Ag BioTech™
INCORPORATED

Biostimulants and Biologicals: A Natural Synergy

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BIO Seed

VITAZYM

an All Natural Conc

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Presentation Outline

- Plant hormones and crosstalk
- Main actives in Vitazyme
- Biofertilizers in general
- Bio Seed actives
- Our symbiotic Cycle
- Results in California

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The Common Players

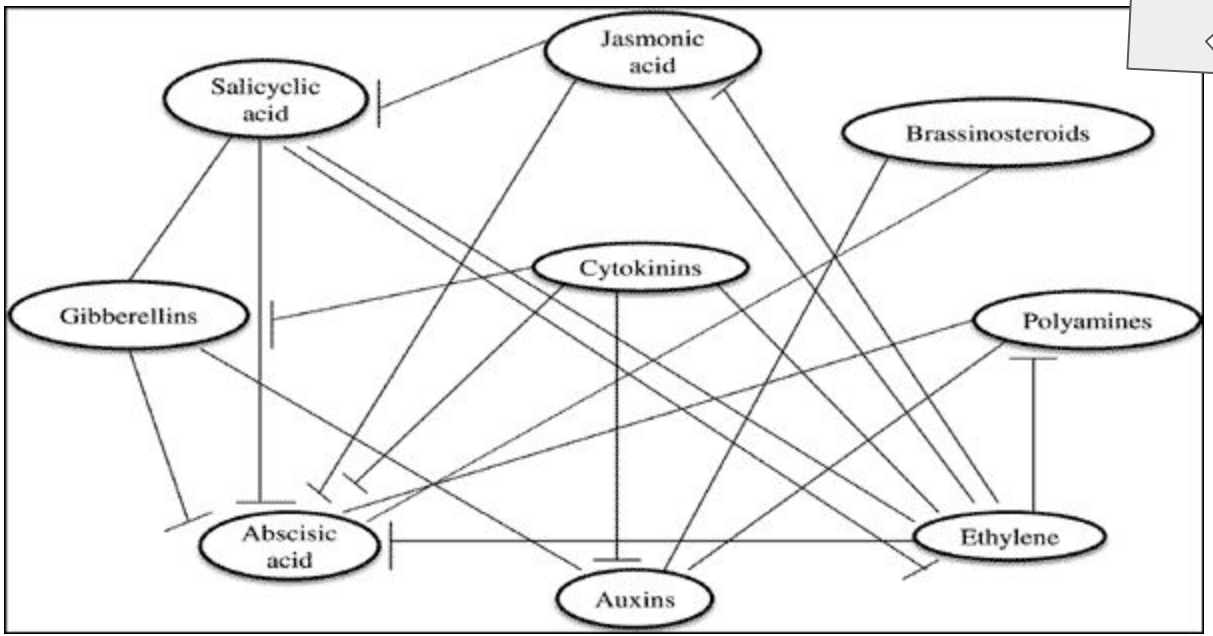

Photo credit: Ohri, P., Bhardwaj, R., Bali, S., Kaur, R., Jasrotia, S., Khajuria, A., & Parihar, R. (2015). The Common Molecular Players in Plant Hormone Crosstalk and Signaling. *Current Protein & Peptide Science, 16*(5), 369-388. doi:10.2174/1389203716666150330141922

Functions governed by BRs

- Increased chloroplast development
- Promote cell expansion and division in shoots
- Root growth in low concentrations
- Pollen tube elongation+growth
- Seed germination
- Cell elongation when **acting with auxins**

No evidence for long distance transport, however, follow-up applications will **compound** the effects

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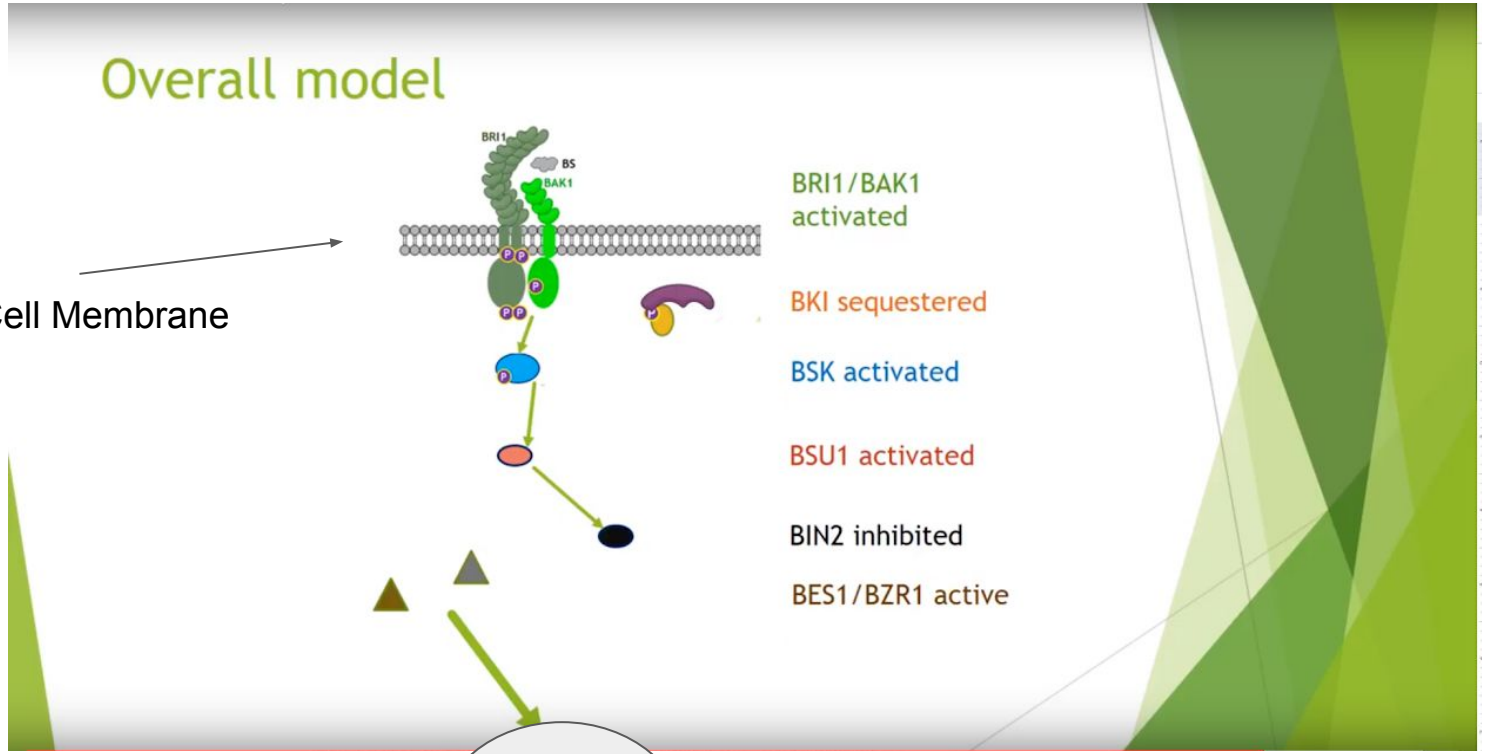
Brassinosteroid signaling



Courtesy of Thomas Gate:
https://www.youtube.com/watch?v=0KFvZimh36A

Key proteins table

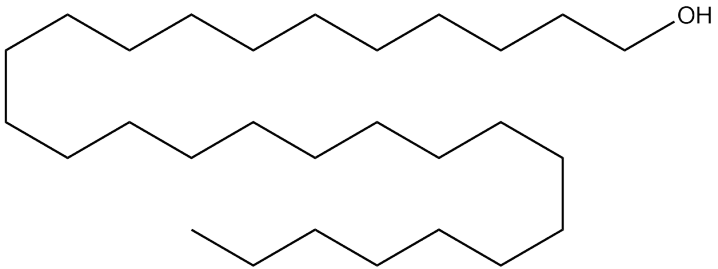
Process	Abbreviation	Full name
Biosynthesis	CPD DWF4	Cytochrome P450 monooxygenase CYP90A1 Steroid 22-alpha-hydroxylase
Inactivation	BAS1 SOB7	Degenerately functioning Cytochrome P450s
Receptors	BRI1 BAK1	Brassinosteroid Insensitive 1 BRI1 associated kinase
Signalling Circuitry	BKI BSK BSU1 BIN2	BRI1 kinase inhibitor S/T protein kinase S/T protein phosphatase Shaggy-related protein kinase
Transcription Factors	BES1 BZR1	BRASSINAZOLE-RESISTANT 2 BRASSINAZOLE-RESISTANT 1

BRI1 → BKI → BES1 and BZR1 → nucleus→ chloroplast development genes (GLK1/2) → **Increases sensitivity to more brassinosteroids**

Courtesy of Thomas Gate:
https://www.youtube.com/watch?v=0KFvZimh36A

Triacontanol: The Other Workhorse

- Fatty alcohol found in cuticle waxes and beeswax
- Mobile growth stimulant
- Not concentration sensitive
- Known for drought stress relief, enhancement of photosynthesis
- Increase of carbohydrate metabolism enzymes, L(+)-adenosine



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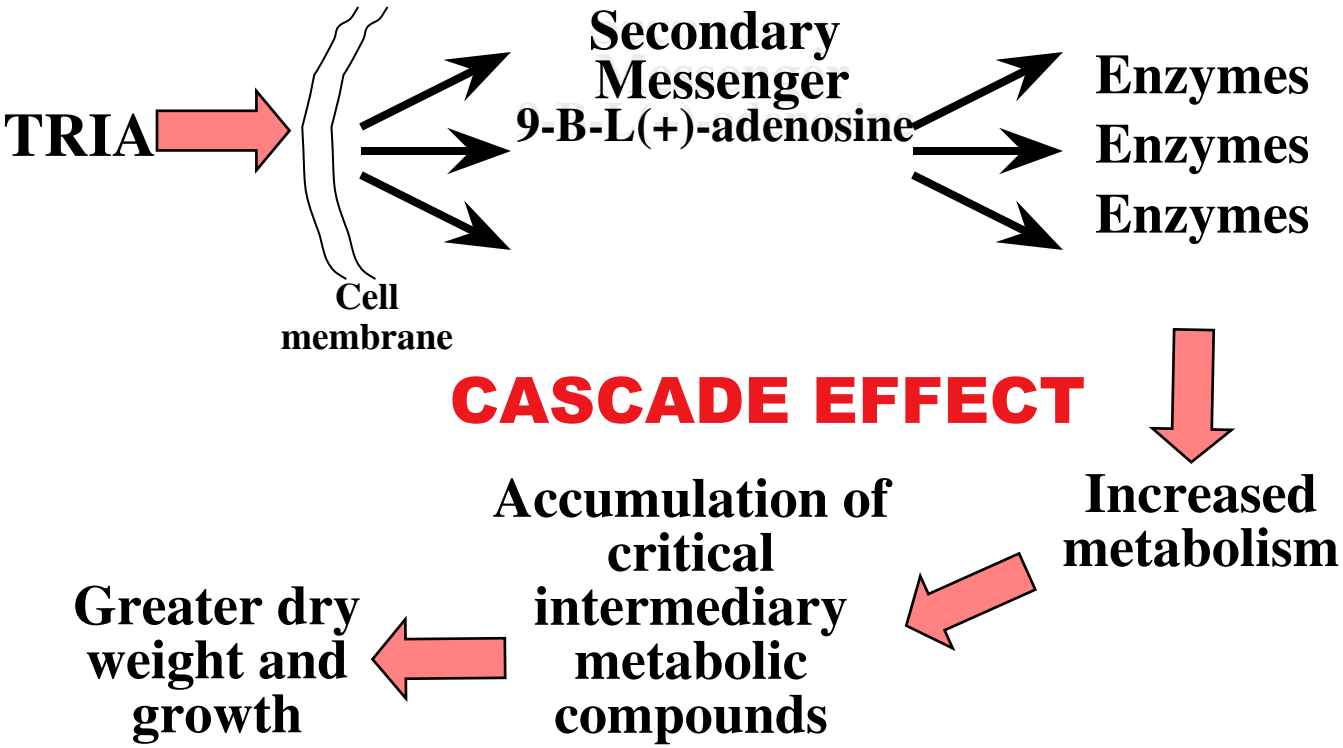
Triacontanol Mode of Action



Plant response to Triacontanol

- Increased rate of CO2 fixation
- Increase in specific activity of RuBisCO and phosphoenolpyruvate carboxylase
- Increased activity of key respiratory enzyme malate dehydrogenase
- Net increase in CO2 uptake
- Increased carbohydrate and amino acid production

(Savithiry et al. 1992 Savithiry, S, Wert, V and Ries, S. 1992. Influence of 9-β-L(+)- adenosine on malate dehydrogenase activity in rice. *Physiol Plant*, 84: 460–466).

Ries and Houtz (1983 Ries, S and Houtz, R. 1983. Triacontanol as a plant growth regulator. *Hort Sci*, 18: 654–662.)

Houtz RL, Ries SK, Tolbert NE 1985a . Effect of triacontanol on *Chlamydomonas* I. Stimulation of growth and photosynthetic CO2 assimilation . *Plant Physiol* 79 : 357 – 364 .;

Ivanov, AG and Angelov, MN. 1997. Photosynthesis response to triacontanol correlates with increased dynamics of mesophyll protoplast and chloroplast membranes. *Plant Growth Regul*, 21: 145–152.

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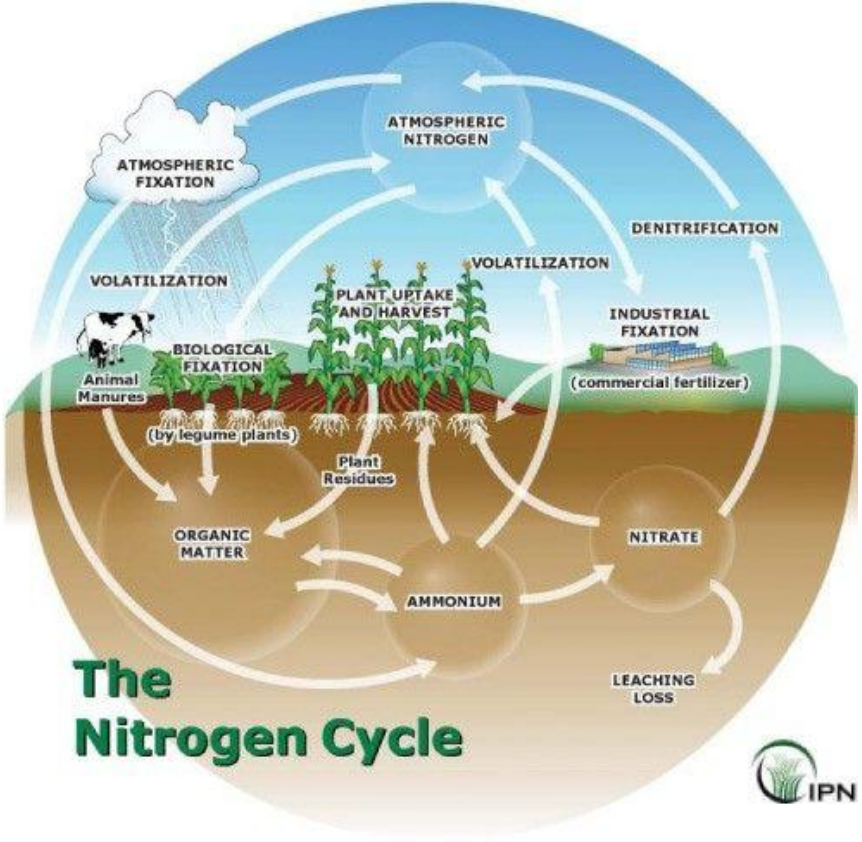
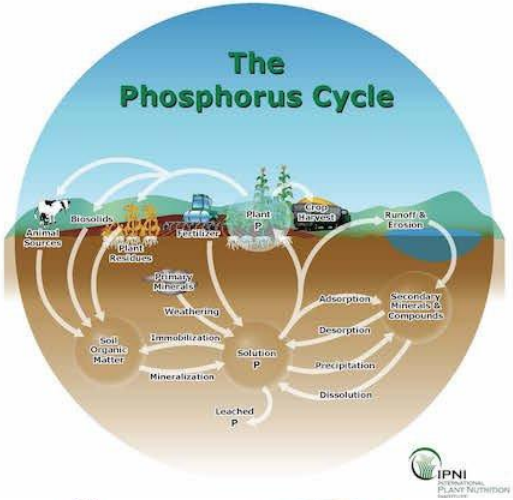
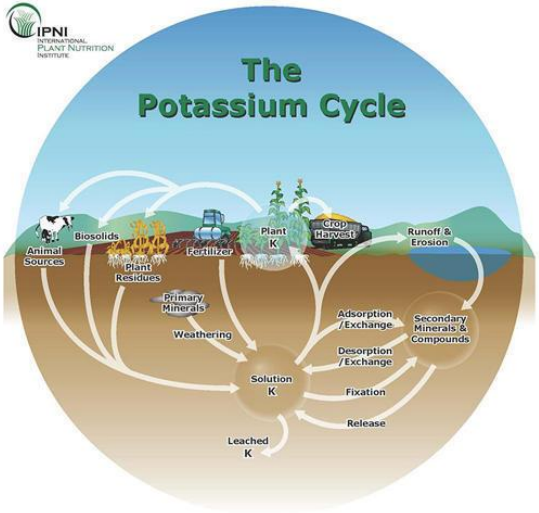
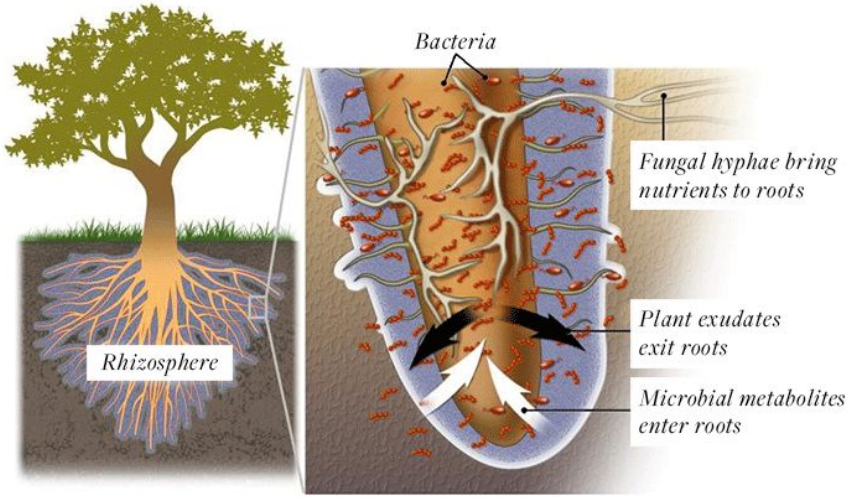
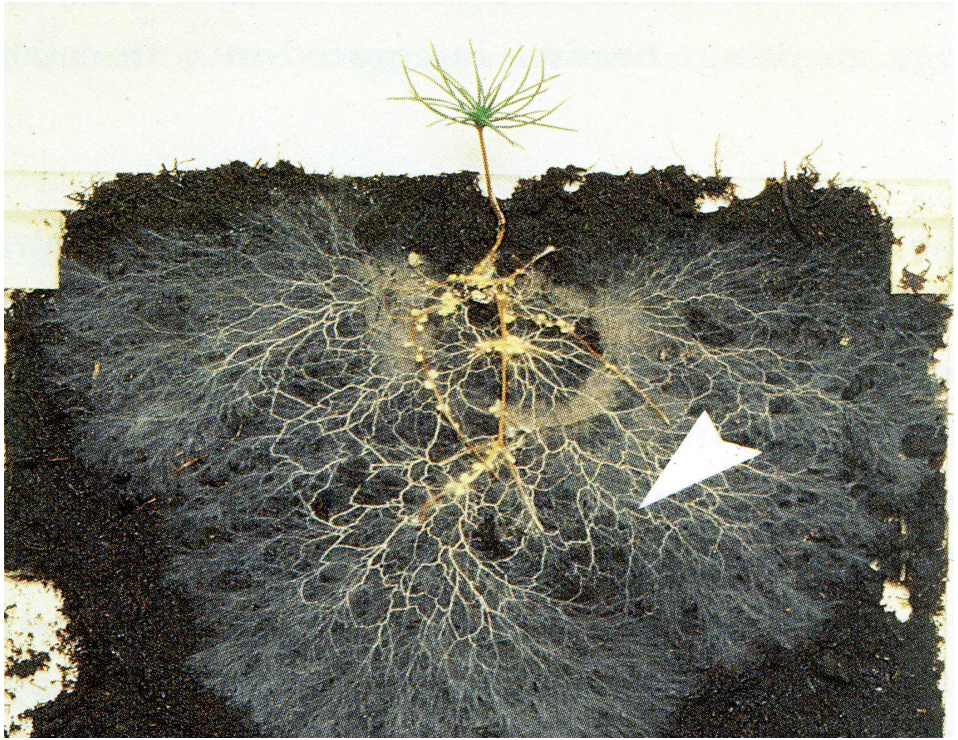

ATMOSPHERIC NITROGEN
ATMOSPHERIC FIXATION
DENITRIFICATION
VOLATILIZATION
VOLATILIZATION
PLANT UPTAKE AND HARVEST
INDUSTRIAL FIXATION
(commercial fertilizer)
BIOLOGICAL FIXATION
Animal Manures
(by legume plants)
Plant Residues
ORGANIC MATTER
NITRATE
AMMONIUM
LEACHING LOSS
The Nitrogen Cycle
IPN


The Phosphorus Cycle
Animal Sources
Biosolids
Plant Residues
Fertilizer
Plant P
Crop Harvest
Runoff & Erosion
Primary Minerals
Weathering
Adsorption
Desorption
Secondary Minerals & Compounds
Soil Organic Matter
Immobilization
Solution P
Precipitation
Mineralization
Dissolution
Leached P
IPNI
INTERNATIONAL PLANT NUTRITION INSTITUTE


IPNI
INTERNATIONAL PLANT NUTRITION INSTITUTE
The Potassium Cycle
Animal Sources
Biosolids
Plant Residues
Fertilizer
Plant K
Crop Harvest
Runoff & Erosion
Primary Minerals
Weathering
Adsorption /Exchange
Secondary Minerals & Compounds
Desorption /Exchange
Solution K
Fixation
Release
Leached K





Courtesy of Nautilus, march 31, 2016

Actives

Guaranteed analysis:

- Paenibacillus azotofixans..... 1x10^6 CFU/g
- Bacillus megaterium ..... 1x10^6 CFU/g
- Bacillus mucilaginosus..... 1x10^6 CFU/g
- Bacillus subtilis ..... 1x10^6 CFU/g
- Trichoderma harzianum ..... 1x10^6 CFU/g

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Known Benefits

- Conversion of unavailable forms of N P and K into plant available forms in the soil solution
- Balancing of the C:N ratios in the soil
- Improving seedling vigor + Leaf area index
- Non-crop specific inoculate
- Facultative, Gram-positive strains - 1 yr stability
- **Rhizosphere - competent**

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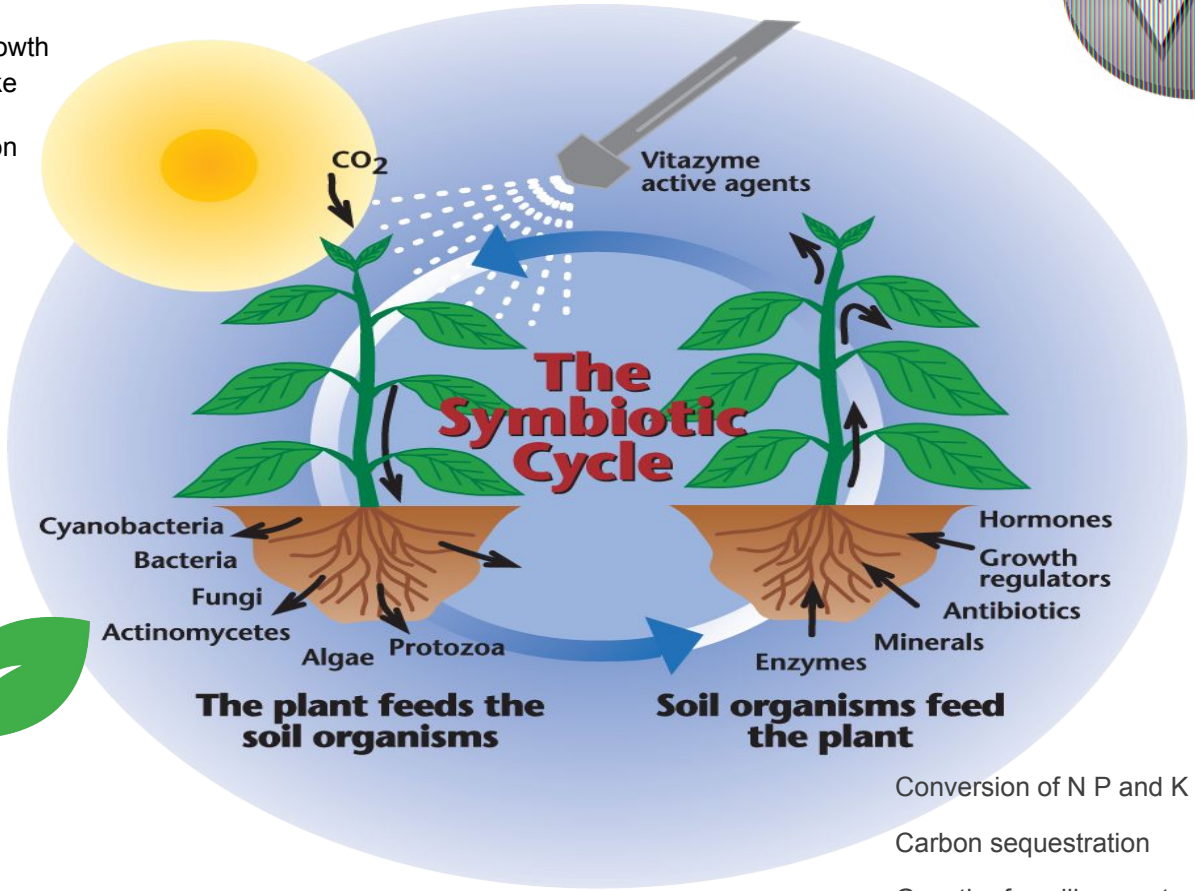
Grower’s standard | Grower’s standard + PGH | Bio Seed 0.1% seed weight | Bio Seed 0.2% of seed weight

Tomatoes, day 19
Salinas, CA 2019

Increased chloroplast development
Cell expansion and division in shoots
Root growth
Pollen tube elongation+growth
Net increase in CO2 uptake
Increased carbohydrate
and amino acid production



Conversion of N P and K into plant available forms

Carbon sequestration

Growth of auxiliary root network

2018 Strawberry Results

Holden Research and Consulting, Oxnard, CA

- July 16 planting date
- 18 pickings Oct 2nd - Dec 5th
- 50 g/ac Bio Seed + 16 oz/ac Vitazyme in drench
- 5 Foliar Vitazyme applications (every 3 weeks)
- Treated and control blocks received NPK applications
- Program cost: $65.60

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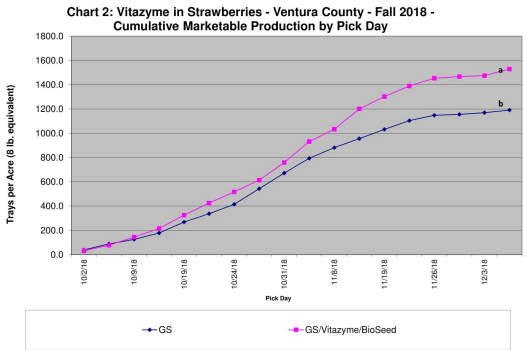
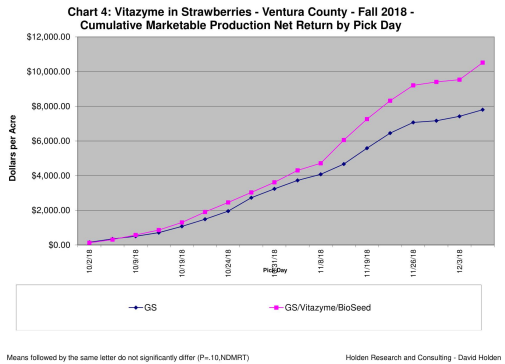
Results

Programs	Total marketable 8lb trays/acre	Total Net returns/acre	% Marketable berries	Net profit/acre
Grower's standard	1191 b	$7800	62.0 b	----
Bio Seed + Vitazyme	1529 a	$10,516	66.1 a	$2650
	+ 338	+ $2716	+ 4.1	



Means followed by the same letter do not significantly differ (P=.10,NDMRT)

Holden Research and Consulting - David Holden



Means followed by the same letter do not significantly differ (P=.10,NDMRT)

Holden Research and Consulting - David Holden

2018 Cabbage Results

Holden Research and Consulting, Oxnard, CA

- Oct 11 planting date
- Harvested Jan 4, 2019
- 400 lbs 6-24-24, followed by AN 20/ CAN 17
- 50 g/acre Bio Seed + 16oz/acre Vitazyme in drench at planting
- Foliar sprays of Vitazyme at 18 and 47 DAP

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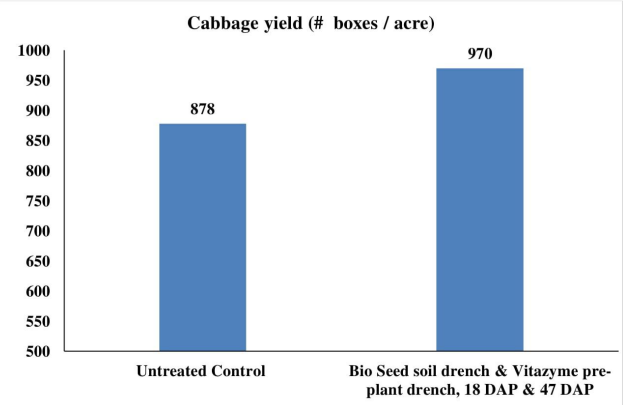
Results

Programs	Marketable head weight (g/head)	# 50 lb Boxes/acre	Tons/acre	Added Income	Net Profit
Grower's Standard	784.2 b	878 b	21.95		
Bio Seed + Vitazyme	886.3 a	970 a	24.25	$2252	**$2208**
	+ 102.1 g	+ 92	+ 2.3		



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Improving Agriculture From the Ground Up®

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