

2019 Crop Biostimulant Evaluation Trials

2019 CA Tomato Conference

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Why the Trials Were 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...**

Crop Biostimulant 101

Biostimulant is different from biopesticide or other biocontrol agents.

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

Input composition

		living			other substances						
		plants	animals	microbes	bio-based	mined					
Input function	weed	Cover Crops Vetch	Insects <i>Chrysolina quadrigemina</i>	Bioherbicides <i>Colletotrichum gloeosporioides</i>	Citrus oil	Heat kill Propane gas for flame weeding					
	Insect						Alfalfa	Ladybugs	<i>Bacillus thuringiensis</i>	Biopesticides Pyrethrin	Kaolin clay
	disease						Brassicas	Psyllid parasitoids (<i>Tamarixia radiata</i>)	<i>Apleomyces quisqualis</i>	Neem oil	Potassium bicarbonate
	stimulate plant growth		Buckwheat (pollinator habitat)	Pollinators	<i>Pseudomonas putida</i>	Biostimulants Seaweed extract	Humic substances				
	improve/maintain	access to nutrients	Legumes	Livestock Pastured poultry	Biofertilizers Rhizobia	Fertilizers Manure Rock phosphate					
soil health		Rye	Soil Fauna Earthworms	Actinomycetes	Soil Conditioners Molasses	Vermiculite					

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.

Biostimulants

**Microbial
Biostimulants**

Bacteria

Fungi

**Bacteria
and Fungi**

**Other
Biostimulants**

How Biostimulants Work

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

Other
biostimulants are
broad in types
and numerous.

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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Two Types of Information of Crop Biostimulants



Number of scientific journal articles (controlled lab condition).



Number of reports growers can use (field condition, efficacy data).



**Growers
expecting
reliable
ROI**

**Scientific
data**

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Summer Trials (Two Trials)

For both trials:

- Location: Patterson
- Tomato Variety: DRI 319

Trial with Cytozyme:

- Products: PTG50 and PTG90 (coded product names requested by manufacturer) – substances promoting crop growth and fruit quality.
- Product delivery: foliar spray
- Application timing: Flowering (June 4, PTG50), Fruit set (July 1, PTG 50 and 90), Two weeks thereafter (July 18, PTG 90), and Fruit color change (August 2, PTG 50 and 90).
- Experiment: two treatments (with/without), 4 reps, 65 ft long per observation row, 2 rows per treatment, hand harvest on Sept. 5.

Summer Trials (Two Trials)

For both trials:

- Location: Patterson
- Tomato Variety: DRI 319

Trial with Bioworks:

- Products: RootShield Plus and ON-Gard – *Trichoderma* promoting root health and growth, and plant-derived nitrogen amendments.
- Product delivery: foliar spray and soil drench
- Application timing: Both products were applied at or after transplanting (April 22).
- Experiment: four treatments (RS+ON-G, RS, ON-G, and control), 4 reps, 40 ft long per treatment, hand harvest on Sept. 4.



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Field Soil Test

Texture: Copay Clay

				Basic Cations (mg kg ⁻¹)			
pH	Organic Matter	Cation Exchange Capacity	Olsen Phosphorus	Potassium	Magnesium	Calcium	Sodium
7.4	1.8%	20.6 meq/100g	24 mg kg ⁻¹	224	1008	2184	205

Routine Nutrient Analysis provided by A&L Western Labs (Modesto, CA)

Fruit yield (tons/acre) and aboveground biomass (lbs/plant) for the trial using Cytozyme products.

	Yield	BER	Aboveground biomass
Treated	52.3	0.64	4.09
Non-treated	49.1	0.52	3.86
P value	0.21	0.4	0.48
LSD_{0.05}	4.80	0.30	0.60

Fruit quality and NDVI for the trial using Cytozyme products.

	pH	Color	Brix	TA	NDVI			
					Overall	July 1	July 17	Aug 1
Treated	4.35	20.9	5.21	2.70	0.781	0.777	0.791	0.781
Non-treated	4.35	21.0	5.20	2.80	0.771	0.770	0.777	0.774
P value	0.93	0.62	0.92	0.64	0.03*	0.37	0.03*	0.25
LSD_{0.05}	0.03	0.27	0.27	0.28	0.009	0.016	0.012	0.014

Fruit yield (tons/acre) and aboveground biomass (lbs/plant) for the trial using Bioworks products.

	Yield	BER	Aboveground biomass
RS/On-G	49.0	0.83	3.69
RS	54.8	0.77	3.66
On-G	47.3	0.78	3.27
Control	49.0	0.81	3.59
P value	0.43	0.98	0.81
LSD _{0.05}	10.78	0.38	1.08

Fruit quality and NDVI for the trial using Bioworks products.

	pH	Color	Brix	TA	NDVI			
					Overall	June 13	July 17	August 1
RS/On-G	4.29	20.50	5.43	2.93	0.826 A	0.830 A	0.837 A	0.811 A
RS	4.33	21.13	5.13	2.75	0.832 A	0.844 A	0.842 A	0.812 A
On-G	4.32	20.88	5.40	2.88	0.829 A	0.833 A	0.840 A	0.815 A
Control	4.28	20.88	5.50	3.08	0.809 B	0.779 B	0.835 A	0.812 A
P value	0.05	0.04	0.04	0.04	0.0098*	0.0034*	0.5029	0.9266
LSD _{0.05}	0.05	0.53	0.312	0.30	0.013	0.029	0.009	0.015

- 1. Minimal yield enhancement**
- 2. Presence of a stress**
- 3. Vegetative vs. reproductive growth promotion**
- 4. Impacts on quality?**

THANK YOU

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