Evaluating Microbial Biostimulants on Processing Tomato Production under Reduced Fertility

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Key Words

Microbe-containing biostimulants: who are they?

Reduced fertility: when do they work most effectively?

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Level of difficulty to distinguish

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Level of difficulty to distinguish

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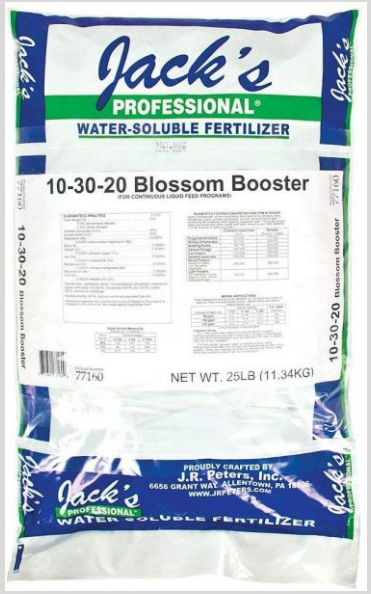
Growth stimulation: fertilizer



Pest suppression: insecticide

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BIO-STIMULANT **BIO-PESTICIDE**

BIO = uncertainties

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Crop Biostimulant 101

Biostimulant **is different from biopesticide or other biocontrol agents.**

Biostimulant has its own recipe in terms of abbreviations, acronyms, definition, etc.

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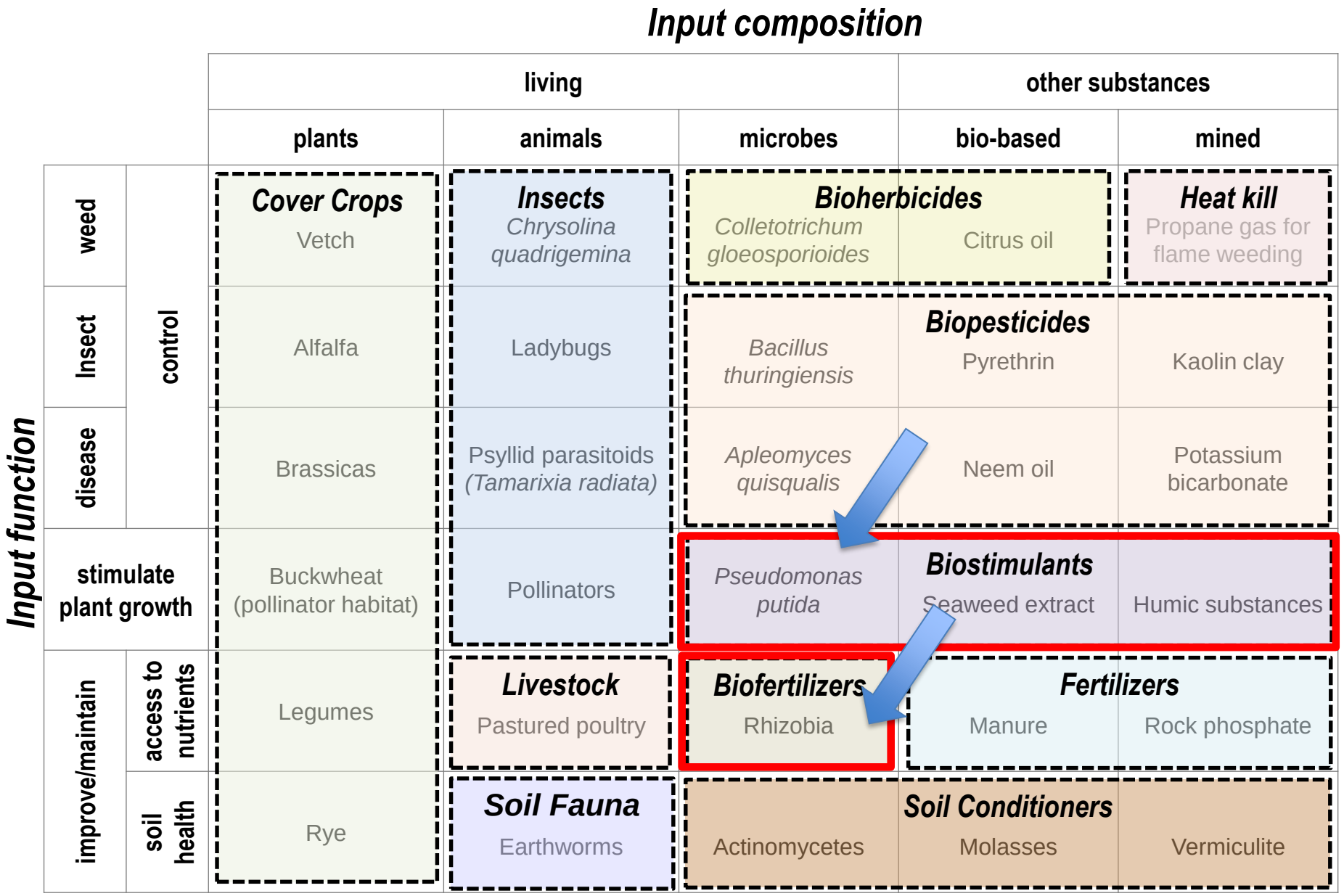

Chart of major input categories (dashed boxes) organized by function and composition. Examples of specific inputs are in gray, and inputs may fall into more than one category.

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Biostimulants

Microbial Biostimulants

- Bacteria
- Fungi
- Bacteria and Fungi

Other Biostimulants

Other biostimulants are broad in types and numerous.

How Biostimulants Work

- regulate plant growth
- enhance tolerance to abiotic stress (e.g., drought)
- improve nutrient acquisition (N, P, Fe)

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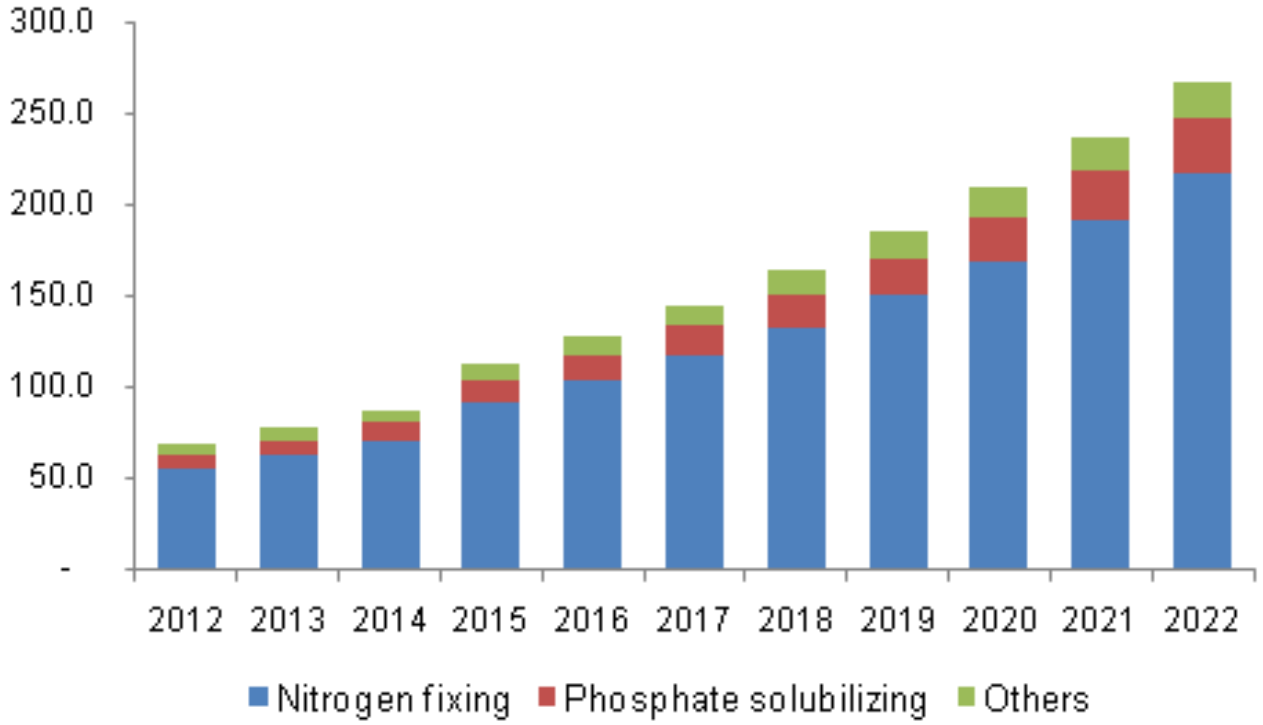
Crop Biostimulants



U.S. biostimulant market revenue by product, 2012-2022 (millions $).

Global biostimulant market worth 2.31 Billion USD by 2022 and 4.14 Billion by 2025.

Source: http://www.grandviewresearch.com/industry-analysis/biofertilizers-industry

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Why the Trials Are Conducted

We are not comparing/ranking products.

- Generate more science-based open-field data with regards to the product efficacy on growth enhancement.
- Fill the data/knowledge gap.

  We are at infant stage on the use of crop biostimulants: definition, categorization, selection, use, field evaluation, soil conditions, crop specificity, education…

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First Statutory Language Regarding Plant Biostimulant in the U.S. (2018 Farm Bill)

"a substance or micro-organism that, when applied to seeds, plants, or the rhizosphere, stimulates natural processes to enhance or benefit nutrient uptake, nutrient efficiency, tolerance to abiotic stress, or crop quality and yield".

Source: Biological Products Industry Alliance

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Trial with three representative biostimulants from two manufacturers:

Potential crop biostimulants to be included in the trial and their characteristics.			
Product name	**Product type**	**Components (genus)**	**Manufacturer**
MycoApply EndoMaxx	Mycorrhizal fungi	*Glomus*	Mycorrhizal Application, Inc.
MycoApply SolubleMaxx	Beneficial bacteria and mycorrhizal fungi	*Glomus*, *Gigaspora*, *Rhizopogon*, *Bacillus*, *Pseudomonas*	
Mycogenesis Soil Amendment	Beneficial bacteria and mycorrhizal fungi	*Azotobacter*, *Bacillus*, *Pseudomonas*, *Streptomyces*, *Glomus*	Tainio Biological, Inc.

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Products are selected based on 5 criteria:

- Commercialized: currently on the market
- A clear label and useful information: use instruction, active ingredient, and concentrations at minimal
- Labelled for tomato
- Allowed for use in California
- Applied via multiple ways

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Experimental design: Split-split plot design with 3 or 4 reps

- Main factor: three crop biostimulants plus a non-treated control.
- Sub-factor: three pre-plant P levels (standard rate [100%], 50% standard rate, and no P).
- Sub-sub factor: two pre-plant N levels (standard 20% fertility, and no pre-plant N).
- There will be a total of 72 or 96 plots (each plot is ≥ 50 ft long to ensure adequate plants for data collection).

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Field management and treatment application

- Border rows will be given to reduce cross-contamination.
- Soil test will tell the actual lbs of fertilizer needed for each treatment.
- Tomato plug trays will be soaked into microbial solutions before transplanting for an effective microbe-root contact and colonization.
- Re-application via drips and/or soil spray will be needed to strengthen the concentration following label instructions.
- Frequent and timely communications are to avoid any conflict against field activities and detrimental effects on the microbes.

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Data collection

Belowground portion	Aboveground portion
Routine soil nutrient analysis: Total N from organic matter, total inorganic P, and SOM	Plant tissue (leaf and petiole) total N and P, NDVI, Fruit yield, PTAB quality, and nutrient content (e.g., lycopene and ascorbic acid).
Soil microbial respiration	Plant and fruit nutrient use efficiency

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Project outcome

Already embarked

- Be more confident when selecting, using, and evaluating the crop biostimulants – less “go in blind” or “snake oil” impression.
- Reduce the guess work on when to use the crop biostimulants with best efficacy.

New passenger

- More people are willing to trial with biostimulants and reduce other chemical inputs - gain returns on investment.

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Project budget

UCANR	Responsibility/Purpose	% Time	Requested Funds
Personnel (salary)	A total of 280 hours for two student assistants $13.89/hour.	14	$3,889
Personnel (fringe)	They will receive a 6.4% composite benefit rate.	14	$249
Supplies and Equipment	Lab and field consumes for soil and plant sampling, treatment setup, and data collection.		$1,000
Sample Analysis	1. Soil nutrient analysis (12 samples at $19/each = $228). 2. End of project soil total N (72 samples at $16/each = $1,152). 3. Soluble P after treatment application (216 samples at $5.75/each = $1,242). 4. SOM after each treatment application (216 samples at $5.50/each = $1,188). 5. Microbial respiration (144 samples at $10/each = $1,440). 6. Plant tissue total N and P (72 samples at $24/each = $1,728). 7. Fruit quality ($150) and nutrient analysis ($150).		$7,278
Travel	Mileage from office to the field using personal vehicle.		$100
Other (specify)	Purchase of supportive materials.		$100
Total costs			$12,616

THANK YOU

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