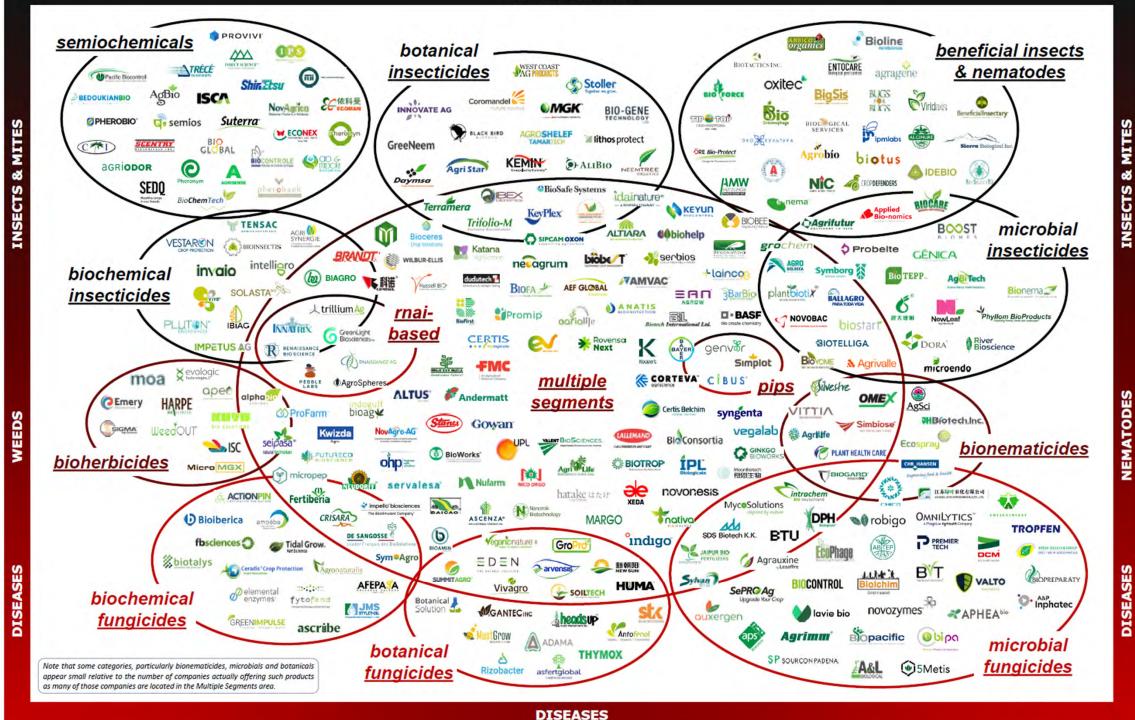




Larry Taylor The Mixing Bowl

DISEASES

INSECTS & MITES



Larry Taylor The Mixing Bowl







Have to assess new products with confidence Have to understand the technologies Have to sell the technologies Have to provide field support The ones that do this the best are the ones that win









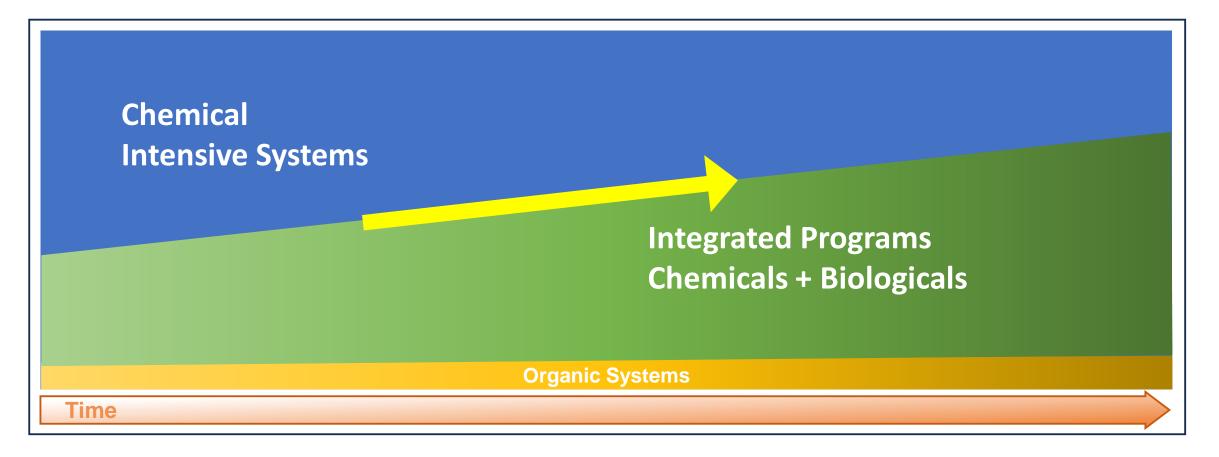
Depend on the retailer Depend on the manufacturer Depend on advisors Margins are thin: growers are techies, but not always anxious to try new things They need encouragement from the people they trust and rely upon







Evolution toward integrated crop management systems





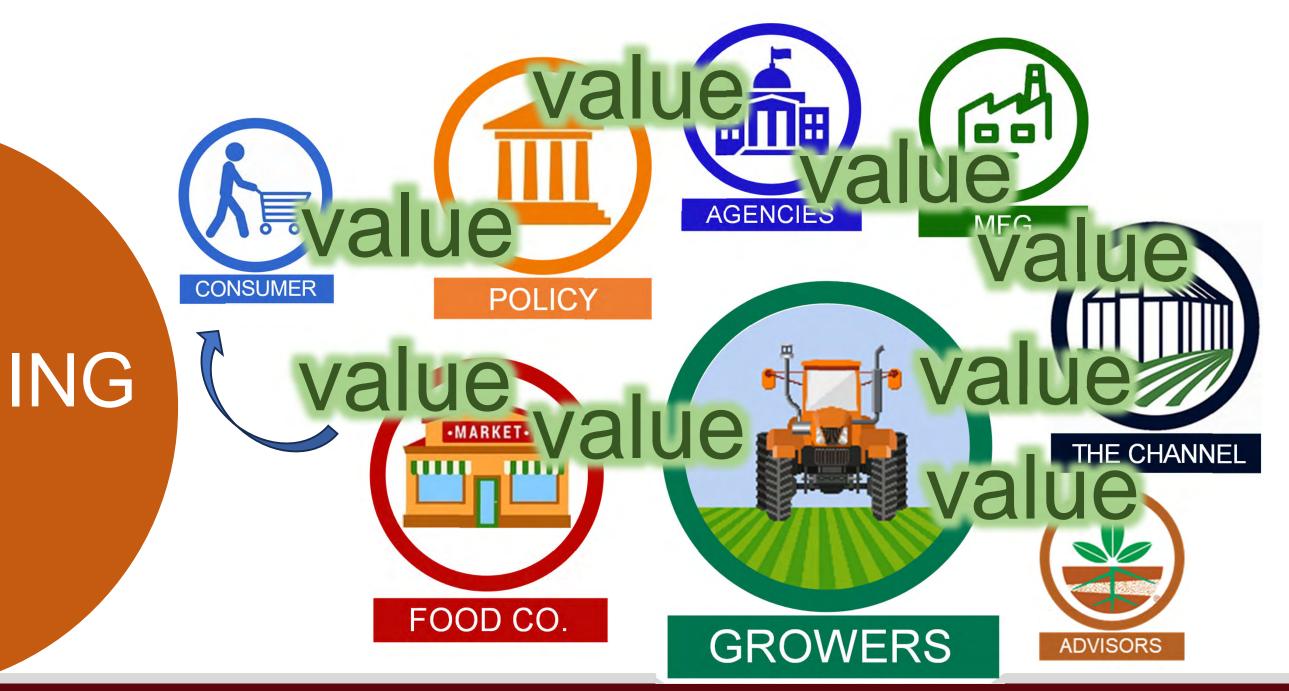
Biologicals Market Growth Focus on Pesticide Residues



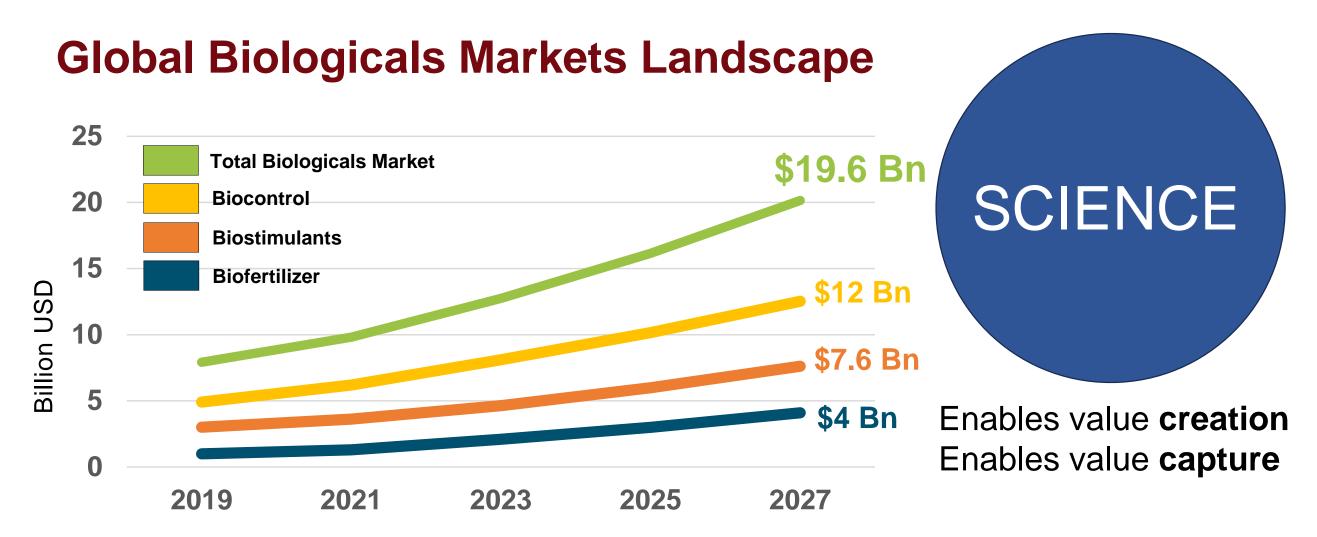
Integrated Programs Chemicals + Biologicals

	EDEKA		REWE		
MRL ¹ : 70%	MRL1: 50%	MRL1: 33%	MRL1: 50%		
ΣMRL ³ : 80%	ΣMRL3:%	ΣMRL3: 80%	ΣMRL3: 100%		
ARfD ² : 80%	ARfD2: 100%	ARfD2: 100%	ARfD2: 50%		
ΣARfD ⁴ : 80%	ΣARfD4:%	ΣARfD4: 100%	ΣARfD4:%		
a.Ingredient ≤ 4/5	a.ingredient≤5	a.ingredient ≤ 5	a.ingredient ≤ 5		
¹ % of Maximun ² % of Acute Re	n Residue Level eference Dose	³ Sum of total MRL ⁴ Sum of total ARfD			









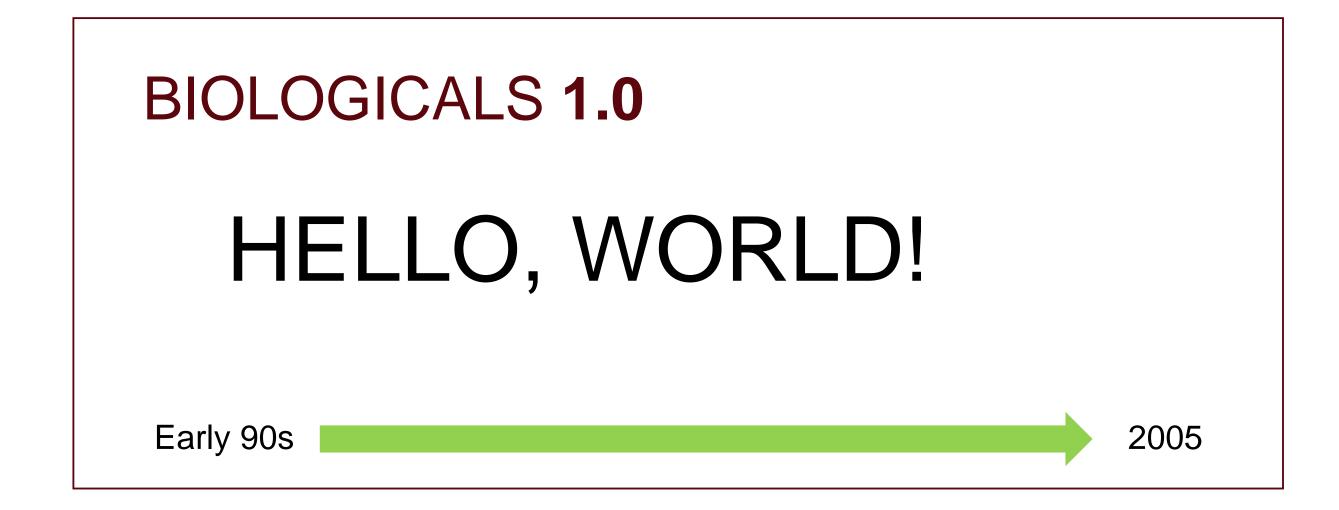
38

Rapid Growth of Biologicals Markets

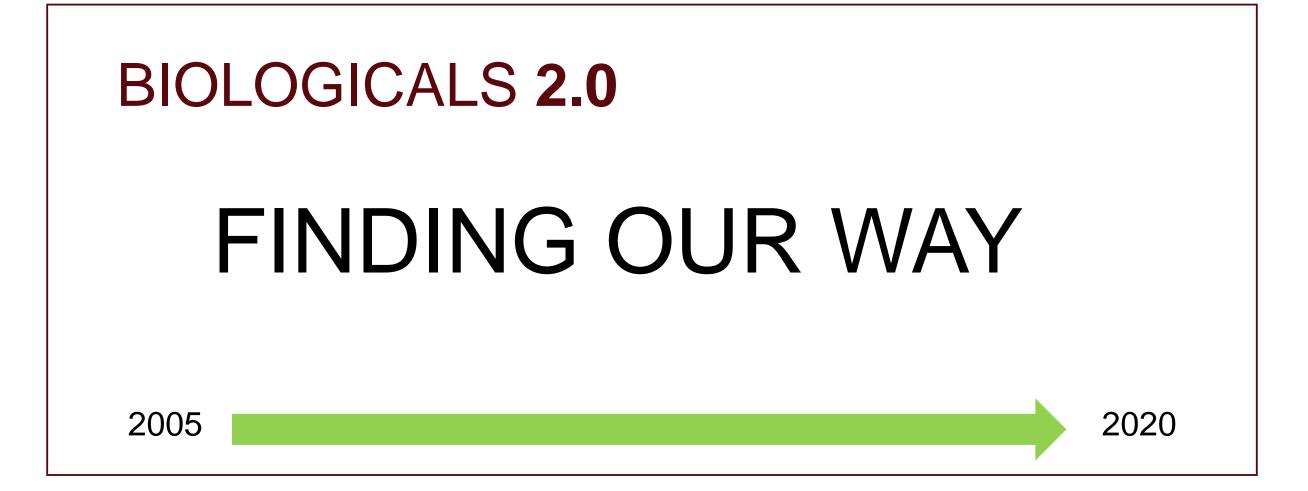
DunhamTrimmer®

International Bio Intelligence

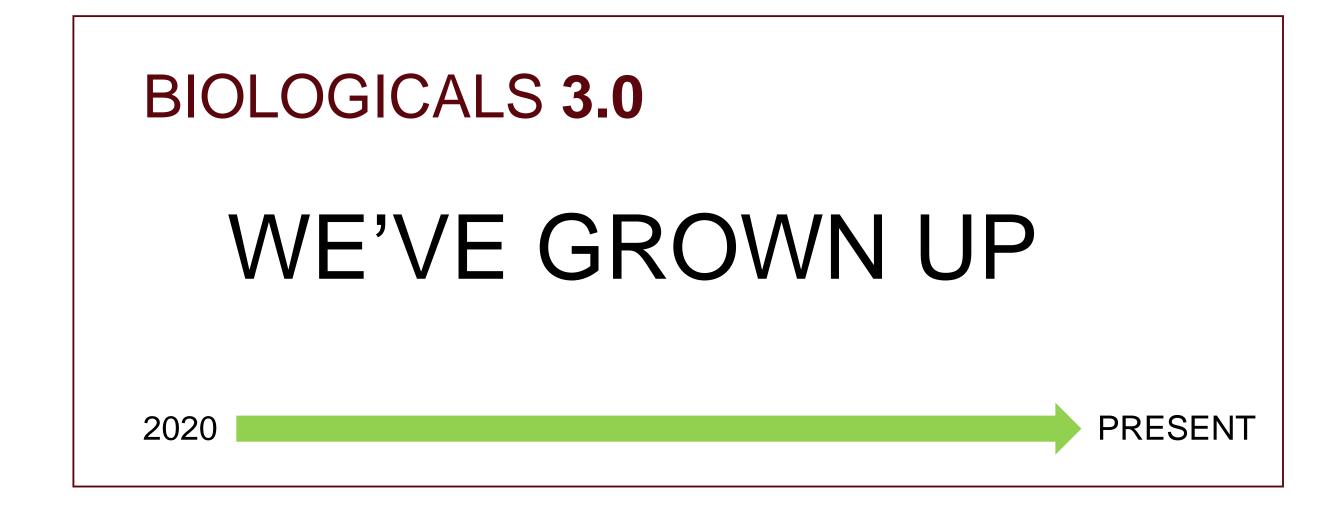
38



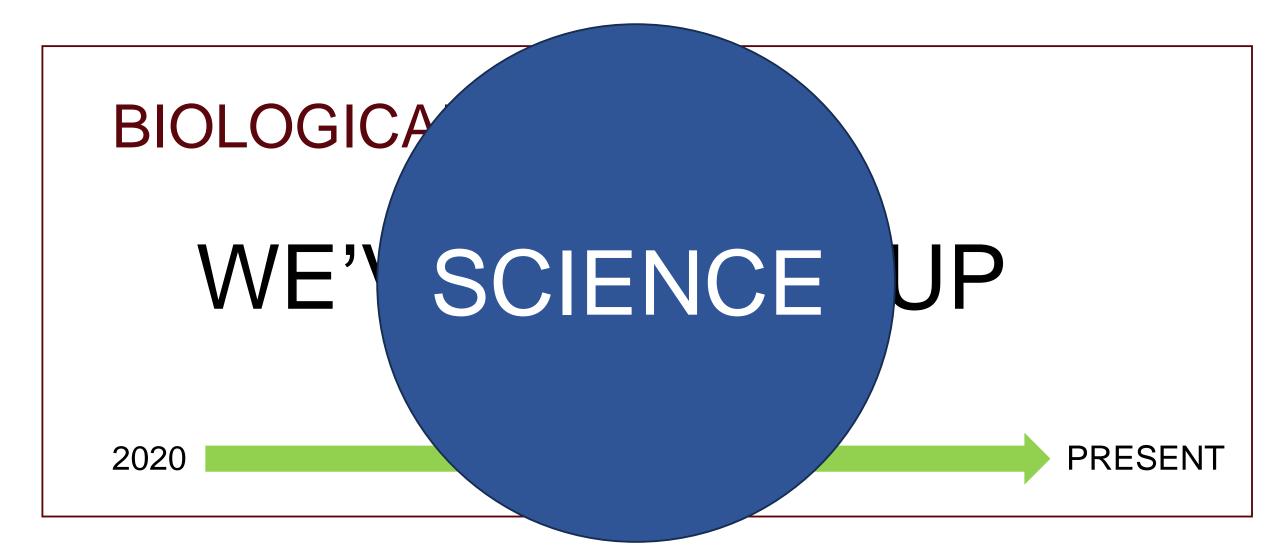














We must accept and be mindful that the Biologicals 1.0 Period included products that were insufficiently supported by sound **science** — resulting in poor performance and negative experiences with growers, advisors, and the channel.





Since then (Biologicals 2.0 & 3.0), the market has corrected itself. The widespread adoption of biological products is a testament to their efficacy — and the **science** behind these technologies.





Our conversations today need to revolve around the **science** behind biologicals, and how that science is bringing forth products that meet the increasing demands of growers, consumers, and the entire food value chain.





Our **science** message has to include information about how and why our products work, but also their limitations — when and why they don't work.





Our **science** message has to include information about how to properly evaluate biological products. It has to communicate the importance of establishing clear expectations and the need to understand the variables that can impact performance. BIOLOGICAL PRODUCTS INDUSTRY ALLIANCE



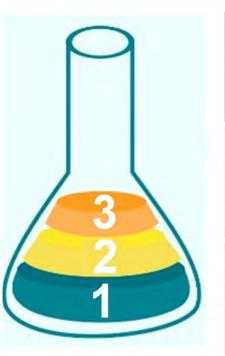
Biologicals 3.0 Biostimulants Science Biostimulants:

Can improve crop vigor and quality Can improve crop tolerance to abiotic stress Can help improve Nutrient Use Efficiency Can enhance the development of soil microbes Can stimulate root growth and water use efficiency Can reduce greenhouse gas emissions **Can help growers preserve the yield potential of their crop** Can reduce waste (Value-Added Fertilizers)





Biologicals 3.0 Value-Added Fertilizers



1 Foundational Components

Compounds that provide essential nutrients necessary for plant development

2 Functional Components

Primarily biostimulants, which improve nutrient assimilation, promote stress resilience, and optimize plant physiological processes

3 Enhancement Components

Chemical additives that improve the stability, compatibility, and delivery of nutrients and biostimulants



Foundational Nutrient Components 5% to 98% Functional/Physiological Components 0.5% to 25% Performance Enhancing Components 0.2% to 12.0% 75% of all Biostimulants are sold as part of Value-Added Fertilizer Blends (VAFs)

SCIENCE

VAFs cor

com

er

VA

allow to.

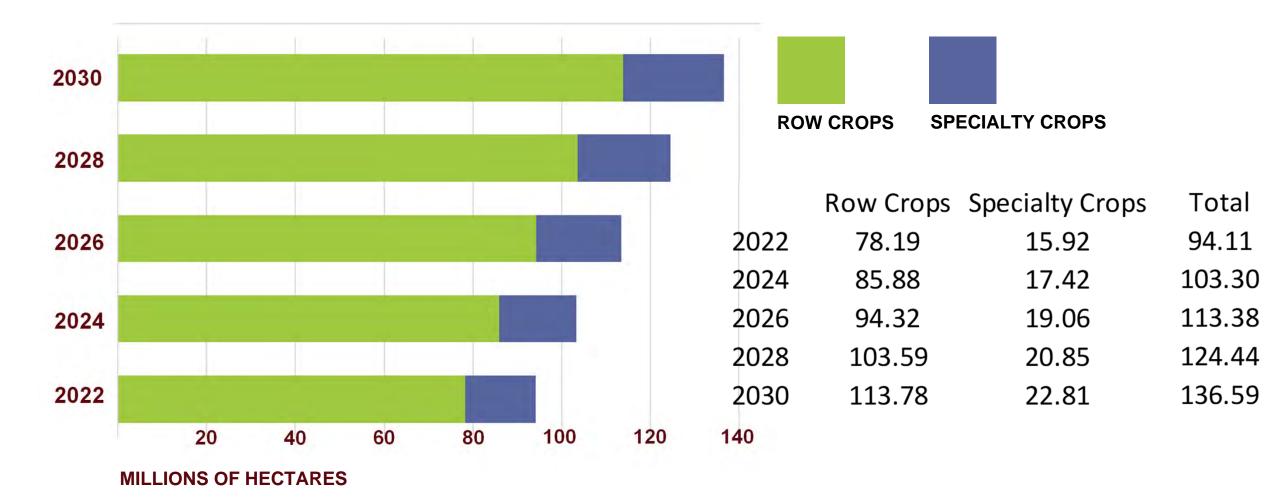
cation

ational

nts +

VAFs reduce waste and lessen environmental impact VAFs deliver high ROI 49

US Value-Added Fertilizer Hectares Treated (MN) 2022-2030





Biologicals 3.0 Biostimulant Trends

Challenge: Biostimulant products work, but the plant response relies on agroecological factors, climatic factors, and management system factors.

- Dependence on these variables means it can be very difficult to replicate results year on year
- Demand creation and technical support for these products often lands on the distributor/retailer
- It is critical that we communicate the science behind these products, and how these variable factor into the performance equation





Biologicals 3.0 Biostimulant Trends

Challenge: The lack of IP protection in the biostimulant market results in differentiation challenges for suppliers

- Lack of IP protection and less intense regulatory requirements create low barriers to entry
- Relatively low number of basic substance suppliers means many products include the same material
- Formulators create the value through unique combinations of ingredients
- It is critical that we communicate the science behind these products, and where the effects are coming from given their complex nature





Biologicals 3.0 Biocontrol Science

Biocontrols:

- Integrate well in systems with conventional products
- Mitigate negative environmental impacts
- Are typically exempt from residue tolerance
- Can typically be applied right up until harvest
- Typically have lowest allowable PHI and REI
- Provide effective resistance management tools
- Can improve fruit quality and packout
- Can help to manage labor costs





Biologicals 3.0 Biocontrol Trends

We are beginning to see adoption of biocontrols more prominently into US Row Crops.

- A few years ago, adoption was minimal and limited to a few bioinsecticide seed treaments
- Today, companies are adapting and learning from their successes in Brazil
- Conditions in Brazil are different continuous cropping, subtropical climate, different soils
- Still, biologicals now control 80% Brazil's bionematicide market – proving biologicals' efficacy beyond a doubt





Biologicals 3.0 Biocontrol Trends

Planter box treatments are making a big comeback.

- Breakdown of traits and resistance issues
- Delivery system innovations
- These applications give growers more control over what goes on their seed
- Planter box applications open the door for biologicals that may not have been viable as seed treatments
- A lot of focus and activity in this area

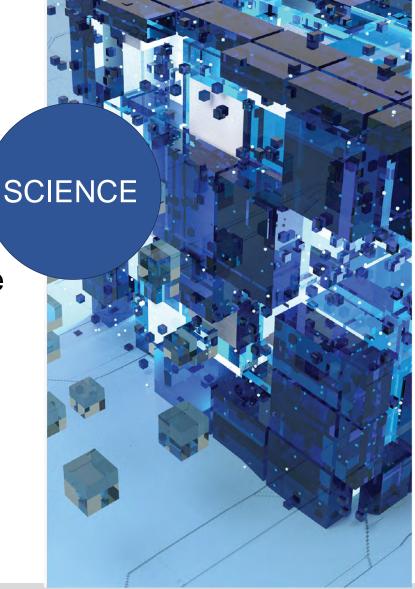




Biologicals 3.0 Biocontrol Trends

Synthetic biology and AI are combining to change the way we approach product development

- Intra-species gene editing is already in place and has demonstrated the ability to improve performance
- These products are looked upon favorably by regulators
- AI has the potential to allow us to custom design peptides with high efficacy and reduced COGs
- All is already speeding up the screening process dramatically, facilitating better and faster discovery





Biologicals 3.0 Clear Opportunities for the Channel

The science is better than ever

As a result, manufacturers' technical sales reps and advisors are more knowledgable and willing to promote biologicals than ever before

Biologicals are good for business, and expertise in biologicals can position a business for the future

Biologicals help growers customers meet the demands of their food retailer and food processors





Biologicals 3.0 Clear Opportunities for the Suppliers

Biologicals allow manufacturers to deliver sciencebased solutions that address unmet needs

Biologicals help manufacturers to differentiate

Biologicals help manufacturers build out their portfolios and better equip their sales team with expanded programs

Biologicals allow companies to position their brand and company as thought leaders





Providing its members with this presentation – you are biologicals ambassadors

Communications committee launching a new Science Taskforce

Communications committee launching a new Website Taskforce





Directory Distribution: Stakeholder Targets

Alabama Fruit & Vegetable Growers Association
Alabama Soybean and Corn Association
Alaska Farmer's Market Association
Alaska Pioneer Fruit Growers Association
American Horticultural Society
American Society of Agronomy
American Soybean Association
Arizona Cotton Growers Association
Arizona Leafy Greens Food Safety Committee
Arkansas Grape Growers Association
Arkansas Green Industry Association
Arkansas Pecan Growers Association
Arkansas Soybean Association
California Apple Commission
California Avocado Commission
California Certified Organic Farmers
California Citrus Nursery Board
California Cotton Ginners and Growers Association
California Fresh Fruit Association
California Strawberry Commission
California Sweet Potato Council

Oslifernia Terresta Oracusara Association
California Tomato Growers Association
California Winegrape Growers Association
Central Plains Organic Farmers Association
Colorado Corn Growers Association
Colorado Fruit & Vegetable Growers Association
Colorado Nursery & Greenhouse Association
Connecticut Apple Marketing Board
Connecticut Greenhouse Growers Association
Connecticut Vegetable and Fruit Growers Alliance
Delaware Center for Horticulture
Delaware Fruit & Vegetable Growers Association
Delaware Nursery & Landscape Association
Delaware Soybean Board
Eastern Region Soybean Board
Florida Citrus Research and Development Foundation
Florida Cotton Growers Association
Florida Fruit & Vegetable Association
Florida Nursery Growers And Landscape Association
Florida Peanut Producers Association
Florida Strawberry Growers Association
Georgia Cotton Commission

Georgia Fruit & Vegetable Growers Association	Iowa Soybean Association	US Senate – Virginia
Georgia Organics	Iowa Specialty Crop Growers Association	WestLink AG Group
Georgia Watermelon Association	Kansas Corn Growers Association	Valley Agronomics
Hawaii Coffee Association	Kansas Grain Sorghum Producers Association	K E Technologies LLC
Hawaii Tropical Fruit Growers Association	Kansas Soybean Association	Wilbur Ellis
Idaho Apple Commission	Kansas Vegetable Growers Association	GS Long
Idaho Grape Growers & Wine Producers Commission	Kansas Wheat Commission	Integrated Agribusiness Professionals
Idaho Potato Commission	Kentucky - Organic Association of Kentucky	
Idaho Wheat Commission	Kentucky Corn Growers Association	
Idaho-Oregon Fruit and Vegetable Association	Kentucky Soybean Association	
Illinois Corn Growers Association	Kentucky State Horticultural Society	
Illinois Soybean Association	Kentucky Vegetable Growers Association	
Illinois Specialty Growers Association	Louisiana Cotton Growers Association	
Illinois Wheat Association	Louisiana Organic Association	
Indiana Corn Growers Association	Louisiana Strawberry Marketing Board	
Indiana Nut and Fruit Growers Association	Maine Federation of Farmers' Markets	
Indiana Organic Grain Farmer Association	Maine Organic Farmers and Gardeners Association	
Indiana Vegetable Growers Association	Maine Pomological Society	
International Fresh Produce Association	Maryland Grape Growers Association	
Iowa Corn Growers Association	Maryland Organic Food and Farming Association	
Iowa Organic Association	Maryland State Horticultural Society	



Directory Distribution: Stakeholder Targets

New Hampshire Fruit Growers Association	North Carolina Cotton Growers Cooperative
New Hampshire Nursery and Landscape Association	North Carolina Cotton Producers Association
New Hampshire Vegetable and Berry Growers Assn	North Carolina Farm Stewardship Association
Northeast Organic Farming Association of NJ	North Carolina Growers Association
New Jersey - Vegetable Growers Association of NJ	North Carolina Soybean Producers Association
New Jersey Agricultural Society	North Carolina Strawberry Association
New Jersey State Horticultural Society	North Carolina Vegetable Growers Association
New Mexico Apple Growers Association	North Carolina Wine and Grape Council
New Mexico Chile Association	North Carolina Winegrower's Association
New Mexico Cotton Growers Association	North Dakota Corn Growers Association
New Mexico Farmers' Marketing Association	North Dakota Farmers Market and Growers Association
New Mexico Wine & Grape Growers Association	North Dakota Grain Growers Association
Northeast Organic Farming Association of NY	North Dakota Grape & Wine Association
New York Apple Association	North Dakota Potato Council
New York State Berry Growers Association	North Dakota Soybean Growers Association
New York State Horticultural Society	NorthEast Organic Farming Association
New York State Vegetable Growers Association	Northland Potato Growers Association
New York Wine and Grape Foundation	Ohio Ecological Food and Farm Association
North America Blueberry Council	Ohio Grape Industries Committee
North Carolina Apple Growers Association	Ohio Green Industry Association
North Carolina Blueberry Council	Ohio Produce Growers & Marketers Association



Directory Distribution: Stakeholder Targets

South Dakota Corn Growers Association
South Dakota Soybean Association
South Dakota Specialty Producers Association
South Dakota Wheat Growers Association
Southern Cotton Ginners Association
Southern Cotton Growers
Tennessee Farm Bureau Federation
Tennessee Organic Growers Association
Tennessee Soybean Association
Texas A&M AgriLife Extension - Horticulture Program
Texas International Produce Association
Texas Organic Farmers & Gardeners Association
Texas Pecan Growers Association
Texas- Plaines Cotton Producers
Texas Soybean Association
Texas Vegetable Association
Texas Wheat Producers Association
North American Raspberry & Blackberry Association
U.S. Apple Association
U.S. Wheat Associates
United States Sweet Potato Council

Northeast Organic Farming Association of Vermont	Alberta Fruit Growers Association
Vermont Tree Fruit Growers Association	British Columbia Blueberry Council
Virginia Association for Biological Farming	British Columbia Greenhouse Growers' Association
Virginia Soybean Association	British Columbia Vegetable Marketing Commission
Virginia State Horticultural Society	Canola Council of Canada
Virginia Vineyards Association	Manitoba Crop Alliance
Washington - Tilth Alliance	Manitoba Pulse & Soybean Growers
Washington State Fruit Commission	Ontario Fruit and Vegetable Growers' Association
Washington State Grape Society	Prairie Fruit Growers Association
Washington State Potato Commission	Prince Edward Island Potato Board
Washington State Tree Fruit Association	Quebec Association of Fruits and Vegetables
Washington State Wheat Commission	Quebec Farmers' Association
West Virginia Farmers Market Association	Saskatchewan Fruit Growers Association
Wisconsin Apple Growers Association	Western Grains Research Foundation
Wisconsin Berry & Vegetable Growers Associations	
Wisconsin Grape Growers Association	
Wisconsin Organic Farmers Association	
Wisconsin Potato & Vegetable Growers Association	
Wyoming Groundskeepers & Growers Association	
Wyoming Wheat Growers Association	

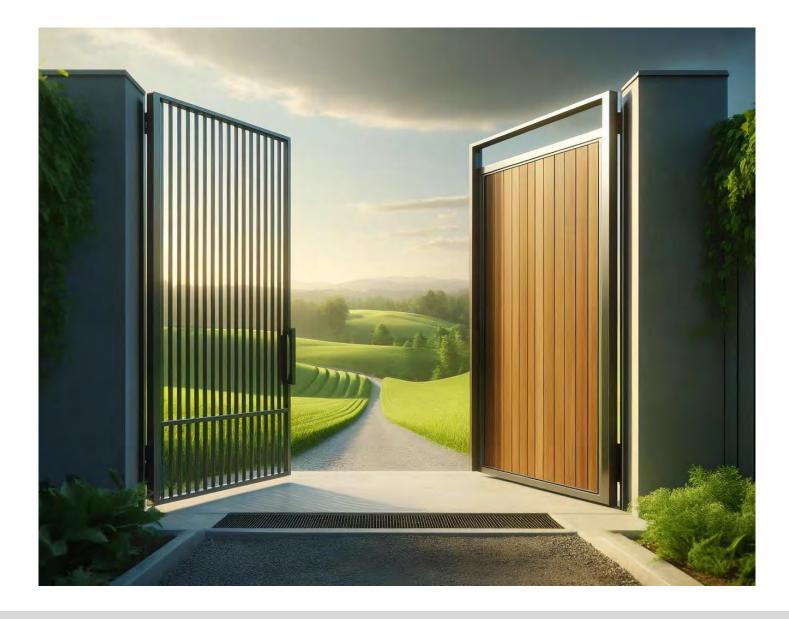
236 Domestic Stakeholder Groups

14 Canadian Stakeholder Groups

250 Total **Stakeholder** Groups



SCIENCE





Thank you for your kind attention.

rick@dunhamtrimmer.com

www.dunhamtrimmer.com