Innovation on plant biostimulants: Status and challenges

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EBIC is made up of 68 companies of all sizes

Breakdown by size (based on global turnover and headcount)

Micro Small Medium Large Very large

As of September 15, 2022

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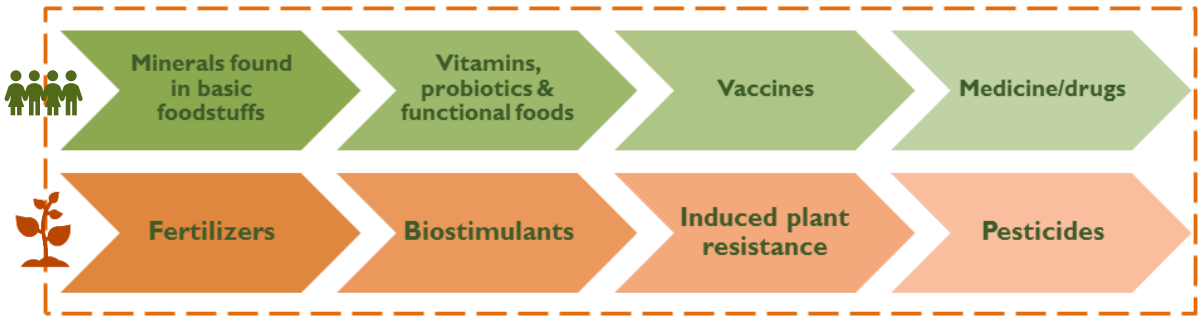
Plant biostimulants update the concepts of plant nutrition and plant health

an innovation in itself



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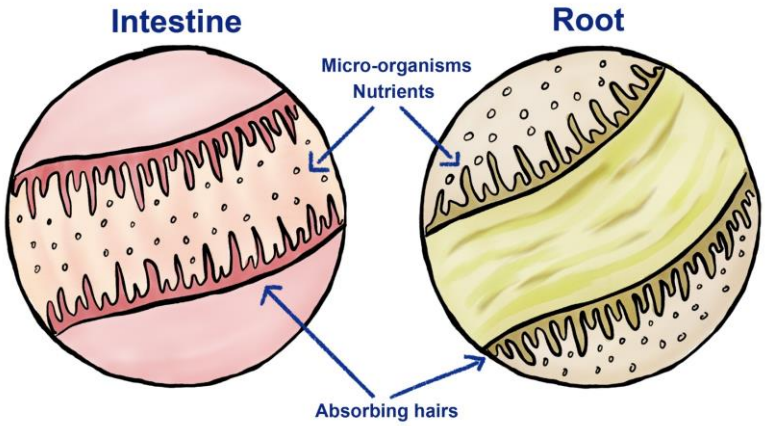
The root is an inside-out intestine

which means the root zone acts like the plant's stomach!



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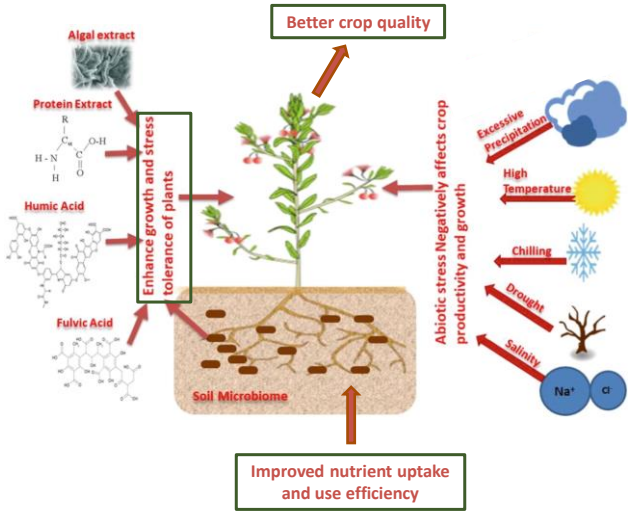
Plant biostimulants are defined by the functions they provide

Plant biostimulants act on natural processes in plants and their root zones to **enhance**:

1. nutrient uptake
2. nutrient use efficiency
3. tolerance to abiotic stress
4. crop quality

With benefits for plant vigor and yield



Source: Adapted from Pandey et al., 2022. https://doi.org/10.1007/978-981-16-7080-0_9

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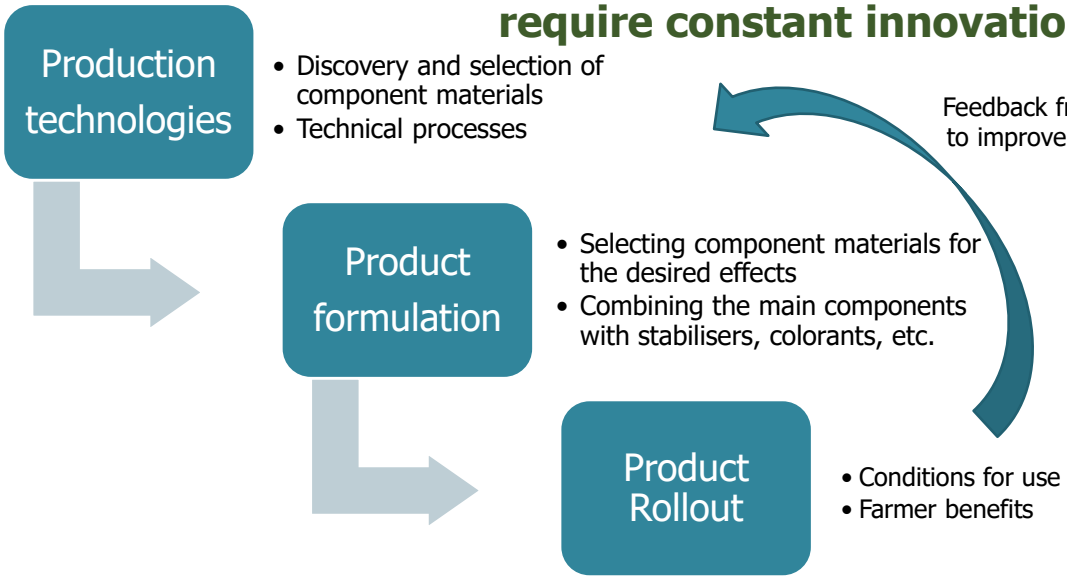
Bio-based products like biostimulants require constant innovation



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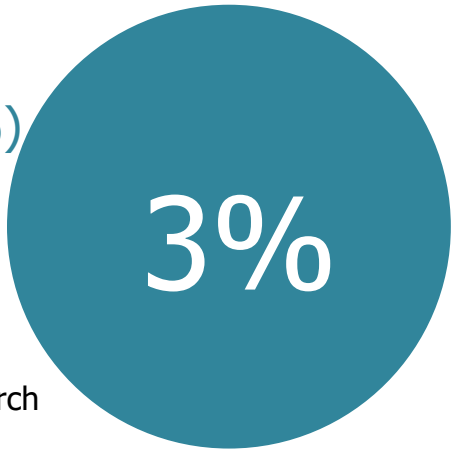
As a result the average reinvestment in R&D&I is relatively high in our sector

Plant biostimulants sector (3-10%)

Mineral fertilizers sector 0.05%



Percentage of annual turnover reinvested into research and development

Sources: EBIC "2011 Economic Overview of the Biostimulants Sector in Europe", USDA "Research Investments and Market Structure in the Food Processing, Agricultural Input, and Biofuel Industries Worldwide (20122), and IFA.

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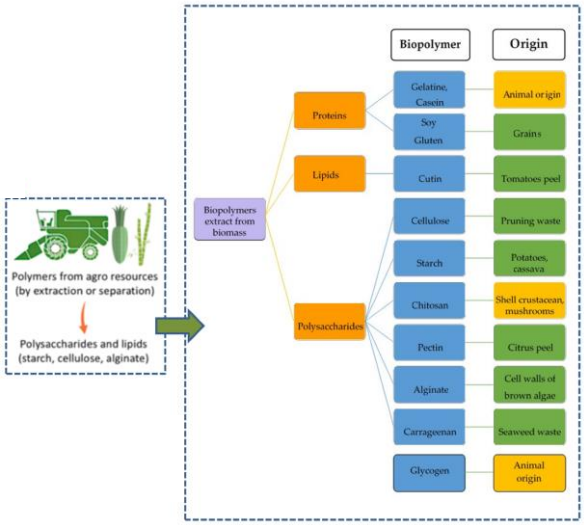
Discovery and selection of component materials

- **Screening** large numbers of **substances** and **microorganisms** for plant biostimulant potential requires increasingly sophisticated technologies and techniques and (often) partnerships
- **Secondary raw materials** require particular know-how related to recovery, refinement, and management of risks (e.g., impurities, contaminants) from the earlier value chain



Source: Adapted from Puglia et al., 2021. https://doi.org/10.3390/su13052710

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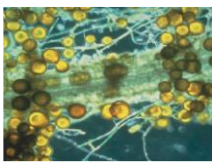
Harvest conditions and processing methods impact the quality and effect of bio-based component materials

- The **content of plant and seaweed extracts varies** according to timing of harvest, temperatures, stress experienced, etc.
- Plant and seaweed extracts are further influenced by the **processing methods** used.
- Processing methods are some of the most precious intellectual property of the biostimulants industry, and **process engineers are vital** players in determining competitive value.



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Formulation of plant biostimulants is both art and science

Idea / observation

Managing natural variability of raw materials through refinement, blending, etc.

Mixing the right recipe (pH, density, viscosity, etc.)

Assays, genomics, trials, etc. to test effectiveness and tweak instructions

High-quality products with reliable performance

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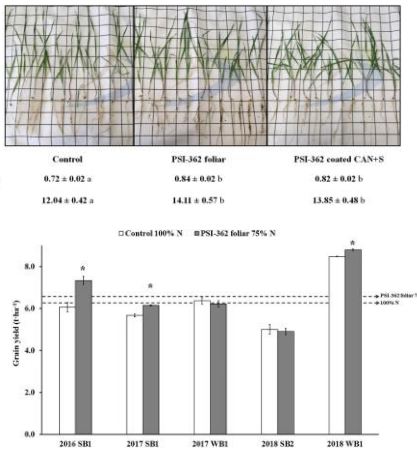
Conditions of use need to consider complex interactions between plant biostimulants and plants

- **Plant biostimulants act on plant metabolic pathways** that determine nutrient use, responses to abiotic stresses or crop quality.
- But **in the field**, plant biostimulants **will never be the only factor acting on these pathways**.
- Results obtained in the lab, where the environmental factors can be controlled may not necessarily translate into **effects under real-world conditions**.
- Therefore, research on plant biostimulants in coming years also needs to **incorporate the latest discoveries in plant science** to better understand these confounding factors.



Source: Goñi et al., 2021. https://doi.org/10.3389/fpls.2021.664682

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More research is needed to use plant biostimulants more effectively

Better understanding modes of action

Studying "negative" results

When the product doesn't work, why not? What can we learn?

Integrating biostimulants into other farmer practices

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More "mid-level research" is needed

Academics are studying **how substances and microorganisms interact with plants and their microbiome**, but much of this research is based on specific or theoretical cases that are hard to extrapolate.

At the moment, there is a **dearth of research looking at mid-level questions**:

Meta-analyses on the contribution of plant biostimulants to nutrient use efficiency, abiotic stress, and farmer return on investment.

We need **social science research** to look at the barriers and levers that affect farmer uptake of bio-based technologies like plant biostimulants.

Companies work on **specific products** from initial discovery through product development and incorporate feedback from real-world results

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So far, there is only one meta-analysis on plant biostimulant studies!

frontiers | Frontiers in Plant Science

SYSTEMATIC REVIEW
published: 14 April 2022
doi: 10.3389/fpls.2022.836702

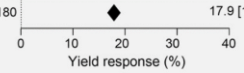
A Meta-Analysis of Biostimulant Yield Effectiveness in Field Trials

*Jing Li, Thijs Van Gerrewey and Danny Geelen**

HortiCell, Department of Plants and Crops, Faculty of Bioscience Engineering, Ghent University, Ghent, Belgium

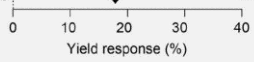
Percentage yield response to biostimulant application affected by application method

Application method	Comparisons	Studies	Estimate [95% CI]
Foliar	975	162	17.0 [16.0, 18.1]
Seed	32	10	17.6 [10.6, 24.6]
Soil	80	22	28.8 [24.1, 33.6]
All methods	1086	180	17.9 [16.7, 19.1]



Percentage yield response to biostimulant application affected by the biostimulant category

Biostimulant category	Comparisons	Studies	Estimate [95% CI]
Chi	88	13	14.8 [11.3, 18.3]
HFA	129	30	16.1 [12.7, 19.4]
PHs	230	47	16.5 [14.3, 18.7]
Si	27	11	16.1 [9.2, 23.0]
Phi	18	3	8.6 [4.6, 12.5]
SWE	449	82	17.1 [15.6, 18.6]
PE	146	32	26.6 [23.1, 30.1]
MLE	71	15	30.8 [26.1, 35.6]
Other PE	75	19	22.3 [17.2, 27.3]
All biostimulant	1087	180	17.9 [16.7, 19.1]



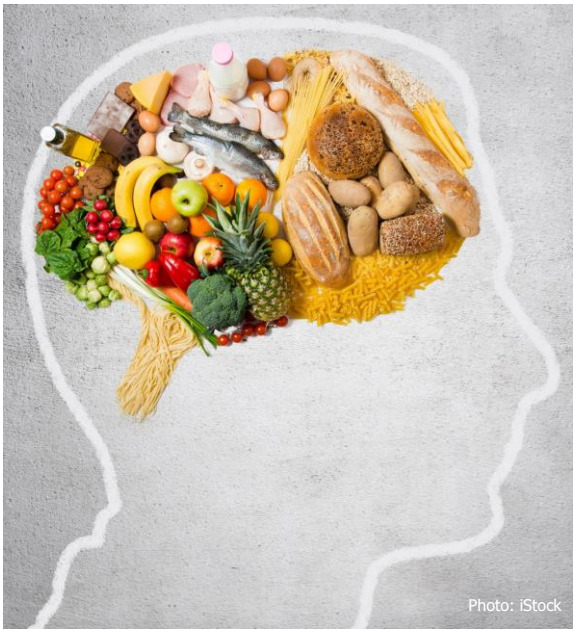
Biostimulants World Congress

Milan, Italy November 2023

- To promote the scientific underpinnings of plant biostimulants, EBIC is a partner of the Biostimulants World Congress
- Join us next year to learn the latest discoveries from plant biostimulant scientists around the world!

The 2021 Biostimulants World Congress in Florida

https://informaconnect.com/biostimulants-world-congress/



Plant biostimulants are an area of **extensive research and innovation**.

Our knowledge is growing quickly, but there are still vast areas that require study and exploration.

Policymakers should continue promoting and supporting research across the board, but also to be forward-looking and **make sure that innovators can have confidence that new technologies and products will have a viable path to market**.

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European Biostimulants Industry Council

Thank you!

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