PhycoTerra®
POWERED BY HELIAE AGRICULTURE

Link to Video

GLOBAL AGRICULTURE TODAY

- **Increased need for sustainable farming practices**
- Biological products are a viable strategy against **higher ground costs**
- **Dirty water run-off** costs growers money & positive perception
- **Water is becoming a scarce resource**
- **Organic food consumption** is impacting both organic & conventional growing strategy
- Early harvests make or break a grower's ability to **capture early labor crews & higher dollar early markets**
- **More crop weight** is a critical value point in competitive markets
- Biological products are an important part of the **solution for growers** vs common crop stressors
- Biological products are **projected at 12.9 billion globally by 2022**

HOW IT ALL BEGAN

A family passion for global sustainability + *ASU's strong knowledge of algae* = heliae

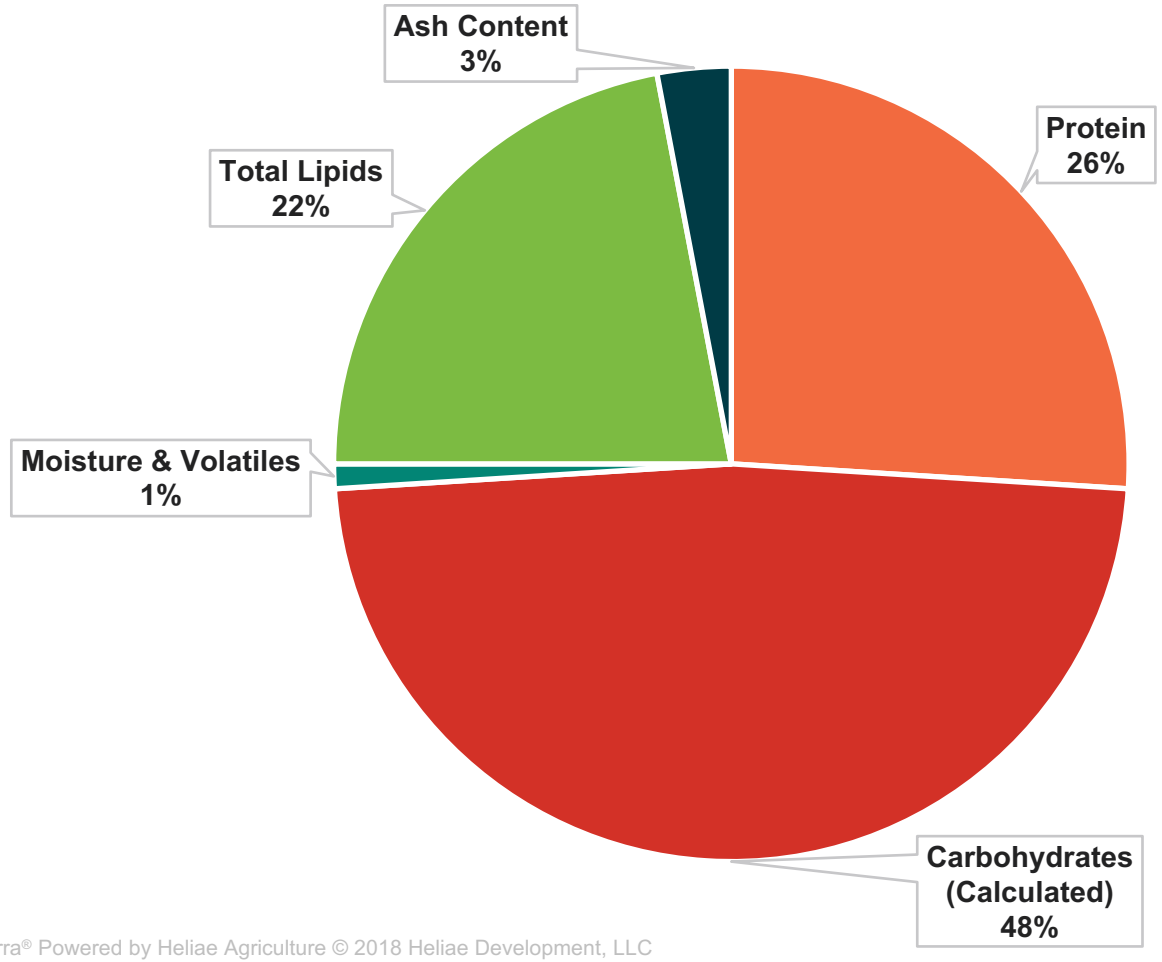
- **A desire to create sustainable solutions using microalgae innovation**.
- **Methodical testing, learning & results** by hundreds of scientists, PhDs & dedicated associates through the years.
- **Microalgae delivering superior results** vs macroalgae and being the more sustainable option.
- **More than 80(14 issued) patents** that have led Heliae down the path focusing on agriculture.
- **Non-wavering devotion** of a passionate family and other select investors.
- **Global demand** for agricultural products that are clean, natural, and proven to perform both conventionally and organically.

PRODUCTS

PhycoTerra
ORGANIC
PhycoTerra
ORGANIC
PhycoTerra
SOIL AMENDMENT
PhycoTerra
ORGANIC
PhycoTerra
ORGANIC

PRODUCT BREAKDOWN

AVERAGE MICROALGAE COMPOSITION



MACRONUTRIENTS N-P-K *(% of Sample)*	
Nitrogen (N)	≥ 0.30
Phosphorus (P)	≥ 0.30
Potassium (K)	≥ 0.10
MICRONUTRIENTS	
Calcium	0.01-0.10%
Iron	10 – 100 ppm
Magnesium	0.0075-0.035%
Manganese	1-10 ppm
Zinc	1-10 ppm
Chloride	40 – 200 ppm
Sodium	0.01-0.1%
Sulfur	0.01-0.1%
Boron	0.2-2 ppm

COMMON APPLICATIONS

- GROUND PREP
- ROOT DIP and DRENCHING
- IN-LINE DRIP APPLICATION
- OVERHEAD IRRIGATION OR DIRECT SPRAY AFTER SEEDING
- FURROW APPLIED or SHANKED INTO THE SEED FURROW
- SIDE-DRESSED / BANDED
- FOLIAR

PhycoTerra®

KEY VALUE PROPOSITIONS

WE DELIVER

- Cleaner Water Run-Off
- Stress Tolerance & Canopy Growth
- Increased Yield
- Increased Water Use Efficiency
- Reduced Soil Erosion
- Increased Soil Carbon & Nitrogen
- Fruit Shelf Life
- Microbiome Enhancement & Root Health

POINTS OF DIFFERENCE

- Whole Cell Product
- CA Leafy Green Req.
- Batch Tested
- Multiple Soils & Crops
- Vertically Integrated
- Healthy Soil
- Pasteurized & Ecosystem Safe

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SUSTAINABILITY STRATEGY

A PLAN THAT FOCUSES ON DOING WHAT'S RIGHT, NOT JUST DOING BETTER, MEANS…

- Healthy Soil
- Healthy Plants
- Healthy People
- Healthy Planet

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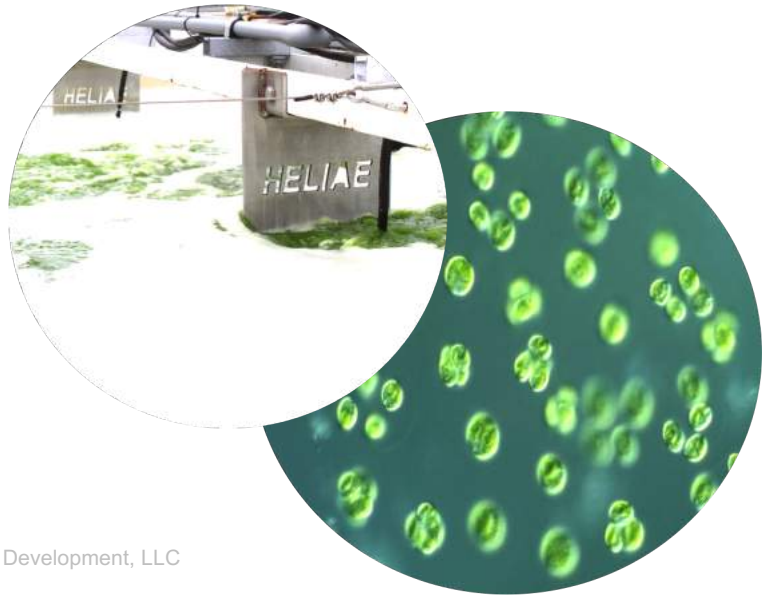
MICRO vs MACRO

MICROALGAL SUSTAINABILITY

Single Cell Algae

- Proprietary technology for less variability
- Controlled agriculture
- Small footprint using non arable land
- Ecosystem-safe



WHAT IS MACROALGAE?

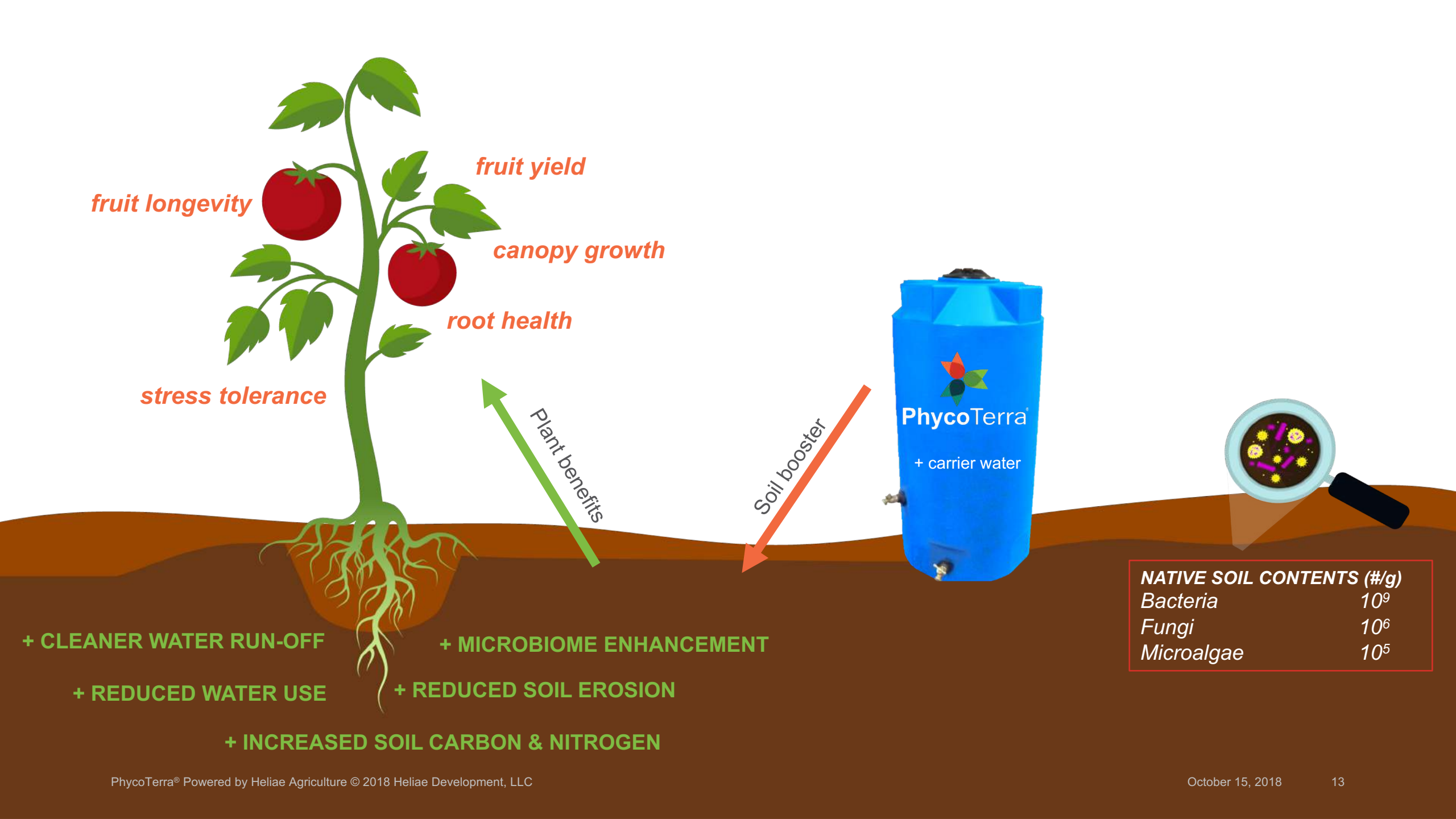
Seaweed/Kelp

WHY IS OUR MICROALGAE BETTER?

- Grown to **satisfy a personalized solution or need.**
- Best **sustainable** algae product option.
- **Our scientists and agronomists collaborated directly with growers** to bring you PhycoTerra®.
- Vertically integrated production facility with **vast expansion capabilities already in place.**
- Demonstrated **vivid benefits in a variety of crops**, regions, and soils.
- **Every batch is tested for efficacy and safety on crops.**
- **The whole cell, pasteurized difference.**

PhycoTerra®

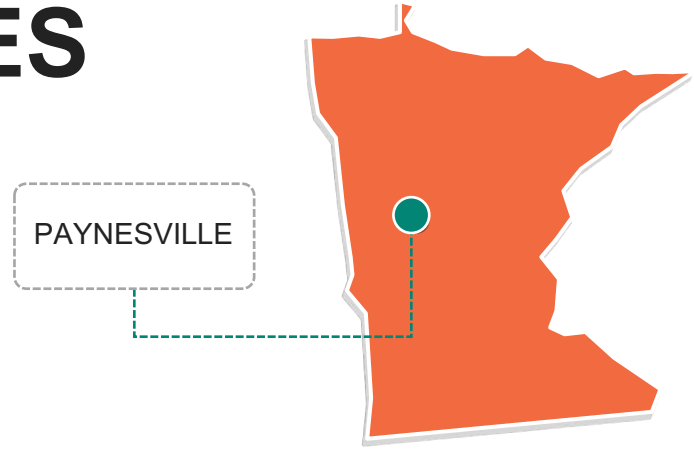
ADVANCING THE FUTURE OF ALGAE

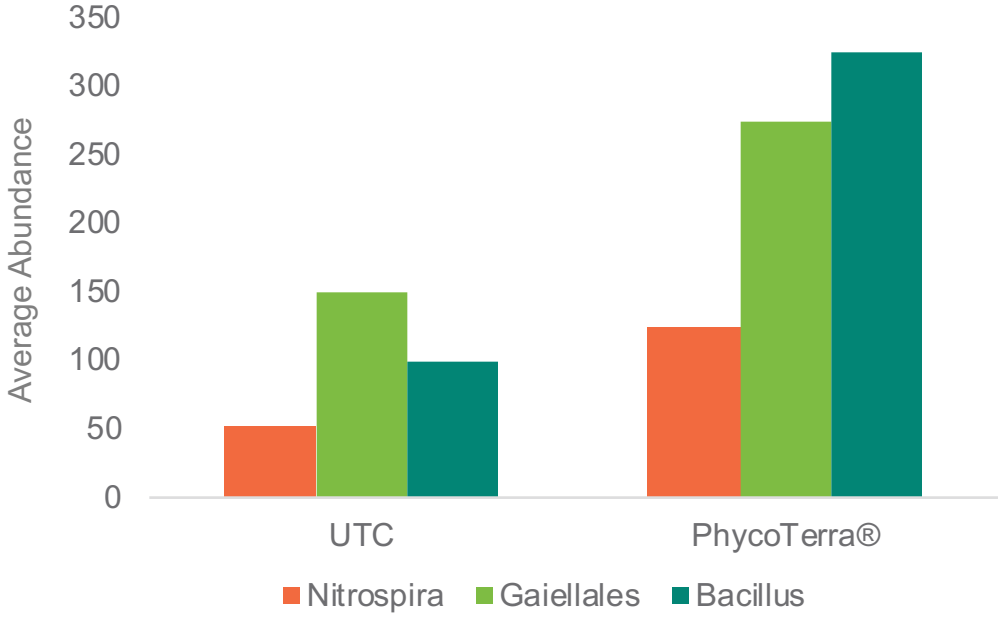

fruit yield
fruit longevity
canopy growth
root health
stress tolerance
Plant benefits
Soil booster
PhycoTerra
+ carrier water
+ CLEANER WATER RUN-OFF
+ MICROBIOME ENHANCEMENT
+ REDUCED WATER USE
+ REDUCED SOIL EROSION
+ INCREASED SOIL CARBON & NITROGEN
NATIVE SOIL CONTENTS (#/g)
Bacteria 10^9
Fungi 10^6
Microalgae 10^5

Our products…

STIMULATE SOIL MICROBIOMES

Paynesville, MN (Sweet Corn, Snap Peas & Snap Beans) Estherville Sandy Loam

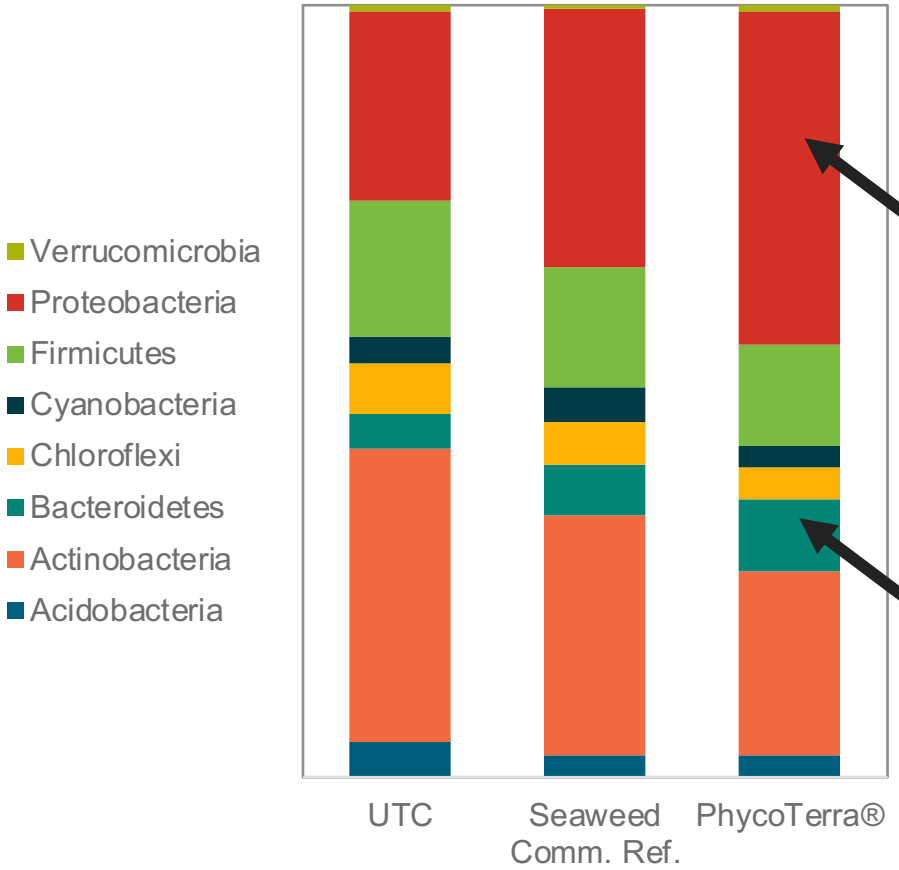




Significant Increases in ***beneficial*** Soil Bacteria

ENRICHED SOIL MICROBIOME

Tifton, GA - Peanut



AVG 14.6% more Proteobacteria - <u>Burkholderia</u> (Proteobacteria) 5 fold increase over UTC, noted PGPR (Poupin et al 2013, PlosOne)

AVG 5% more Bacteroidetes - <u>Sphingobacterium</u> (Bacteroidetes) 6.5 fold increase over UTC, noted PGPR (Marques et al. 2010 Soil Biol. Biochem.)

SOIL HEALTH IMPROVEMENT

Texas
Houston Black
Clay

Louisiana
Frost
Silt Loam

Alabama
Heidel
Sandy Loam

Arkansas
Calloway
Silt Loam

Arizona
Tuba-Tyende
Sandy Loam

South Carolina
Williman
Loamy Fine
Sand

North Carolina
Cecil
Sandy Loam

Tennessee
Dickson
Silt Loam

Kentucky
Hammack-Baxter
Silty Clay Loam

Mississippi
Dundee
Loam

Georgia
Alapaha
Loamy Sand

Oklahoma
Renfrow
Loam

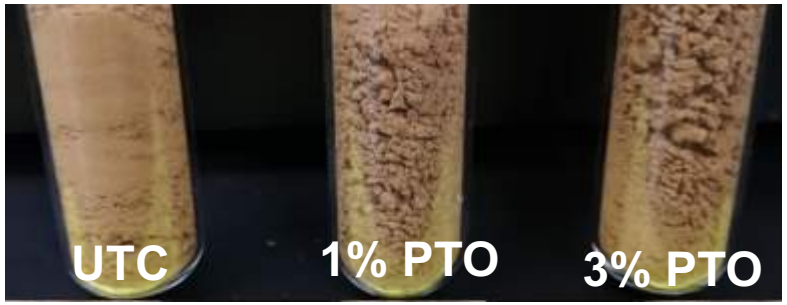
New Mexico
Mespun
Loamy Fine
Sand

Florida
Hurricane
Fine Sand

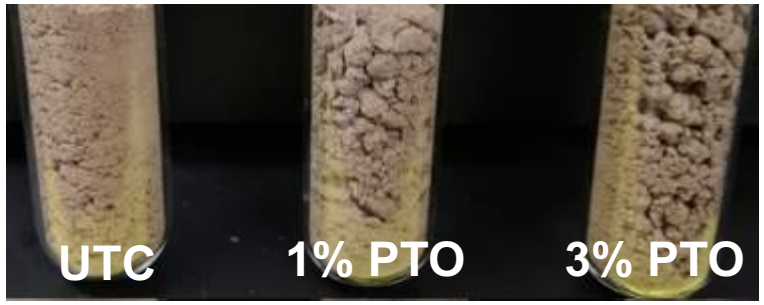
Soil Aggregation Increase with PhycoTerra® Organic

Pictures taken 40 Days after 1st application of 3 total applications

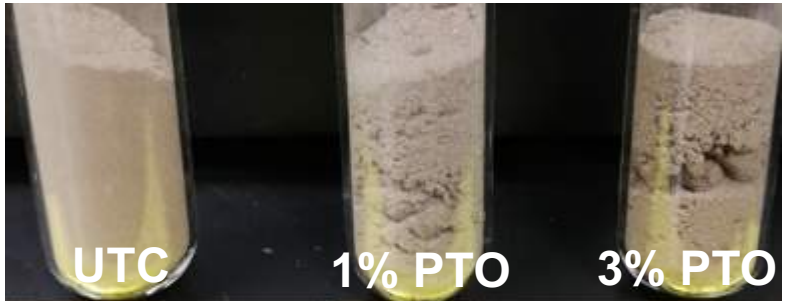
KY Hammack-baxter Silty Clay Loam



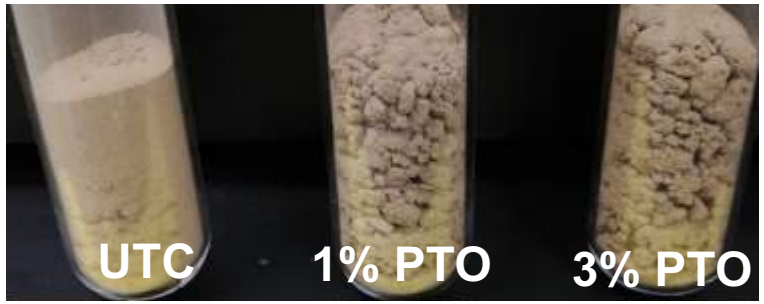
MS Dundee Loam



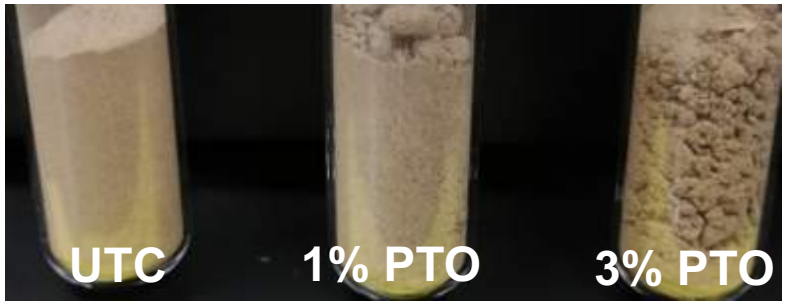
SC Williman Loamy Fine Sand



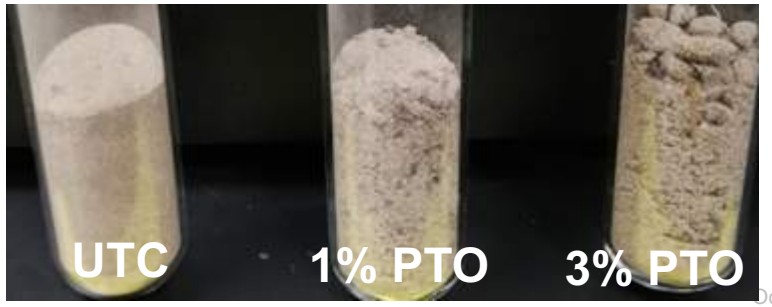
AL Heidel Sandy Loam



GA Alapaha Loamy Sand



FL Hurricane Fine Sand



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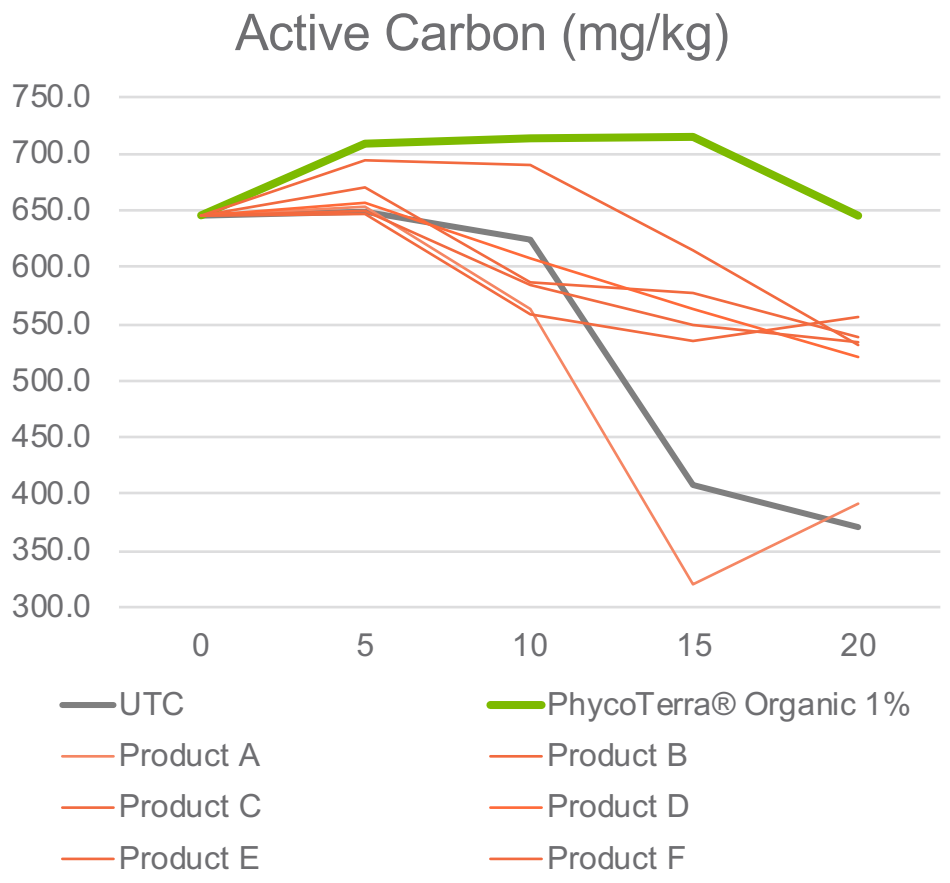
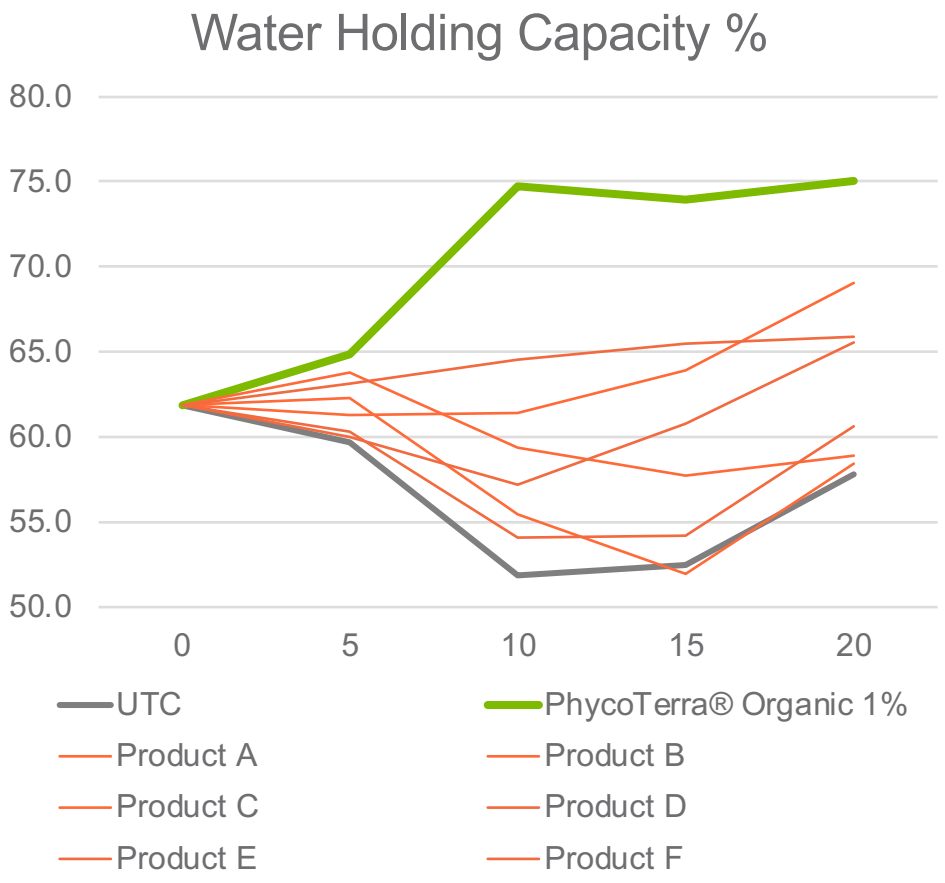
Product Comparison at Label Rate

Greenhouse: Significant increase in soil health compared to products with similar soil health claims



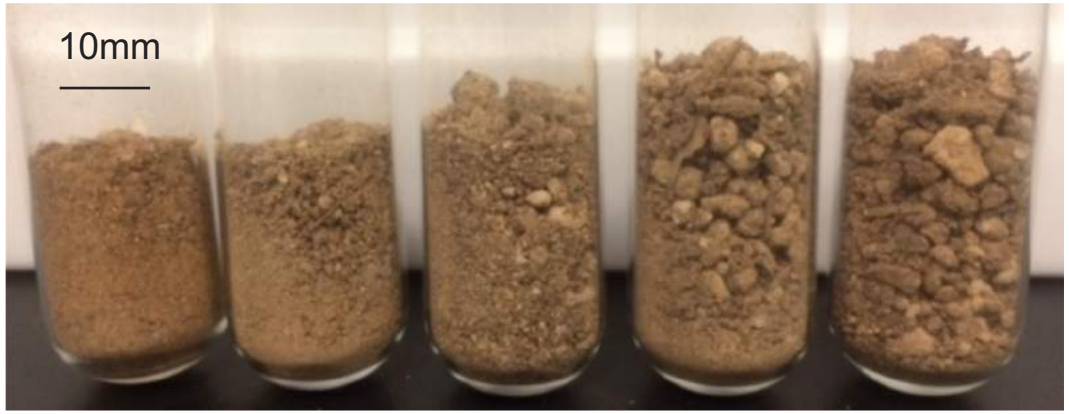


Our products prove…

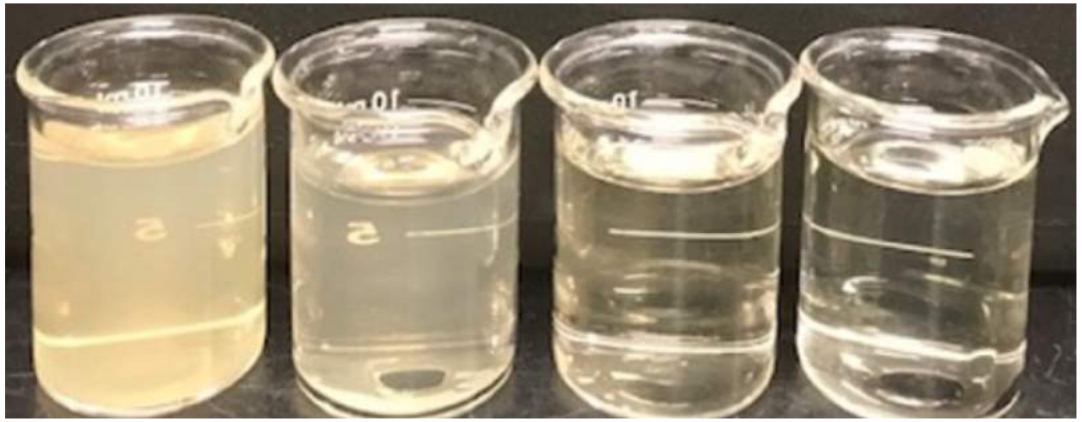
SOIL STRUCTURE & WATER QUALITY

POSITIVE RESULTS

- Increased aggregation and soil structure, after 1st application
- 6 times less soil particle run-off
- Total dissolved solids reduced from “brackish” to EPA “drinking water” standards
- Increased water retention in soil



INITIAL | UTC – WATER ONLY | SEAWEED CONTROL 0.3% | PHYCOTERRA® 0.3% | PHYCOTERRA® 3%



FERTILIZER ONLY | SEAWEED CONTROL 1% | PHYCOTERRA® 1% | PHYCOTERRA® ORGANIC 1%

Our products prove…

WATER RETENTION

POSITIVE RESULTS

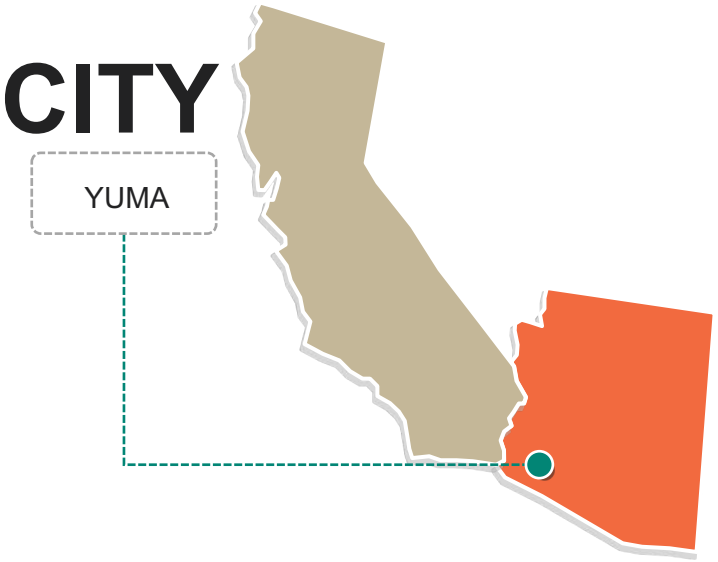
In a specific farm trial, 1mL reduction in height equates roughly to the capacity of the soil to hold onto 24,000 more gallons of water per acre.

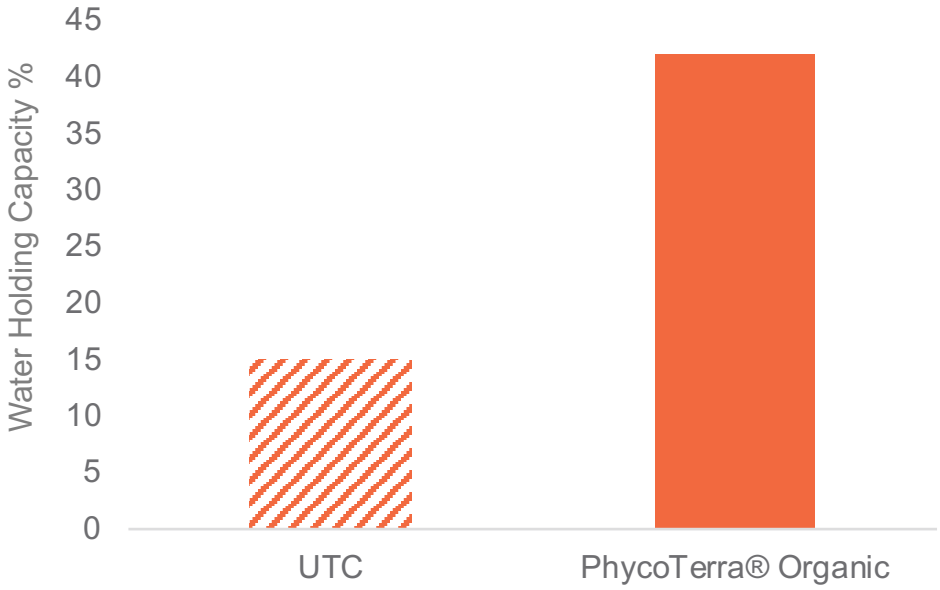
Fertilizer Only | Seaweed Control 1% | PhycoTerra® ORGANIC 1%

Our products prove…

SOIL WATER HOLDING CAPACITY

Yuma, AZ (Bell Pepper) Indio Silt Loam

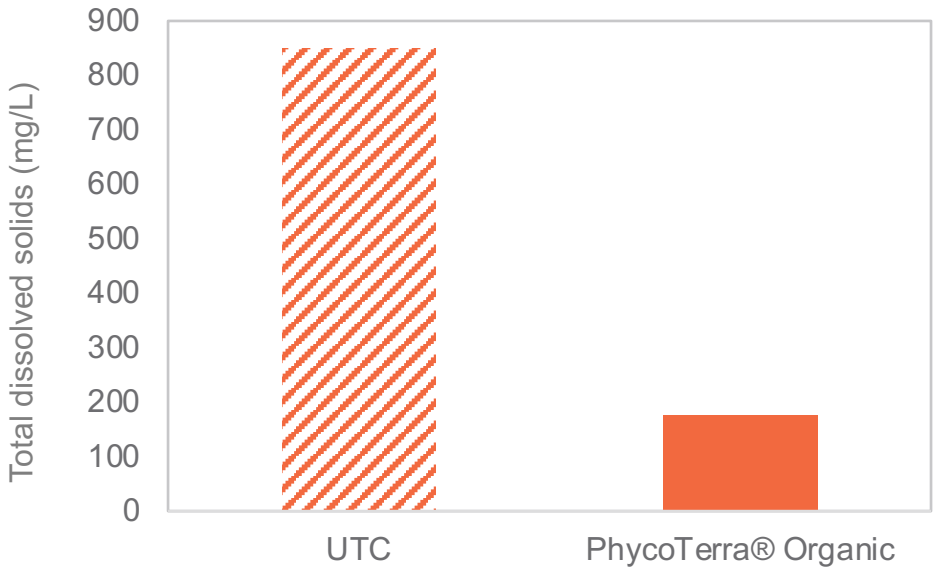




Our products prove…

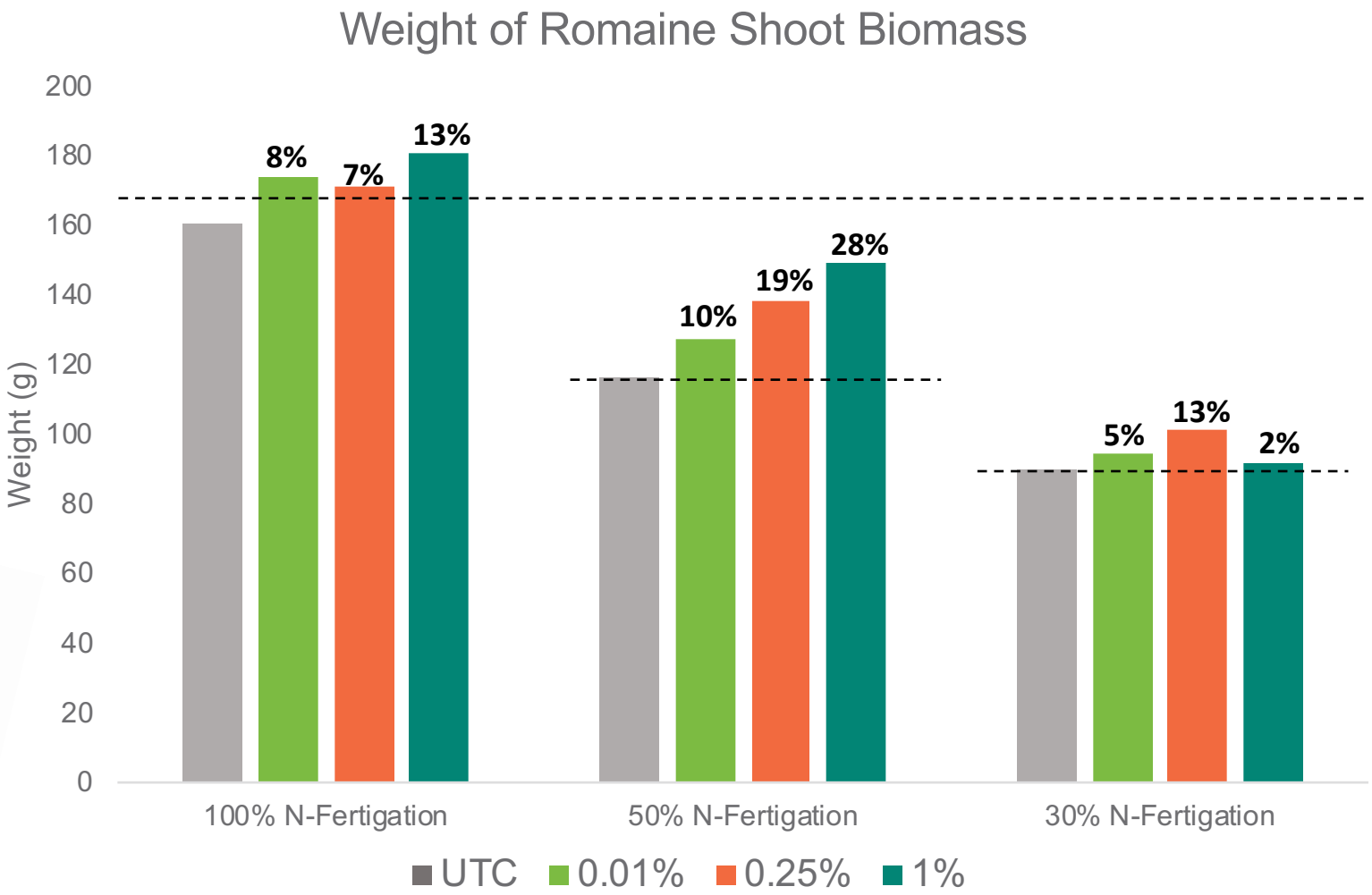
DISSOLVED SOLIDS - RUN-OFF

Oxnard, CA (Strawberry) Cropley Clay



NITROGEN REDUCTION CAPABILITY

PhycoTerra® improved harvest weight despite nitrogen deficiency



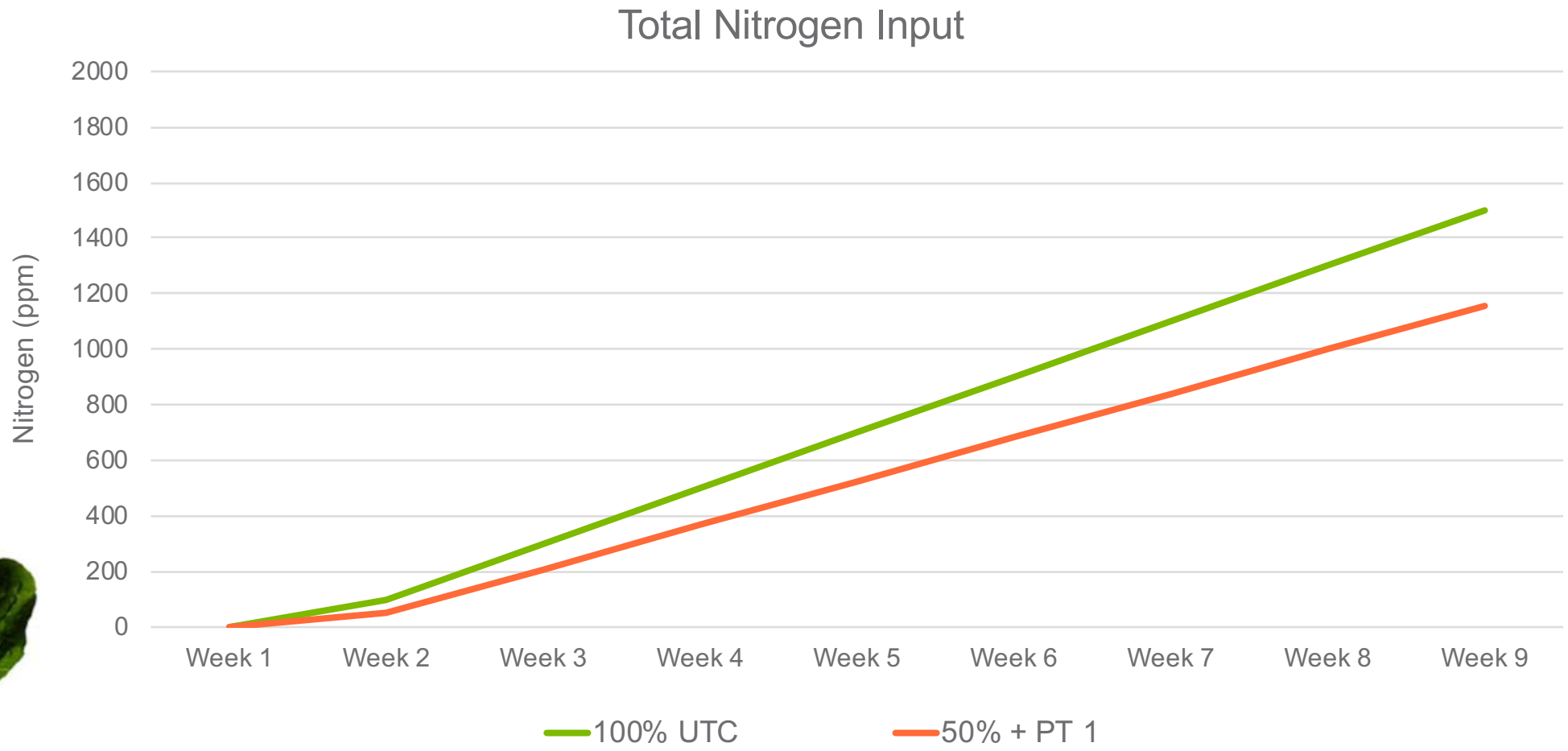
100% N
UTC

50% N
PhycoTerra® 1%

- *Harvested 65 days after seeding.*
- *First two weeks received corresponding fertilizer.*
- *Week 3 PhycoTerra® application until harvest (7 times).*

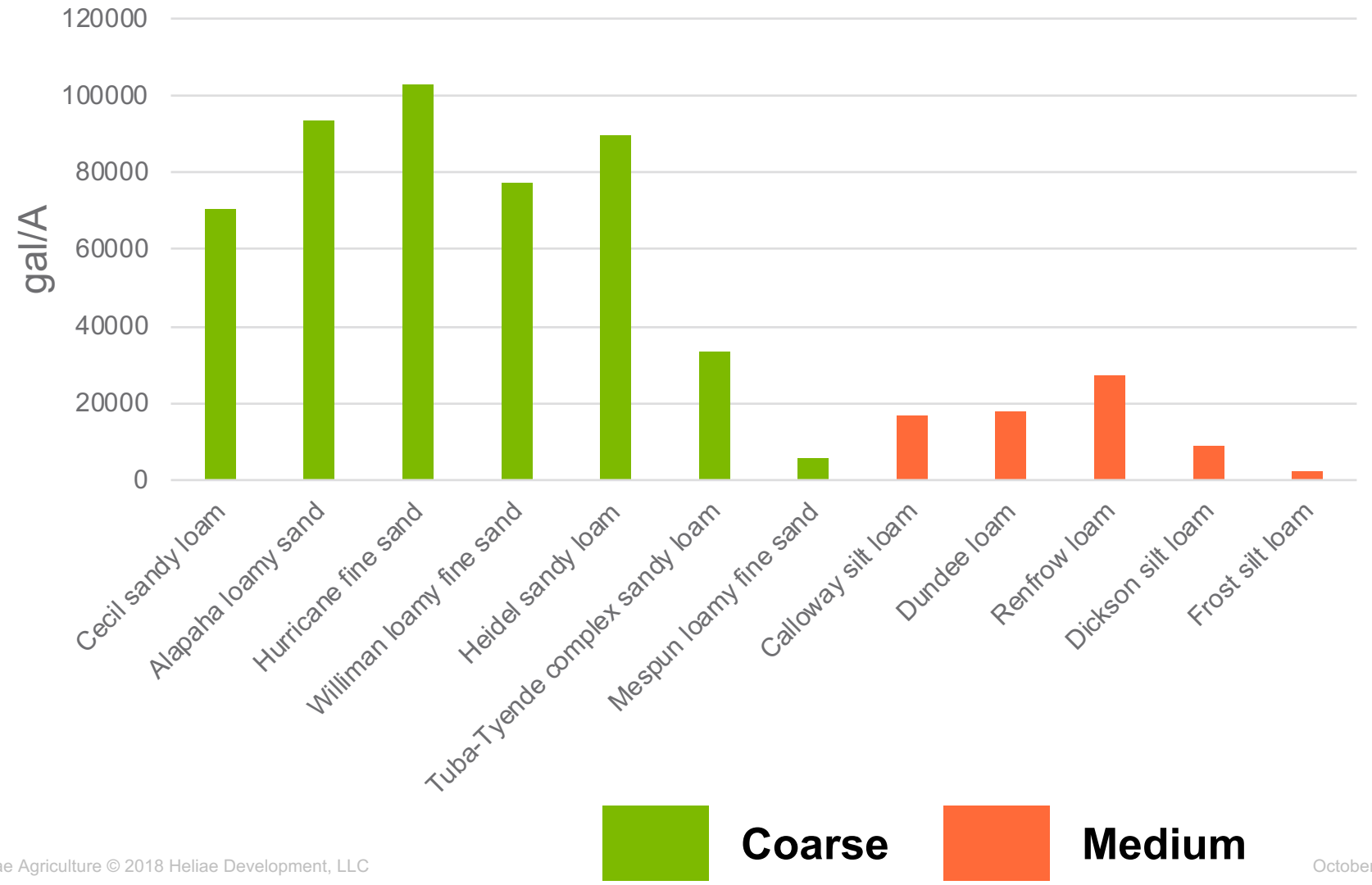
NITROGEN REDUCTION CAPABILITY

PhycoTerra® 1% weekly application allowed similar harvest rates with 50% less nitrate input



Week 3 PhycoTerra® application until harvest (7 times)

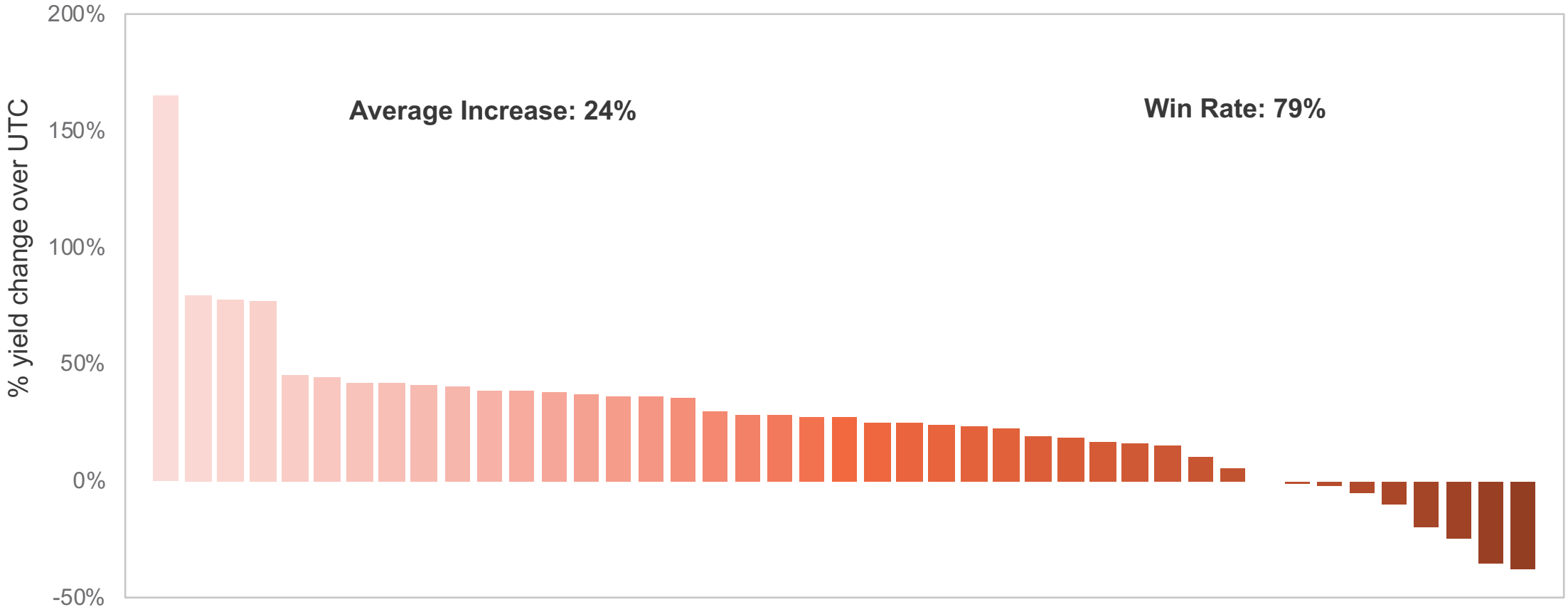
POTENTIAL WATER SAVED WITH PHYCOTERRA® ORGANIC



Our products prove…

SUCCESS IN STRESSED CONDITIONS

Win rate = yield increase of at least 1% over standard practice in 43 field trials

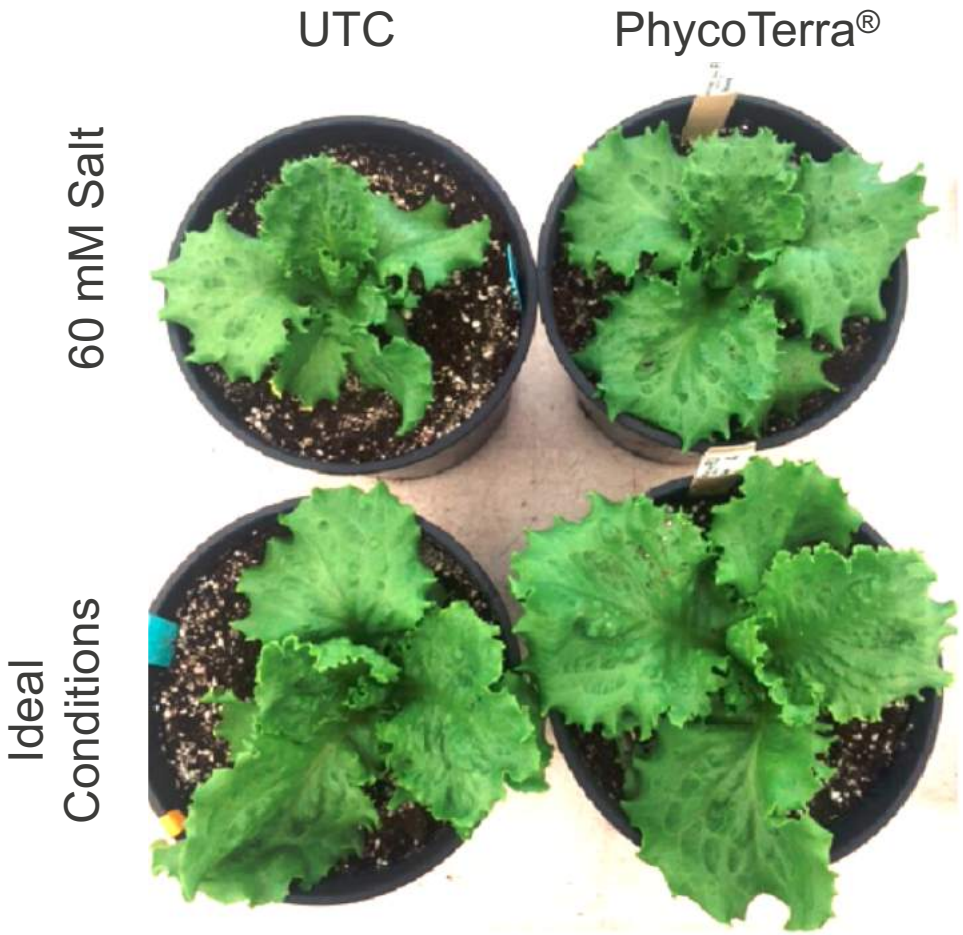


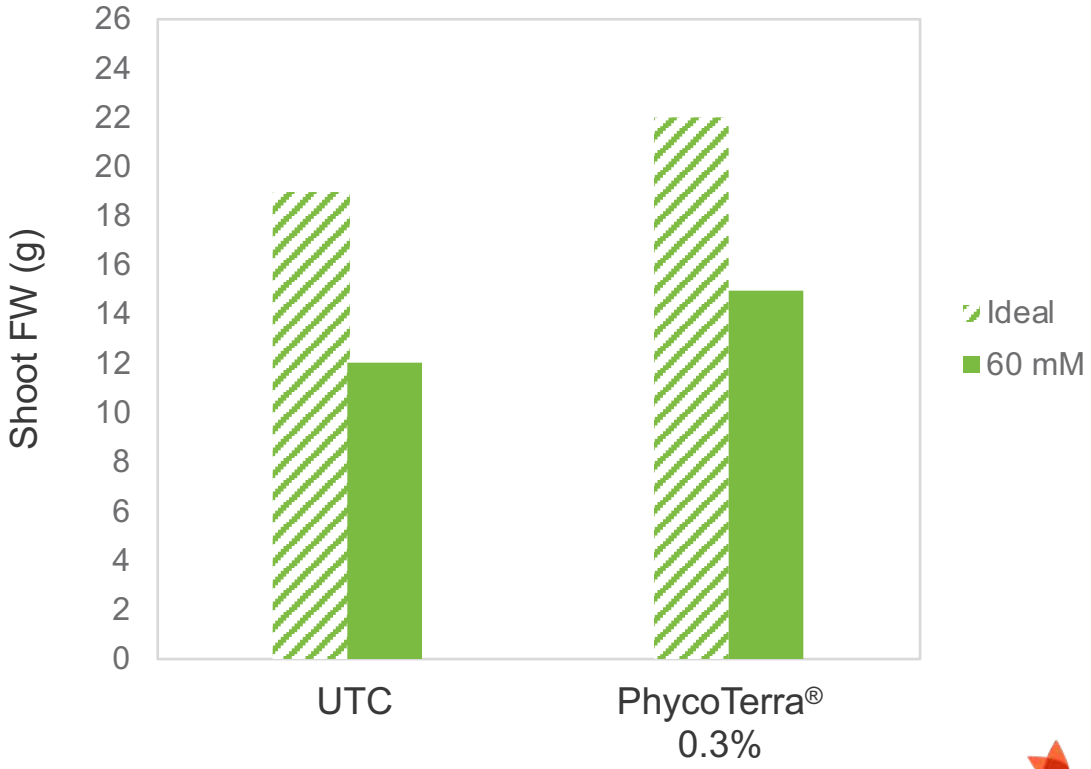
*Stress conditions observed may include drought, extreme heat or cold, salt, etc.

Our products prove…

NATURAL PLANT RESILIENCE TO COMMON STRESSORS

SALT STRESS REDUCTION - Heliae Greenhouse, March 2017

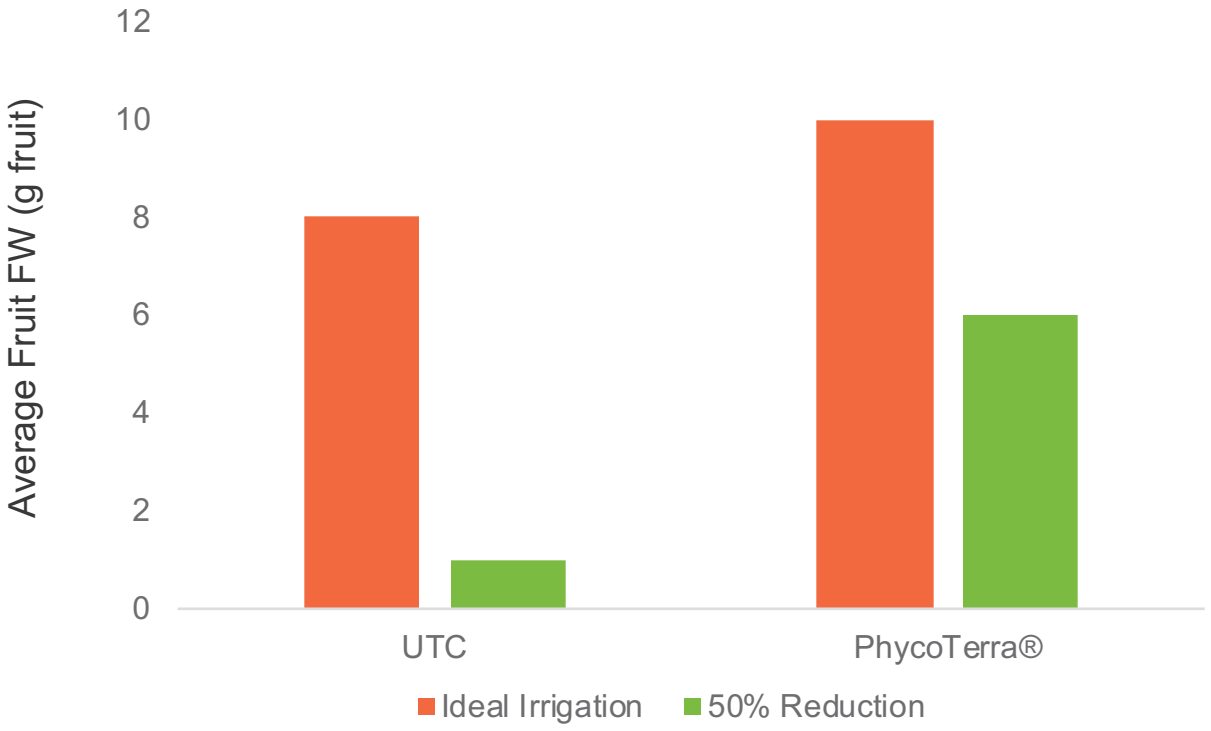




Our products improve…

NATURAL PLANT RESILIENCE TO COMMON STRESSORS

DROUGHT STRESS REDUCTION- University Greenhouse



University Greenhouse Trial
10 weeks post transplant

Ideal Irrigation

> 50% Reduction in Soil Water Content

UTC **PhycoTerra® (0.6 mL/pl)**

Our products improve…

NATURAL PLANT RESILIENCE TO COMMON STRESSORS

University – Observed Reduction in Leaf Spot and Stem Rot

UTC **PhycoTerra®**

Barley and Leaf Spot
(*Bipolaris sorokiniana*)
Soil Drench Application

UTC **PhycoTerra®**

Canola and Stem Rot
pathogen (*Sclerotinia*)
Soil Drench Application

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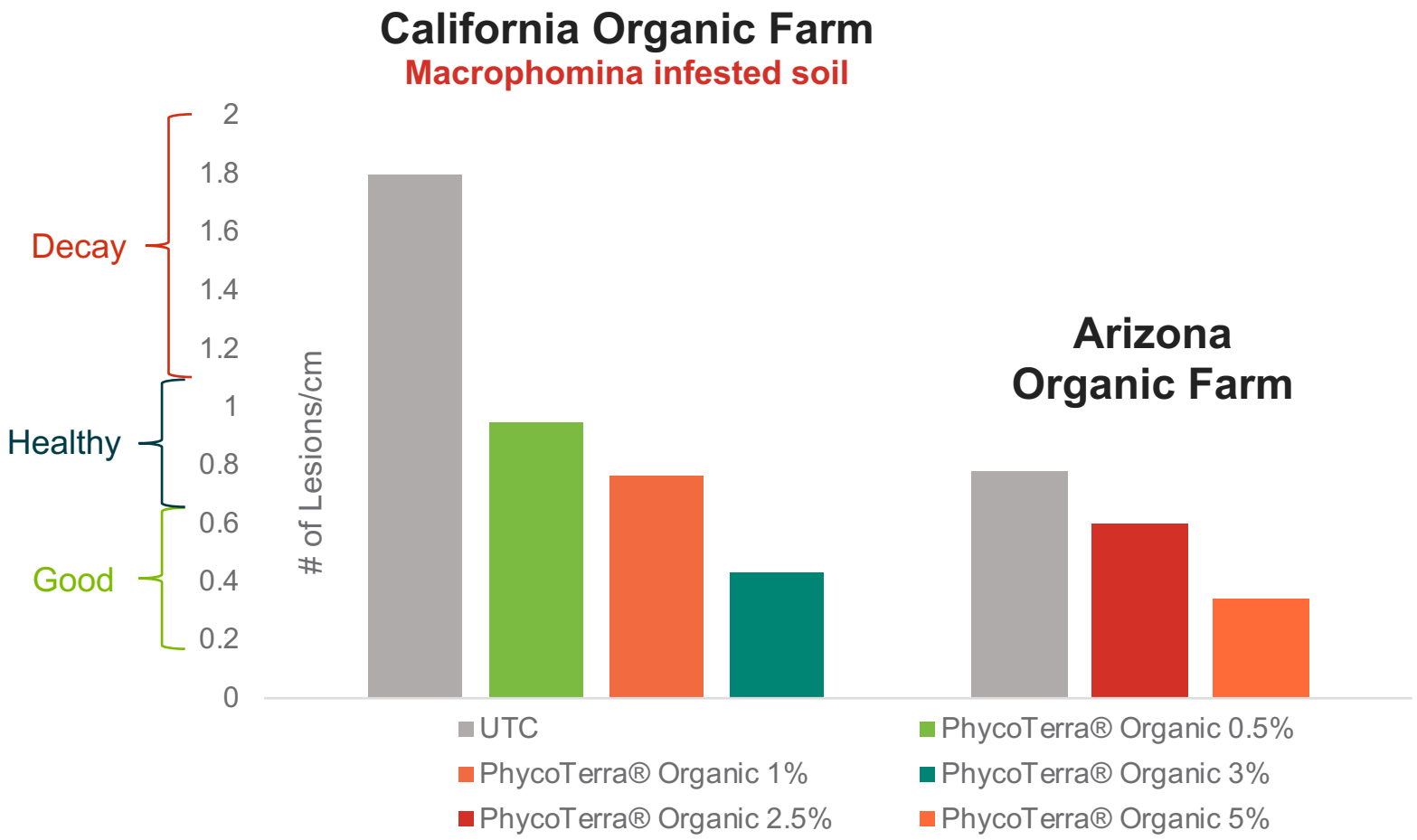
Our products improve…

NATURAL PLANT RESILIENCE TO COMMON STRESSORS

Laboratory-Observed - Green bean bioassay with single application of PhycoTerra® Organic



UTC

3% PhycoTerra® Organic

STRAWBERRY *Variety: Proprietary*

Grower-observed greater resilience of his plants to verticillium – SALINAS, CA

UTC
Planted 11/14/2017

PhycoTerra®
Applications Started 5/22/2018

APPLICATIONS

- UTC (3 acres)
- PhycoTerra® (3 acres)
  - 1 gal/A, every 2 weeks

	UTC		PhycoTerra®	
Random Sample Section	No. Healthy Plants	No. Infected Plants	No. Healthy Plants	No. Infected Plants
1	35	18	52	2
2	37	4	53	2
3	32	12	48	5
4	35	12	42	7
5	39	13	50	2
Total	188	59	245	18
Average	37.6	11.8	49	3.6
Percent Infected Plants		31.4%		7.3%

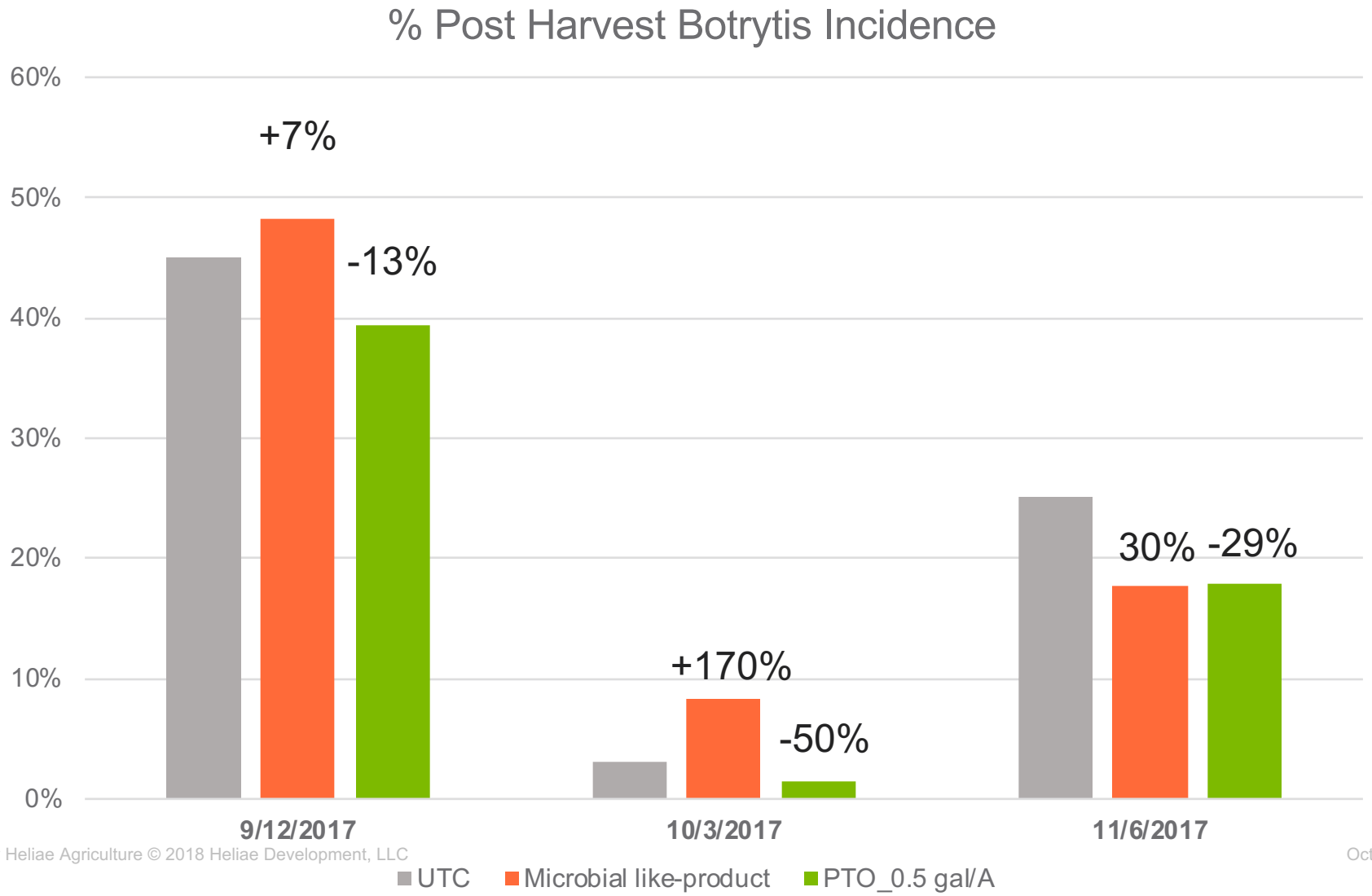
RESULTS

- Grower observed reduction in occurrence of verticillium

Our products improve…

NATURAL PLANT RESILIENCE TO COMMON STRESSORS

Grower-Observed – Bi-weekly drip applications. Three holding tests completed, 6-10 days in cold storage



½ gal/A showed >10% reduction

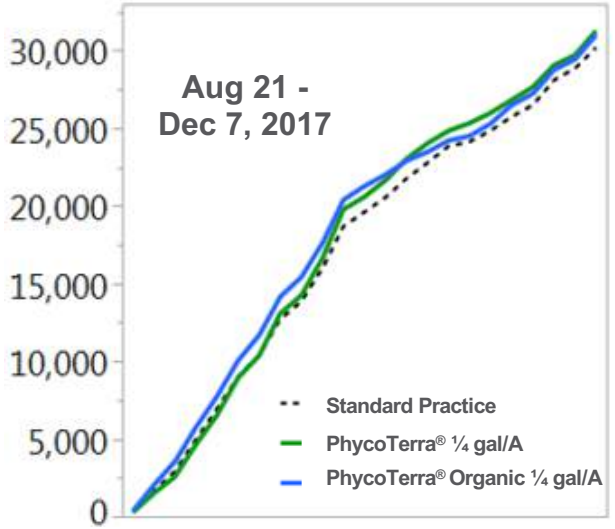
Strawberries

Strawberries

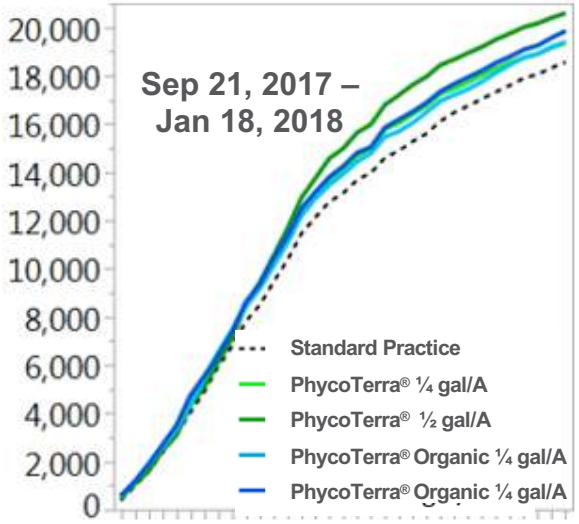
HIGHER CUMULATIVE YIELDS *var. Portola (all trials)*

Cumulative Marketable Yield (lb/A)

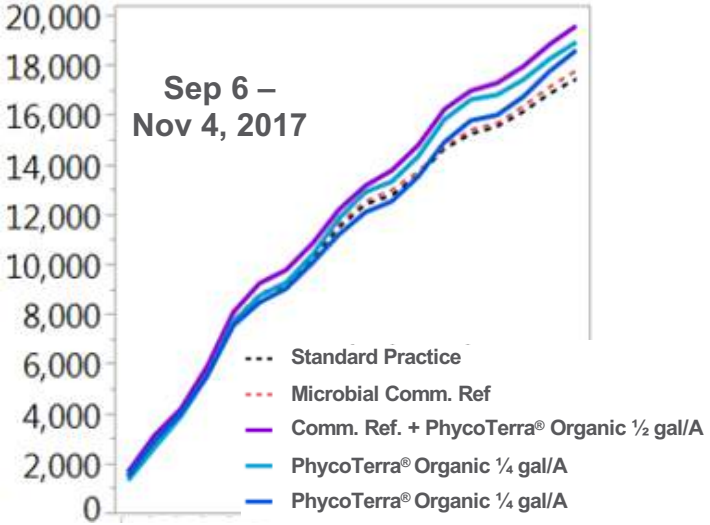
Guadalupe Valley, CA



Oxnard, CA



Santa Maria, CA Organic



Soil Classification

Metz Loamy Sand

Cropley Clay

Corralitas Sandy Loam

PER ACRE	GUADALUPE	OXNARD	SANTA MARIA
Additional Sales	$1200-1500	$1100-3400	$4000-5800
Cost of PhycoTerra®	$130-163	$130-325	$125-250

Strawberries

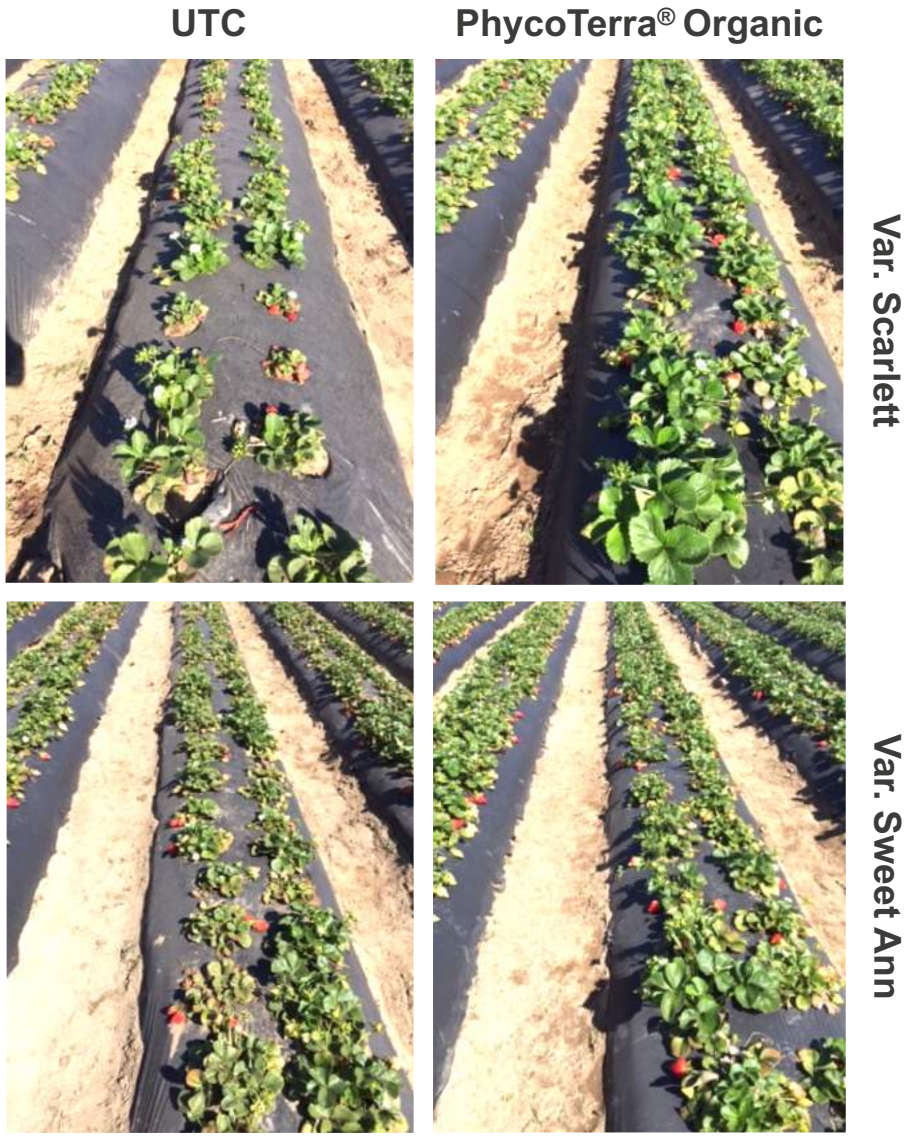
Salinas, CA (Organic) – Fast Help for Strawberry Growers

2 VARIETY TRIAL

- Scarlett
- Sweet Ann

AFTER 2 APPLICATIONS

- 1st App = 3qts/A
- 2nd App = 2qts/A



Strawberries

Heliae Greenhouse – Jan-Apr 2018, New Root Growth After PhycoTerra® Organic Application

Control

PhycoTerra® Organic 5% Root Dip

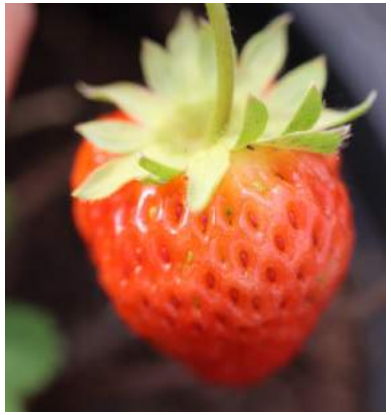
PHYCOTERRA® ORGANIC INCREASED NEW ROOT GROWTH IN MONTERREY STRAWBERRIES CROWN

Application rate: PhycoTerra® Organic at different concentrations (5%,10%, and 50%) was applied in strawberry crowns by dipping roots before transplanting to pots.

Strawberries

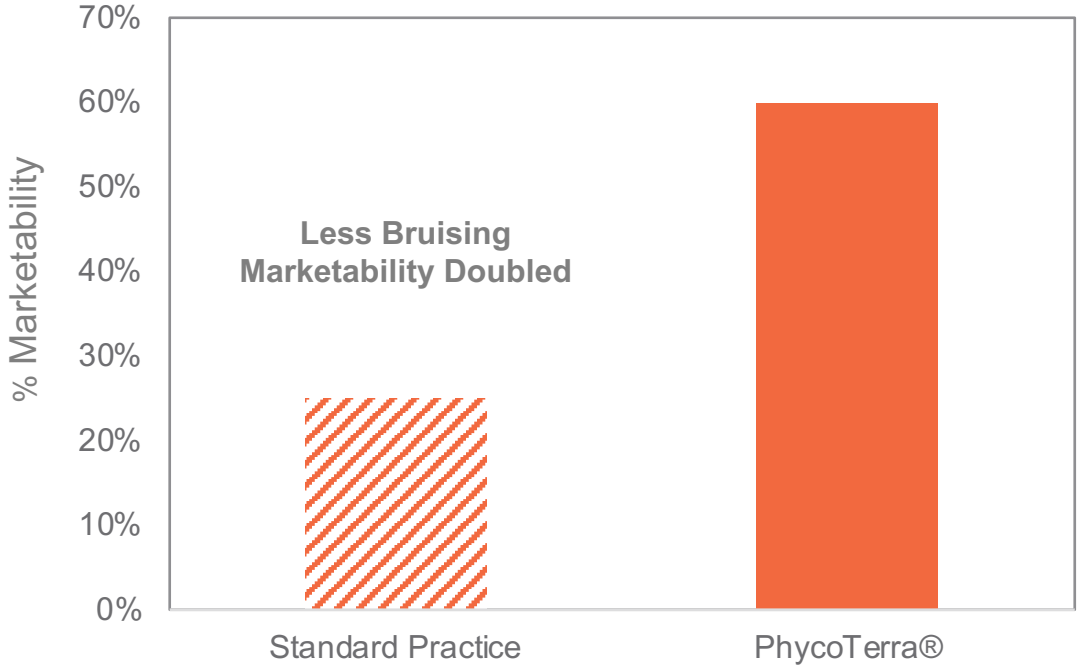
QUALITY, YIELD, CONSISTENCY, VALUE

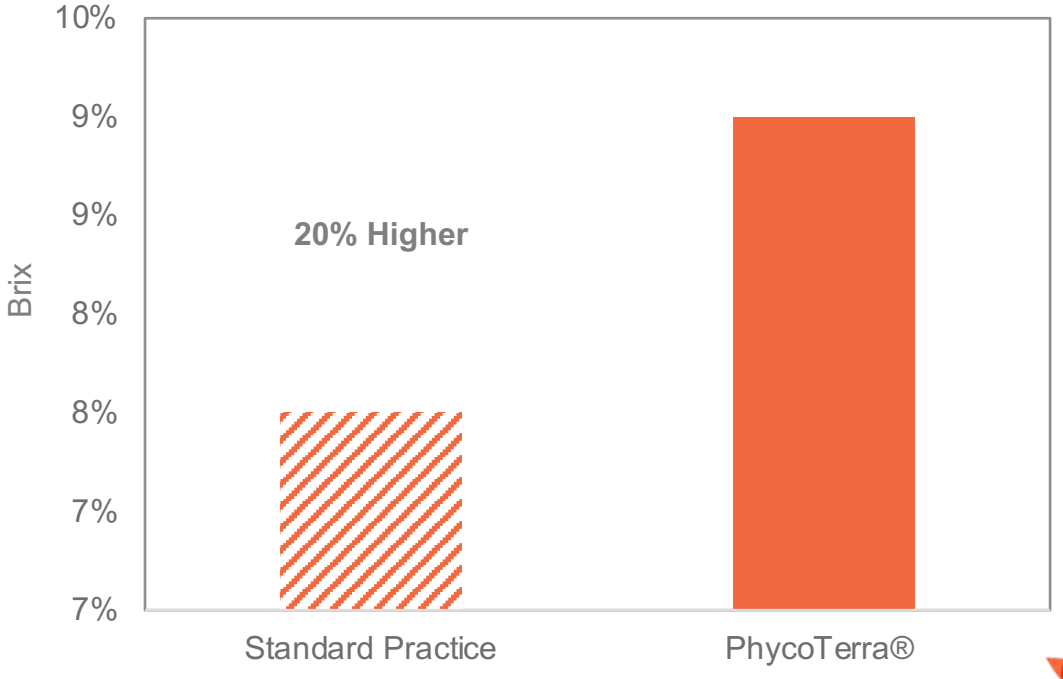
High Brix, Decreased Bruising



STRAWBERRIES SHIPPED FL TO NY: STORED 3 DAYS AT 34ºF

In-Line Application

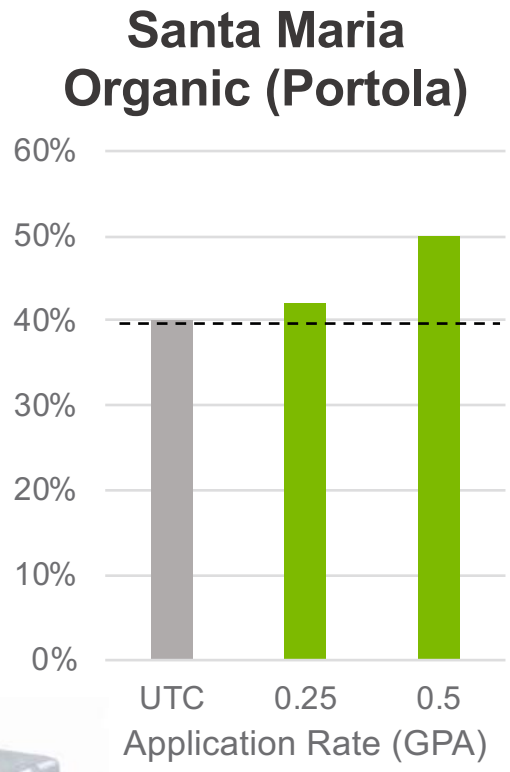


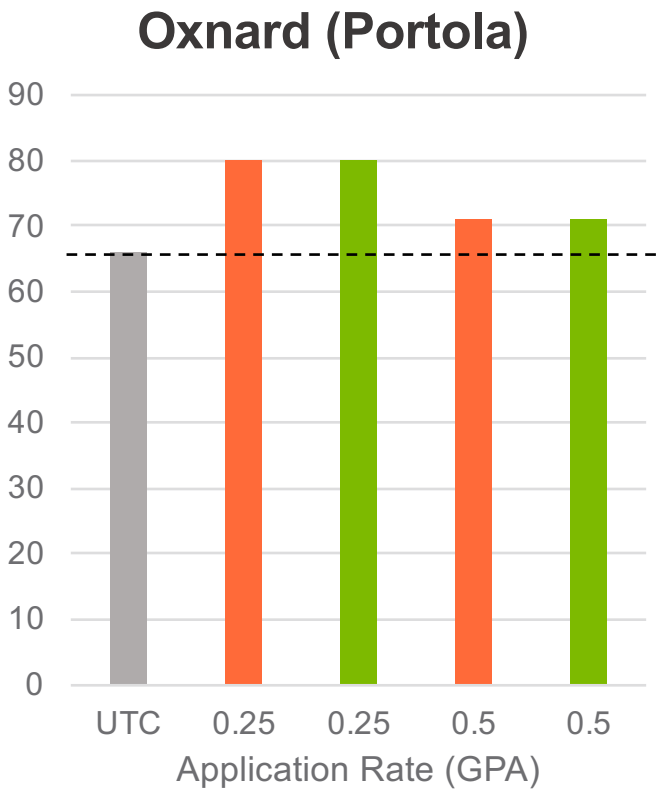


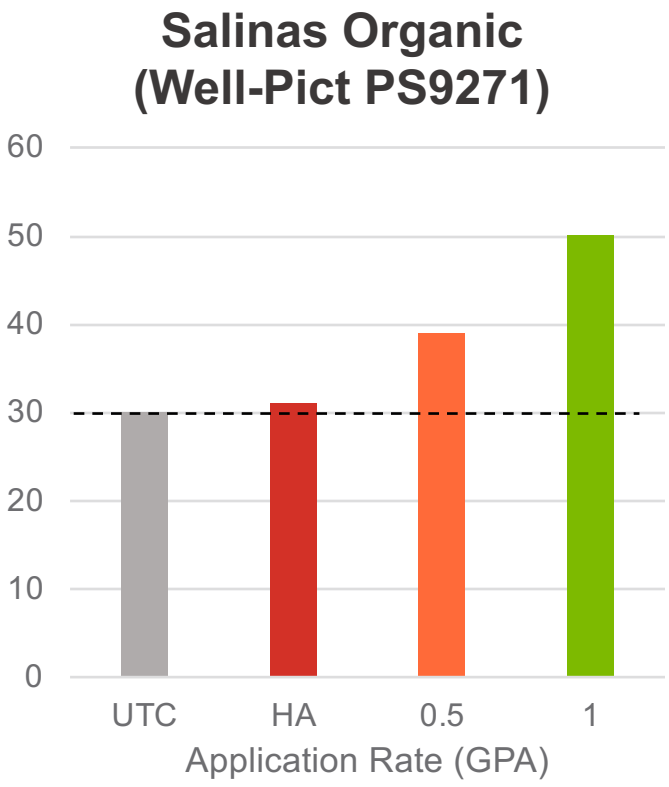
Our products improve...

LESS BRUISING

2018 Strawberry Field Trials - 30% Increase in Marketability







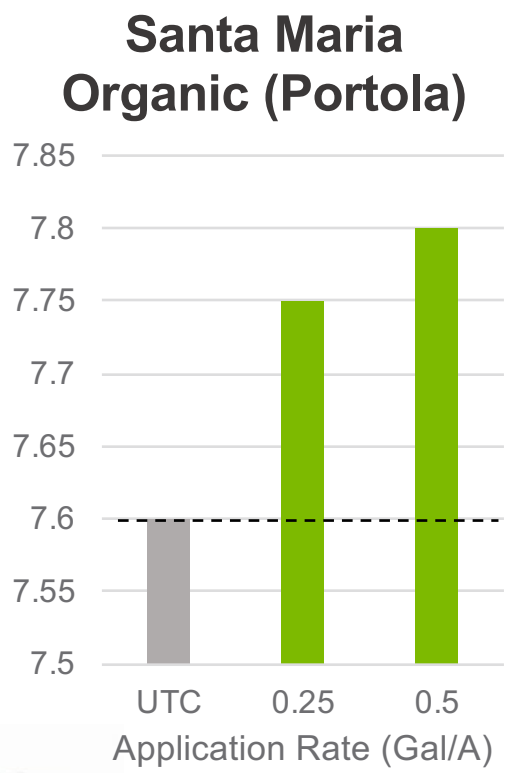
UTC
PhycoTerra®
PhycoTerra® Organic
Humic Acid

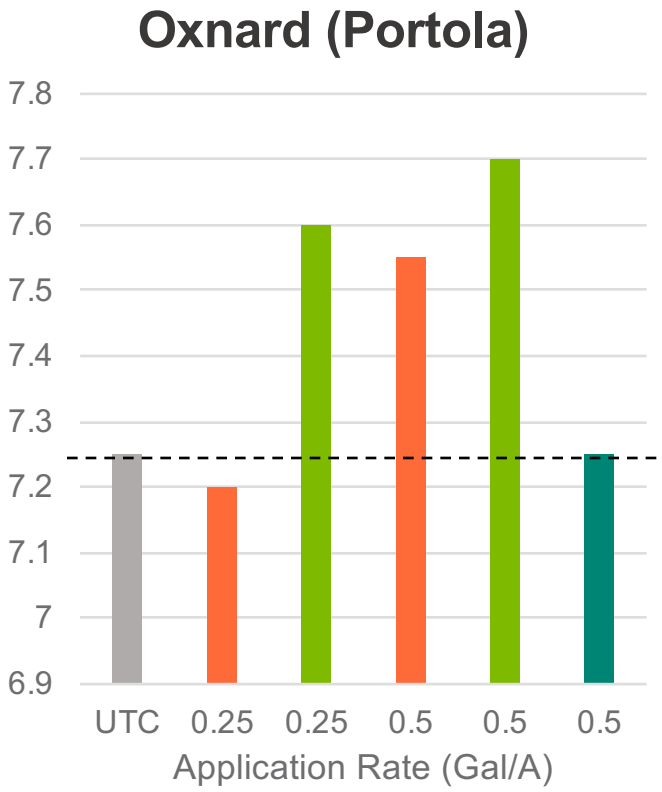
PhycoTerra® Powered by Heliae Agriculture © 2018 Heliae Development, LLC

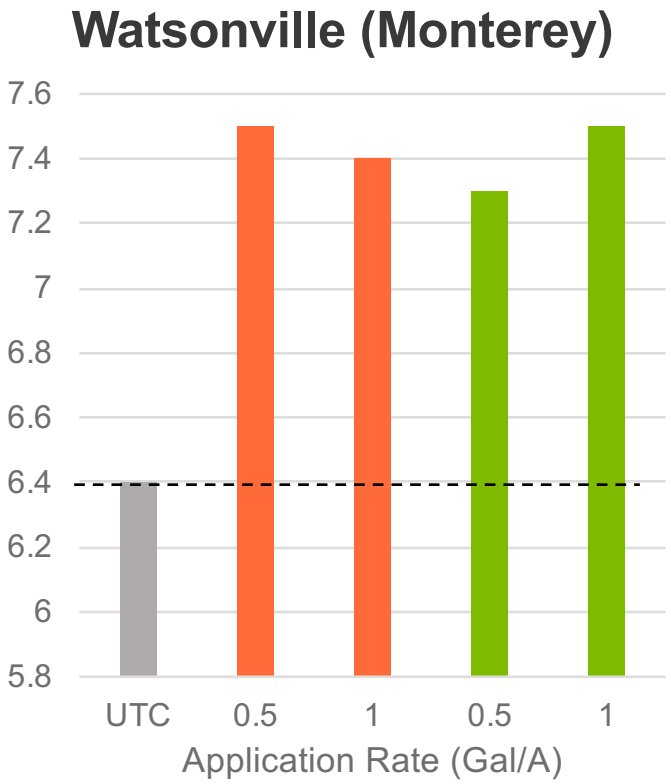
Our products improve…

PERCENTAGE OF BRIX

2018 Strawberry Field Trials – 13-18% Increase from Bi-Weekly Applications



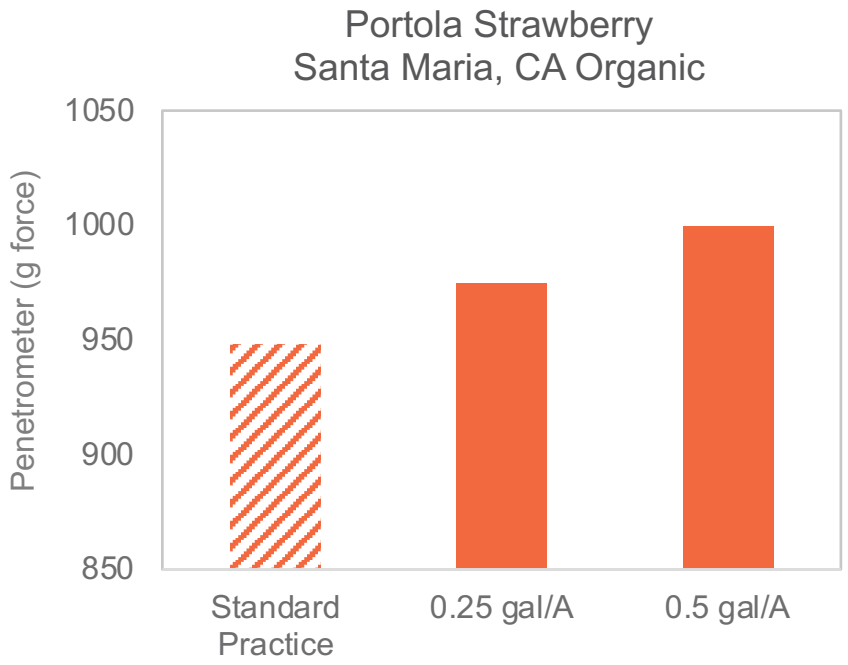


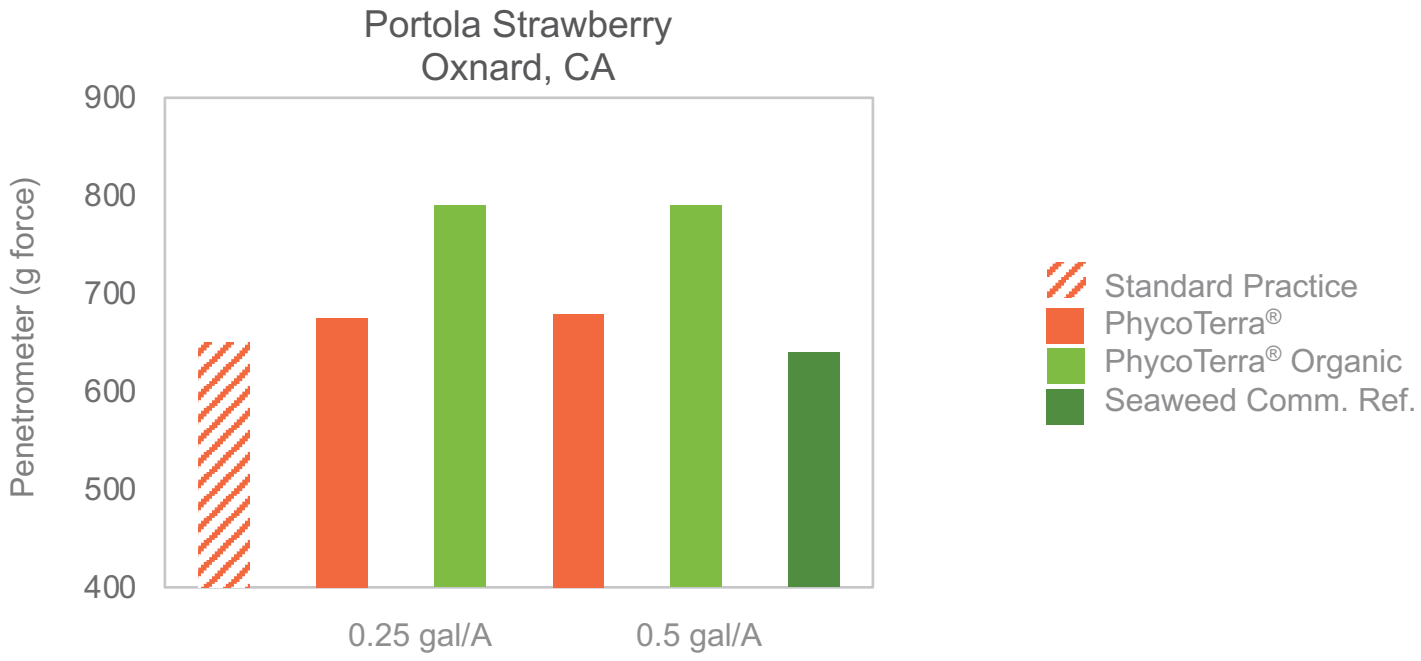


UTC
PhycoTerra®
PhycoTerra® Organic
Seaweed comm. Ref

Strawberries

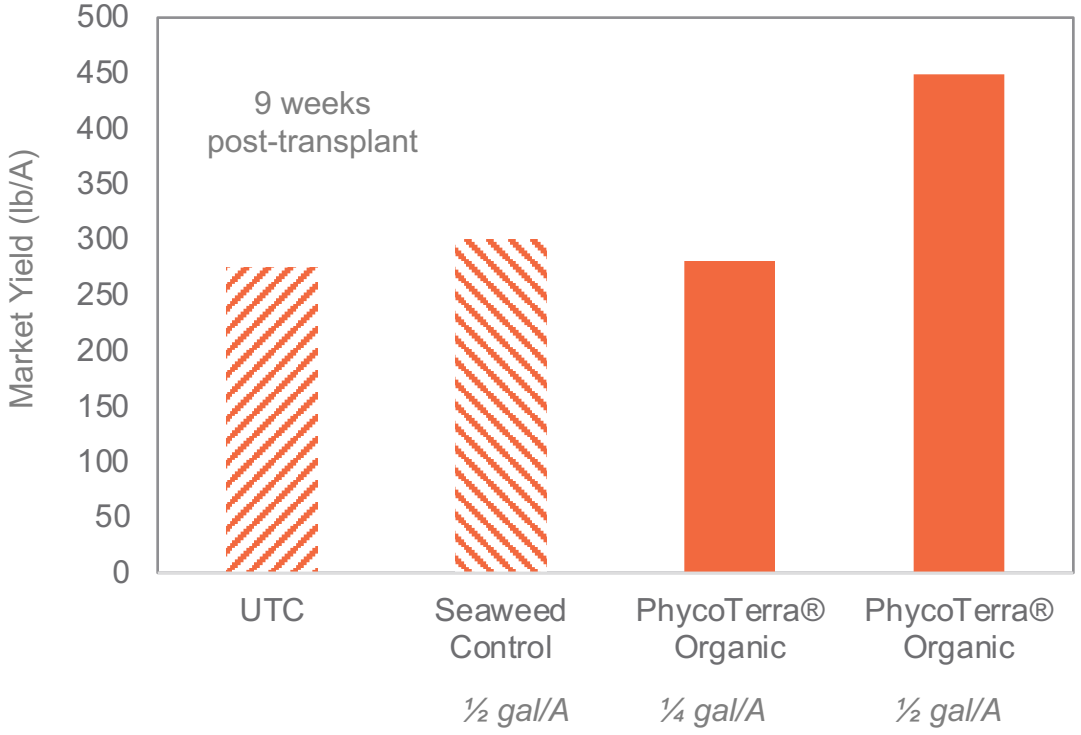
Berry Firmness Post-Storage

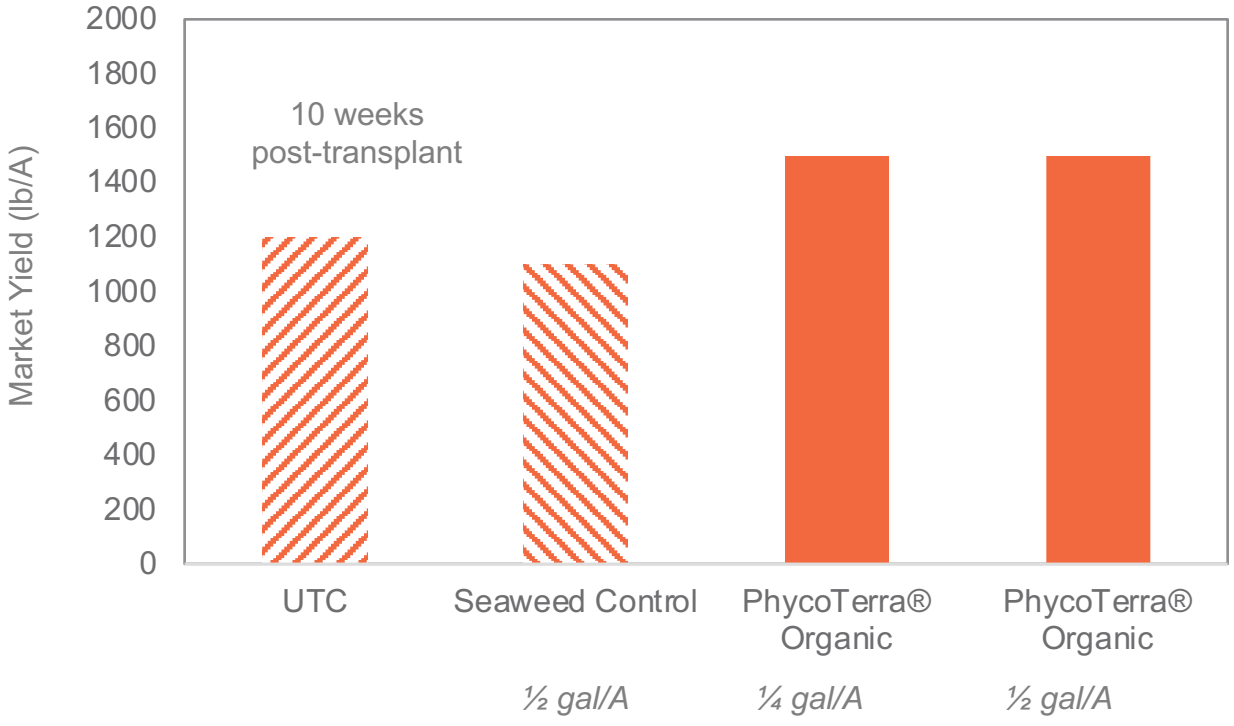




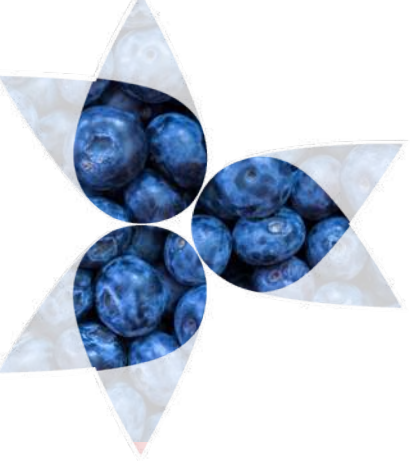
Strawberries YIELD: 1st & 2nd HARVEST

*Guadalupe, CA – Summer 2017 *Significant advantage over control (standard practice) by Dunnet's $p<0.05$*
Higher Early Yields





Blueberries



Blueberries

A common trend across trials with PhycoTerra® is larger fruit size

Blueberries

PhycoTerra® Optimized Application for Large Fruit

Organic Blueberries - Central WA

Focus: size, yield, sweetness and shelf-life

- ✓ Apply at 1 gal/A via drip irrigation at 50% bloom + 1 week later

  Focus on cell division during early fruit set – number of cell divisions during cell division establishes later berry size potential

- ✓ Apply at 0.5 gal/A every 2 weeks after bloom to harvest

  Maintain strong soil/plant health to assure highest quality fruit development, taste and shelf-life

- ✓ After harvest, two applications at 0.5 gal/A prior to fall leaf senescence

  Optimize plant carbohydrate reserves for strong early season growth

COMPLETED BLUEBERRY TRIAL *Variety: Emerald*

WE RESCUED A STRUGGLING ORGANIC BLUEBERRY CROP – OXNARD, CA

UTC

PhycoTerra® Organic

Photo taken 6 weeks after 1st application

CHALLENGE:

Help requested on stressed block 2 weeks into fruit harvest.

APPLICATIONS

1. UTC (3 acres)
2. PhycoTerra® Organic (3 acres)
   - 1 gal/A by drip every week for 5 weeks straight ($250/Acre)

RESULTS

✓ Crop turnaround by late harvest

RAINIER CHERRY TRIAL

POSITIVE RESULT - EARLY HARVEST, WA

Rainier Cherries must reach a brix 17 before harvesting

APPLICATIONS

PhycoTerra® Organic

- 1 gal/A for 2 consecutive weeks starting at 50% bloom
- 1 gal/A post bloom every 2 weeks until harvest (3 applications)

Year One Results (PhycoTerra® Organic)

✓ Brix of 17 achieved 5 days earlier than Control.

COMPLETED WATERMELON TRIAL *Variety: Wonderland*

INCREASED YIELD AT FIRST HARVEST - HEMET, CA

UTC

PhycoTerra®

Photos taken 1 week before harvest

Application

PhycoTerra® - 4 drip applications at 1 gal/A

- 5 days prior to transplant
- Once every 3 weeks except during flowering (3 total)

Results

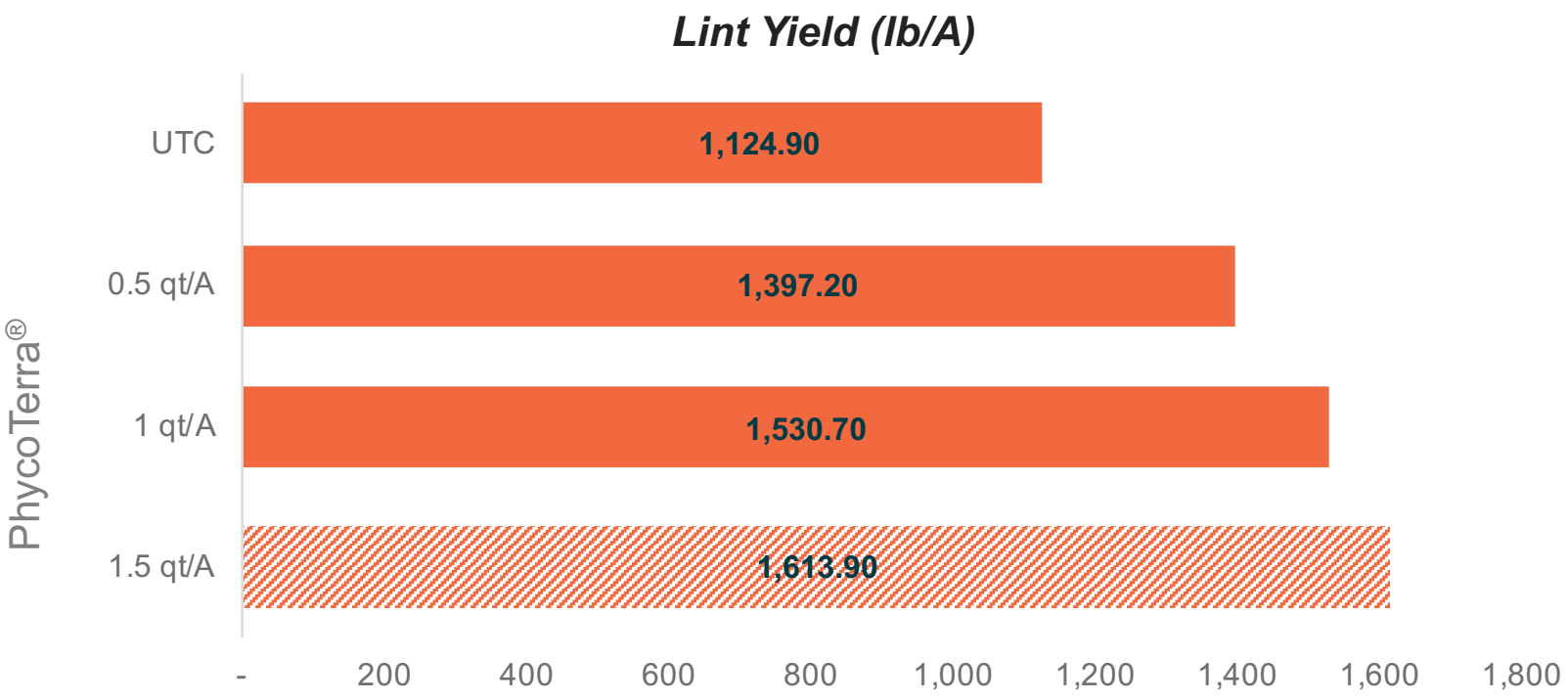
✓ Grower-observed natural plant resilience to common crop stressor in PhycoTerra® section

✓ 10% yield advantage at first harvest

Cotton

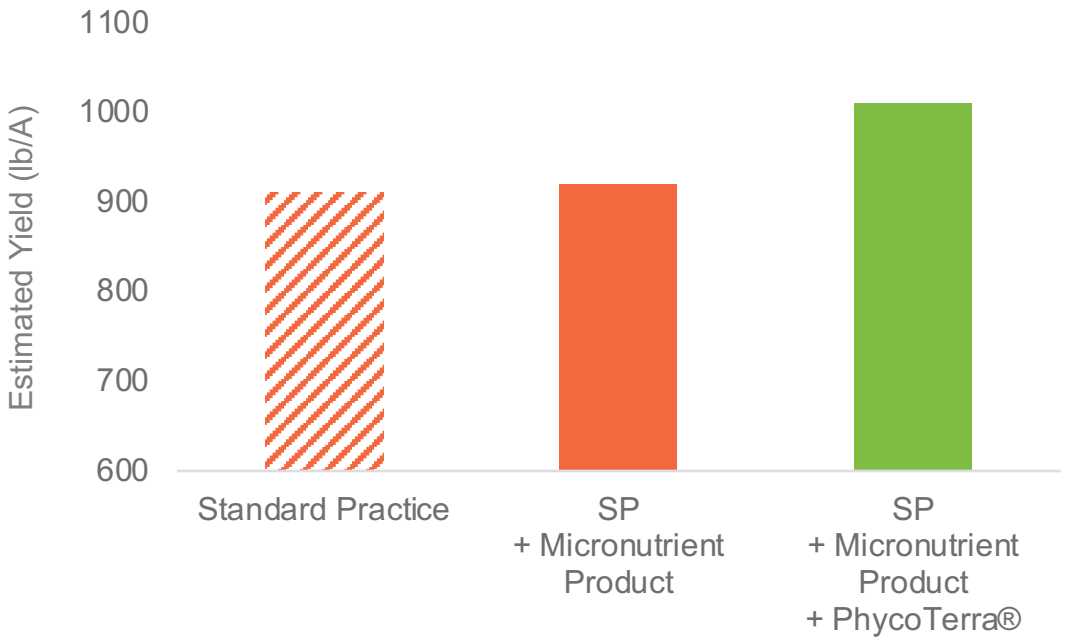
Cotton

Safford, AZ – Yield & Fiber Quality from Customer-Based Trials



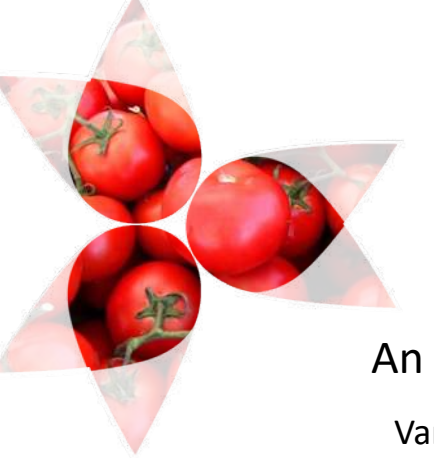
Cotton

Somerville, TN – Improves Cotton Yield



Improved yield by 12%

Tomatoes



Tomatoes

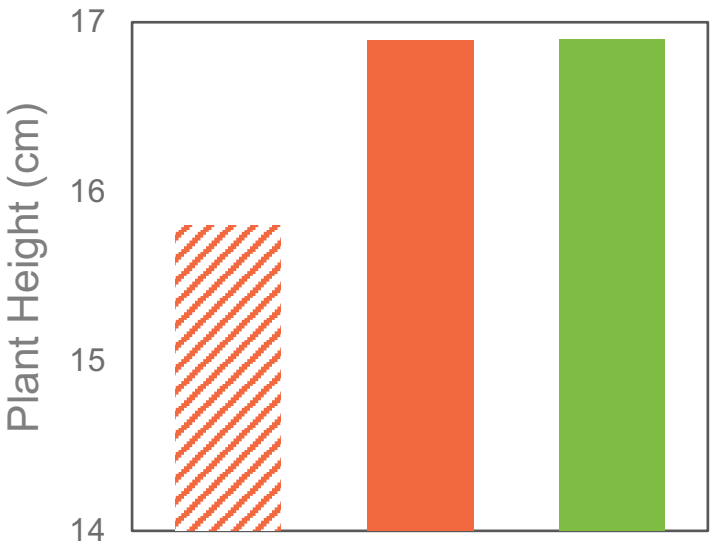
Thonotosassa, FL– PhycoTerra® Improves Early Field Establishment of Tomato

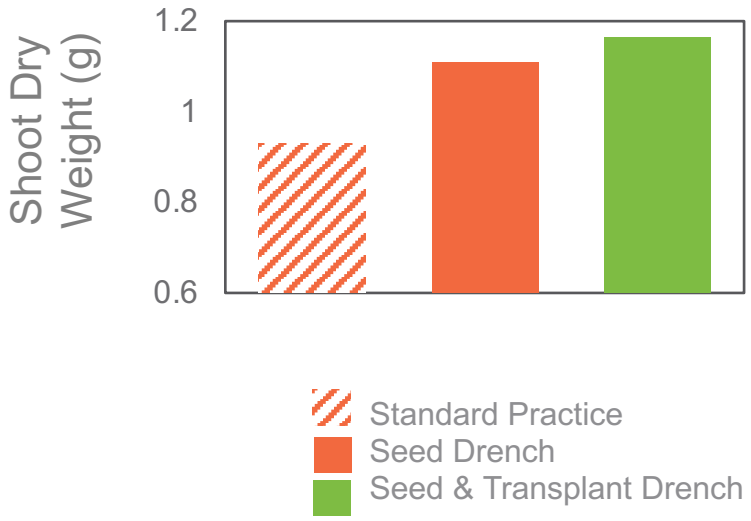
An independent research organization trial

Variety: Charger
Flat Mix: Speedling Germination Mix
Field Soil: 99.5% sand, 0.5% clay
Trial Design: Randomized Complete Block Design

Application Methods	Frequency	Rate
Seed Drench	One time at seeding	3% vol/vol solution applied at flat seeding
Transplant Drench	One time at seeding	3% vol/vol solution 2 oz, or 50 millimeters/plant

Results (two weeks after field transplant)





Tomatoes

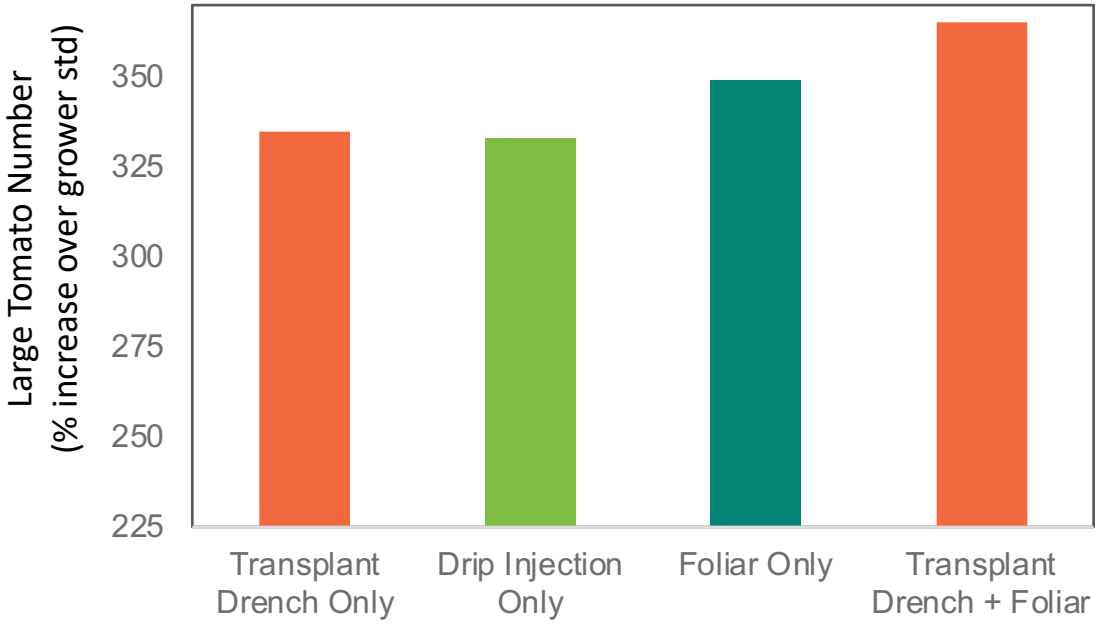
Thonotosassa, FL– Increases Harvest Tomato Number and Weight

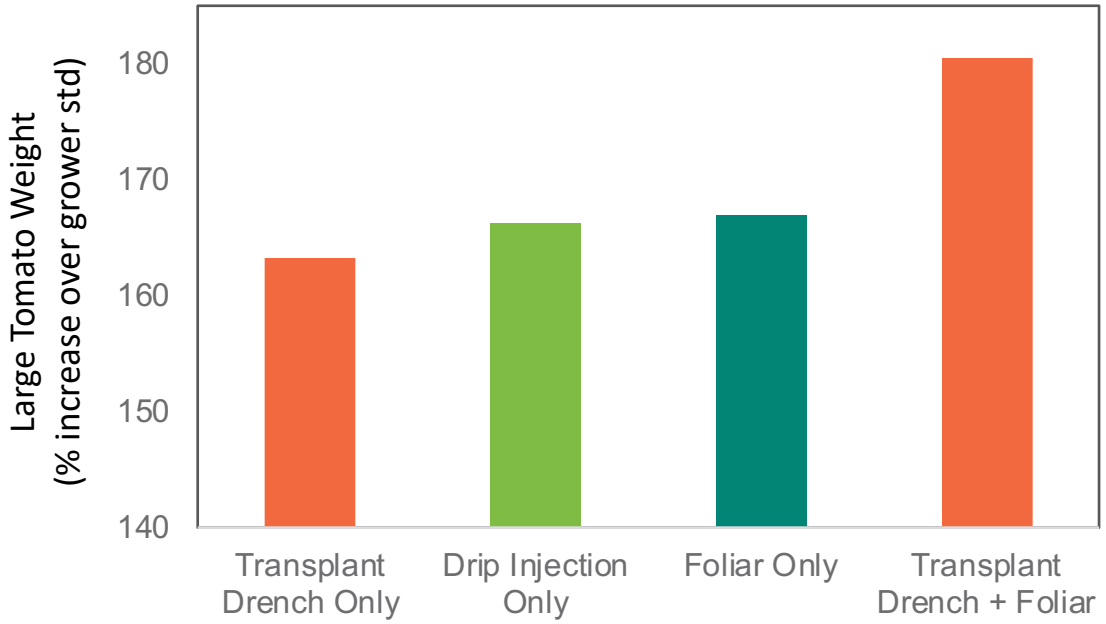
An independent research organization trial

Variety: Charger
Flat Mix: Speedling Germination Mix
Field Soil: 99.5% sand, 0.5% clay
Trial Design: Randomized Complete Block Design

Application Methods	Frequency	Rate
Transplant Drench	One time	3% vol/vol solution 2 oz, or 50 millimeters/plant
Drip Irrigation	Every two weeks	1 gal/A
Foliar Spray	Every two weeks	1% vol/vol solution at 25-50 gal/A

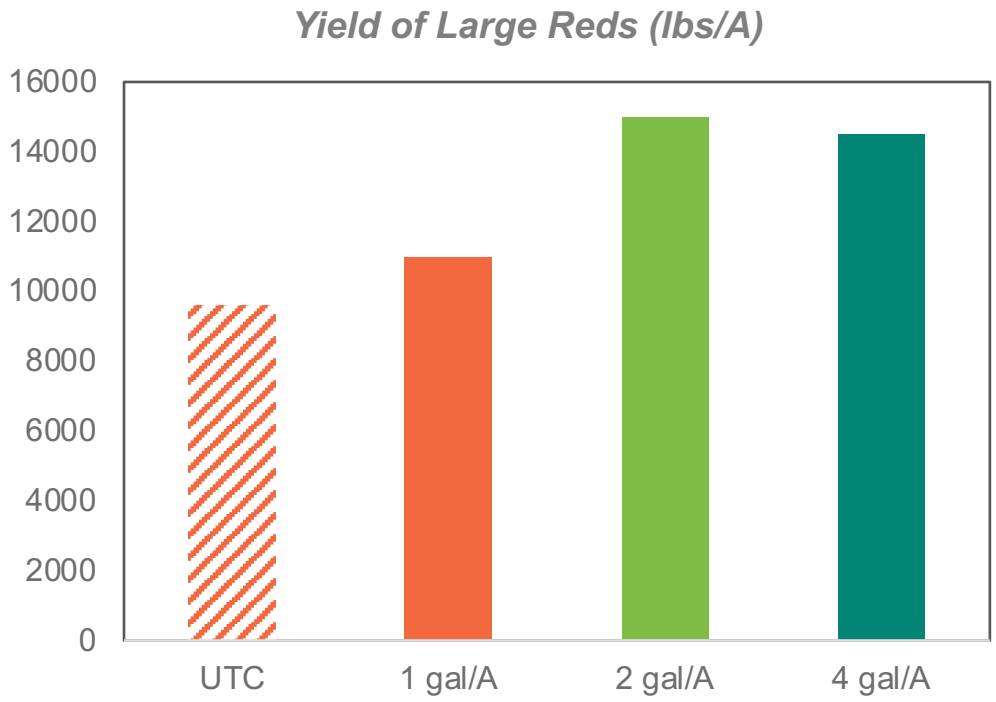
Harvest Results

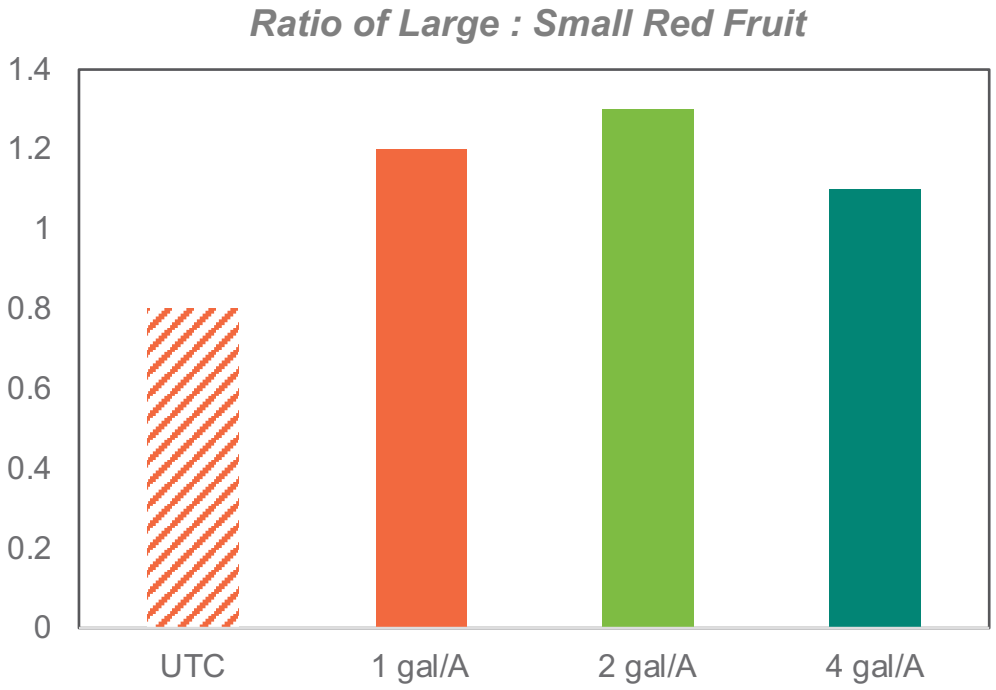




Tomatoes

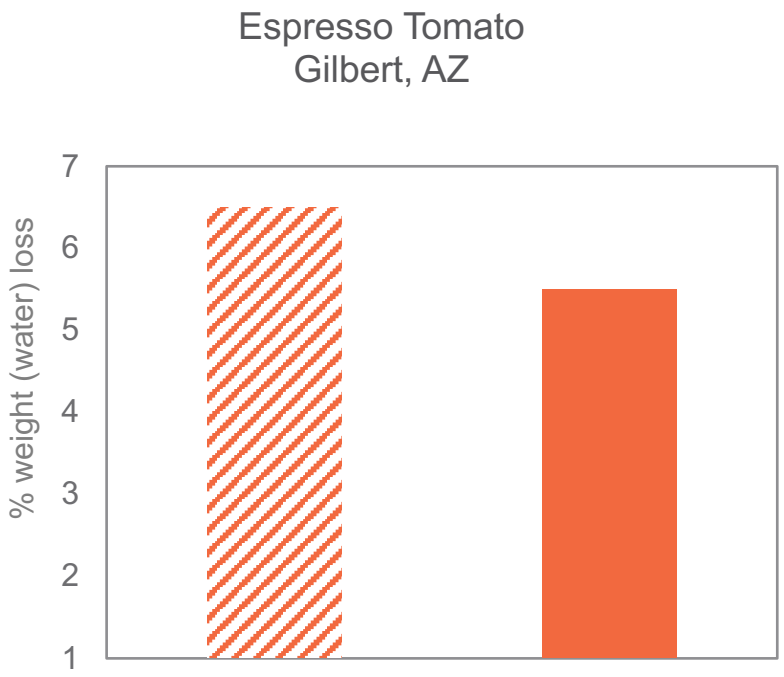
Fresno, CA – We increase tomato size





Tomatoes

Fruit Water Retention Post-Storage



Standard Practice

PhycoTerra® Organic

Our products …

DEMONSTRATED MORE BIOMASS

Heliae Greenhouse – Dec 2017, 45% More Biomass in Greenhouse Compared to a Customer's Program!

GREENHOUSE COMPARISON
Customer Soil + Inputs to PhycoTerra® Organic

5% PhycoTerra® Organic Only

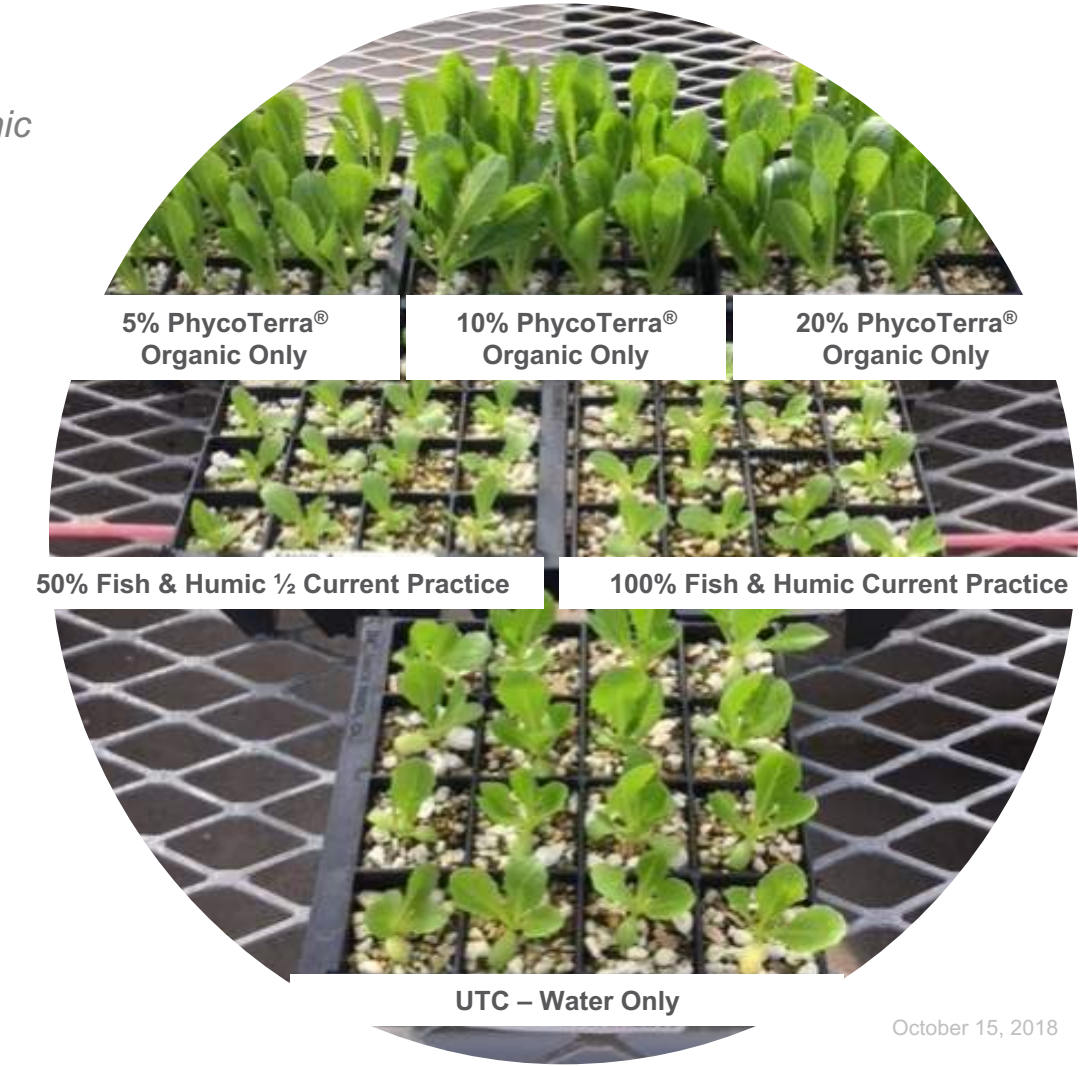
10% PhycoTerra® Organic Only

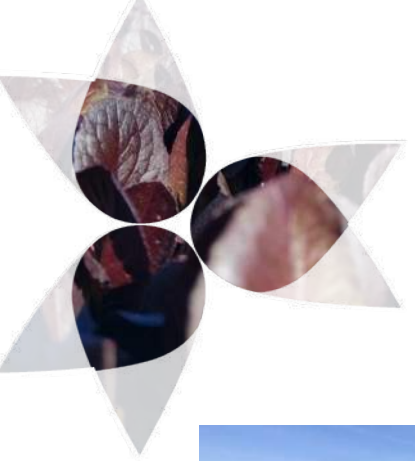
20% PhycoTerra® Organic Only

50% Fish & Humic
½ Current Practice

100% Fish & Humic
Current Practice

UTC – Water Only

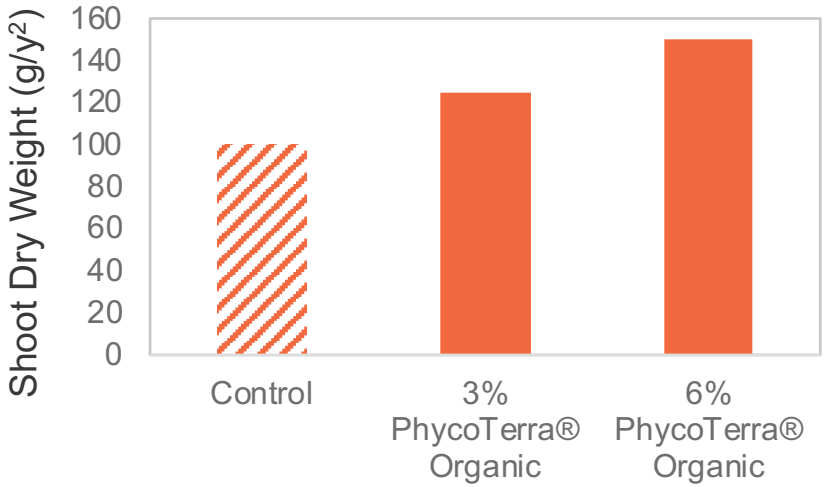




Red Romaine

AZ Organic Grower Test – One Application of PhycoTerra® Organic Following Seeding Increased Fresh Weight

We moved the trial into a 7 acre field test



Harvest Results – 6 weeks after seeding

23% Increase in fresh weight/A = $1780 value/acre for this grower test

ROI CALCULATOR

Input	Cost	EST LB Yield Per Acre	9,000
Fish EM	$ 10.00	EST AVE ANNUAL $ PER LB	$ 1.10
Humic Acid	$ 10.00		
Compost	$ -	AVE Crop REVENUE/ Acre	$ 9,880
Other	$ -		
Other			
Total Input Cost	$ 20.00		

23%	AVERAGE YIELD PER ACRE INCREASE

Advantage Demonstrated with PhycoTerra® Organic			
Input	Cost	EST LB Yield Per Acre	11,070
Fish EM		EST AVE ANNUAL $ PER LB	$ 1.10
Humic Acid			
Compost	$ -	AVE Crop REVENUE/ Acre	$ 12,077
Other	$ -		
PhycoTerra® Organic	$ 80.00		
Total Input Cost	$ 80.00		
Value Increase per Acre		$ 2,197	
WHAT IF 1/2 Value Increase/ Acre is realized		$ 1,099	

#1 - Assumes spray on after seeding application method

#2 - Assumes two applications during crop

#3 - Assumes blended average of harvested trial blocks

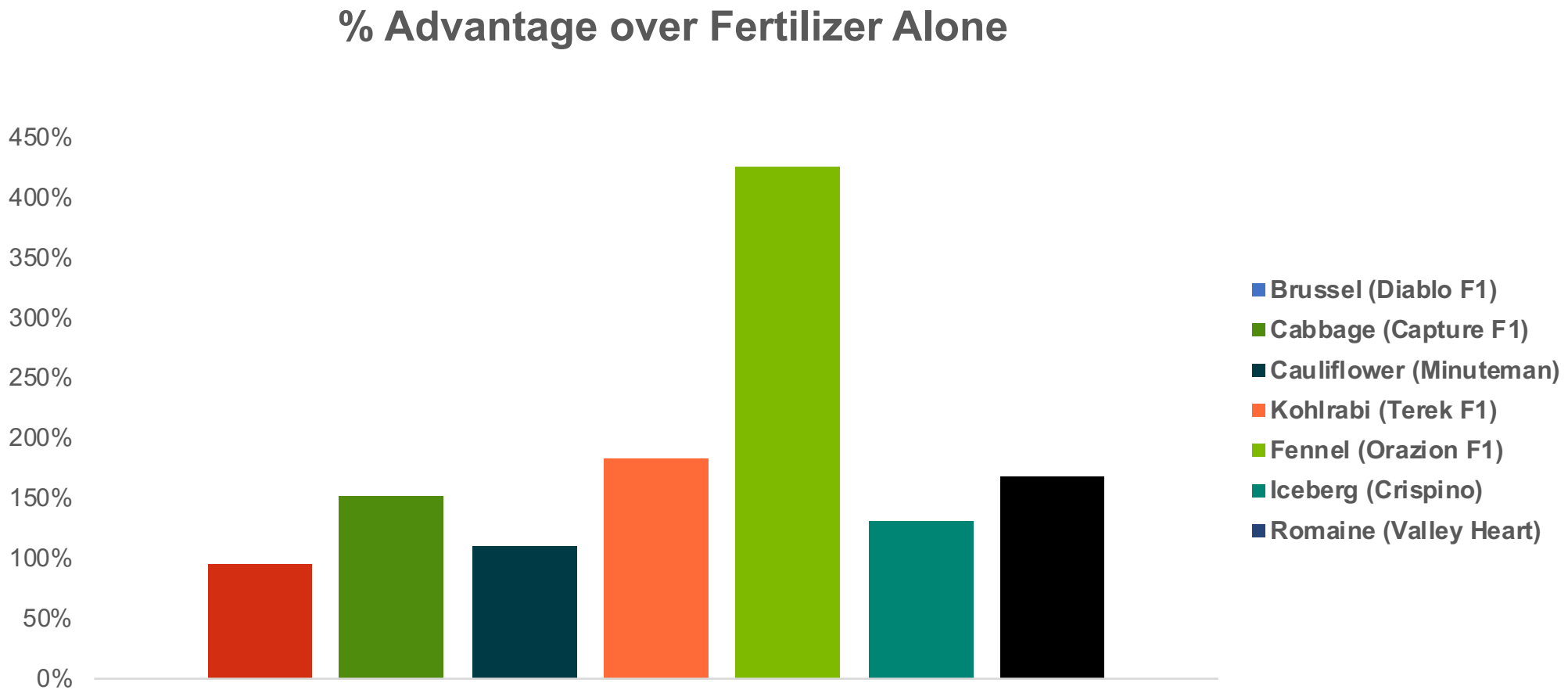
#4 - Assumes yield & Price/lb are average USDA Values

#5 - No incremental application costs

Our products improve…

DIRECT EFFECT ON SHOOTS

Leafy Vegetables – One Time Application at Seed of PhycoTerra® Organic



Canopy pictures were taken 24 days after application.
They received only one application of 5% v/v at seeding.
Phytamin (156ml/L) fertilizer was applied 12 days after product application, twice per week.

Our products improve...

DIRECT EFFECT ON SHOOTS

One Time Application at Seed of PhycoTerra® Organic

CABBAGE

PTO UTC

ICEBERG

PTO UTC

ROMAINE

PTO UTC

CAULIFLOWER

PTO UTC

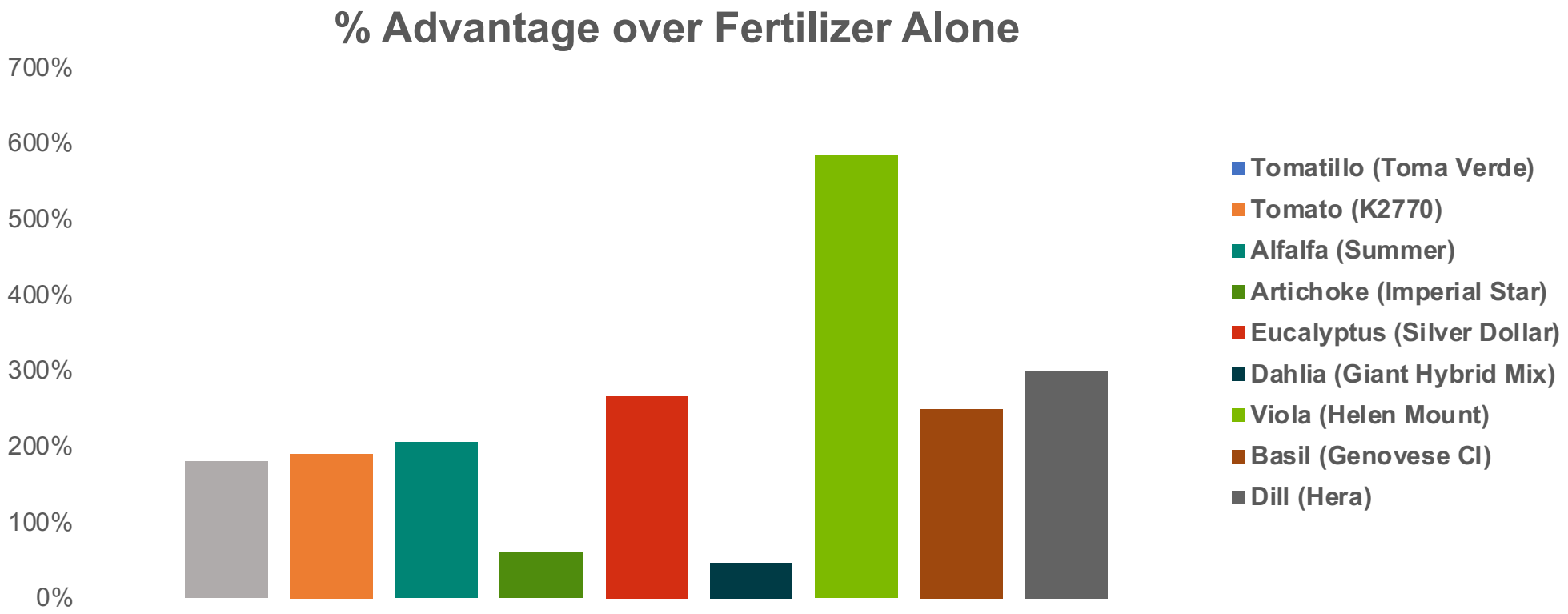
One application of PhycoTerra® Organic increased root growth in different crops

Pictures were taken 24-30 days after application. They received only one application of 5% v/v at seeding.
Phytamin (156ml/L) fertilizer was applied 12 days after product application, twice per week.

Our products improve...

DIRECT EFFECT ON SHOOTS

One Time Application at Seed of PhycoTerra® Organic



Canopy pictures were taken 24 days after application.
They received only one application of 5% v/v at seeding.
Phytamin (156ml/L) fertilizer was applied 12 days after product application, twice per week.

Our products improve...

DIRECT EFFECT ON ROOTS

One Time Application at Seed of PhycoTerra® Organic

TOMATILLO

PTO UTC

TOMATO

PTO UTC

ARTICHOKE

PTO UTC

BASIL

PTO UTC

One application of PhycoTerra® Organic increased root growth in different crops

Pictures were taken 24-30 days after application. They received only one application of 5% v/v at seeding. Phytamin (156ml/L) fertilizer was applied 12 days after product application, twice per week.

Broccoli

Salinas, CA – We Increased Yield

Final yield increase

202 CARTONS PER ACRE

PhycoTerra®
470 Cartons/A 1st Cut Yield

Control
358 Cartons/A 1st Cut Yield

2X Side Dress (1gal/A) 5-6 Leaf Stage
+ 2 XFoliar (1gal/A) Cupping Stage

P = PhycoTerra® C = No PhycoTerra® Control

C P C P C P C P C P

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SNAP PEA TRIAL *Variety: Proprietary*

INCREASED NUMBER OF HARVESTS – SALINAS, CA

PhycoTerra® Organic

APPLICATIONS

Conventional Trial

1. UTC (8 rows)
2. PhycoTerra® (2 acres) – 1 drip application at 1gal/A ($40/A)
   - 3 weeks prior to harvest

Organic Trial

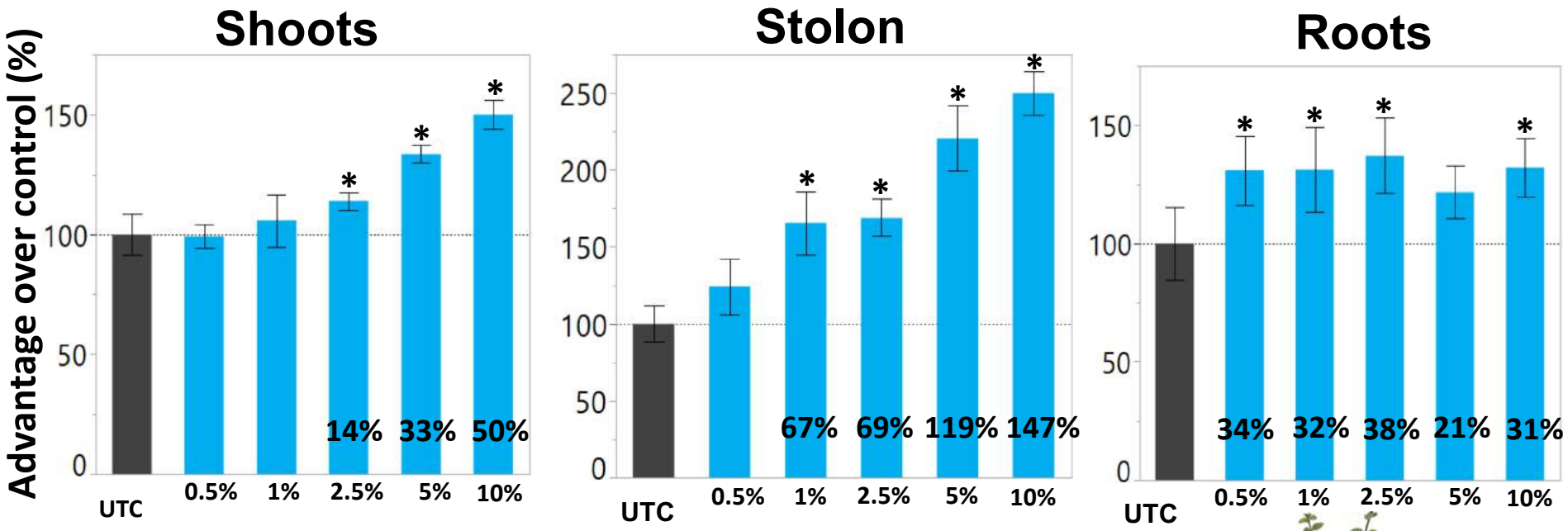
1. UTC (8 rows)
2. PhycoTerra® Organic (2 acres) – 1 drip application at 1gal/A ($40/A)
   - 3 weeks prior to harvest

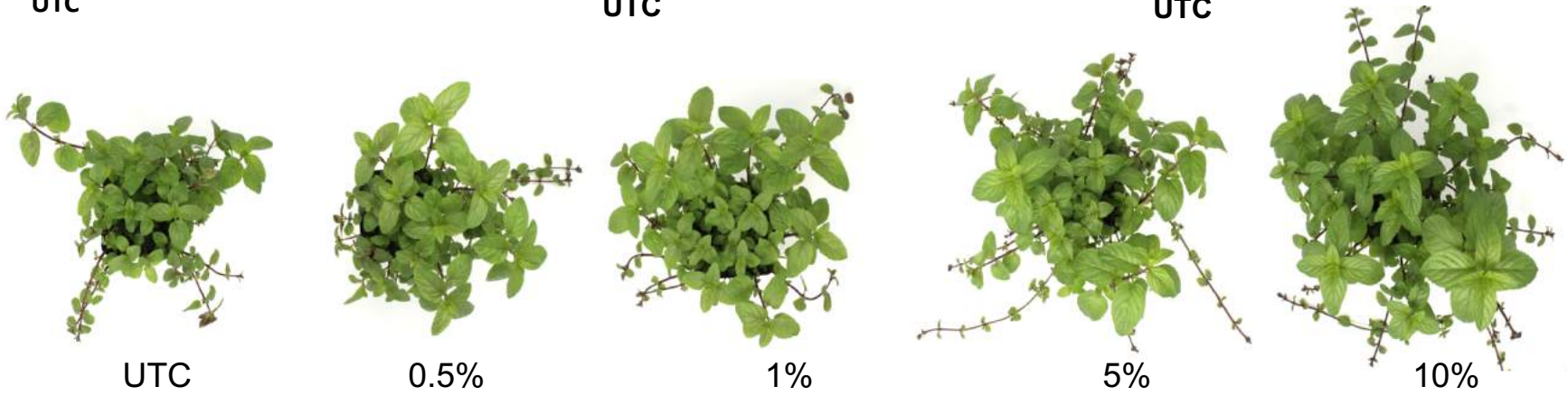
RESULTS

- ✓ More flowers and extended flowering interval
- ✓ 4 harvests from PhycoTerra® Organic and PhycoTerra® compared to 2 harvests from respective UTC rows

HELIAE AG SCIENCE MINT TRIAL

PHYCOTERRA® ORGANIC AS SOIL DRENCH

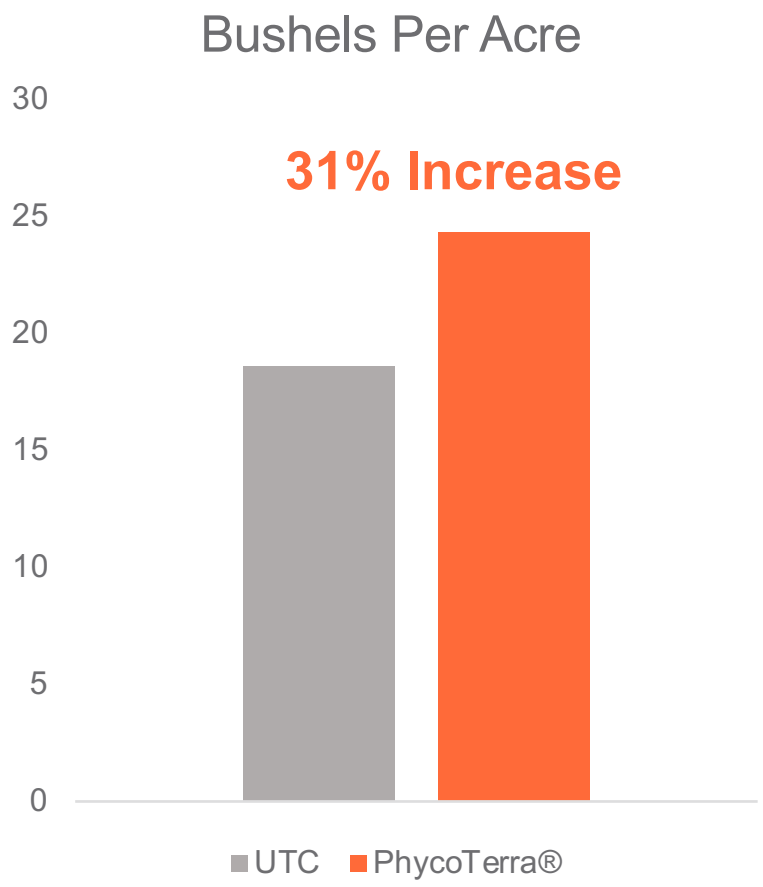




Note: three application of PhycoTerra® Organic with harvest 49 days after plug transplanting.

IMPROVED SOYBEAN YIELD

5.7 Bushels Per Acre Increace – Van Buren, AR



Rate: 0.5 Gal/A in-furrow
Frequency: Single Application at seeding
UTC: none, planting followed wheat

"Treated acres had better stand and beans appeared to hold up better in heat and drought conditions"
– TN grower

Our products improve…

TRANSPLANT PRODUCTION

Only one application at seeding!

EARLY EMERGENCE GROWTH

2 months after seeding/application

Marigolds

Impatiens

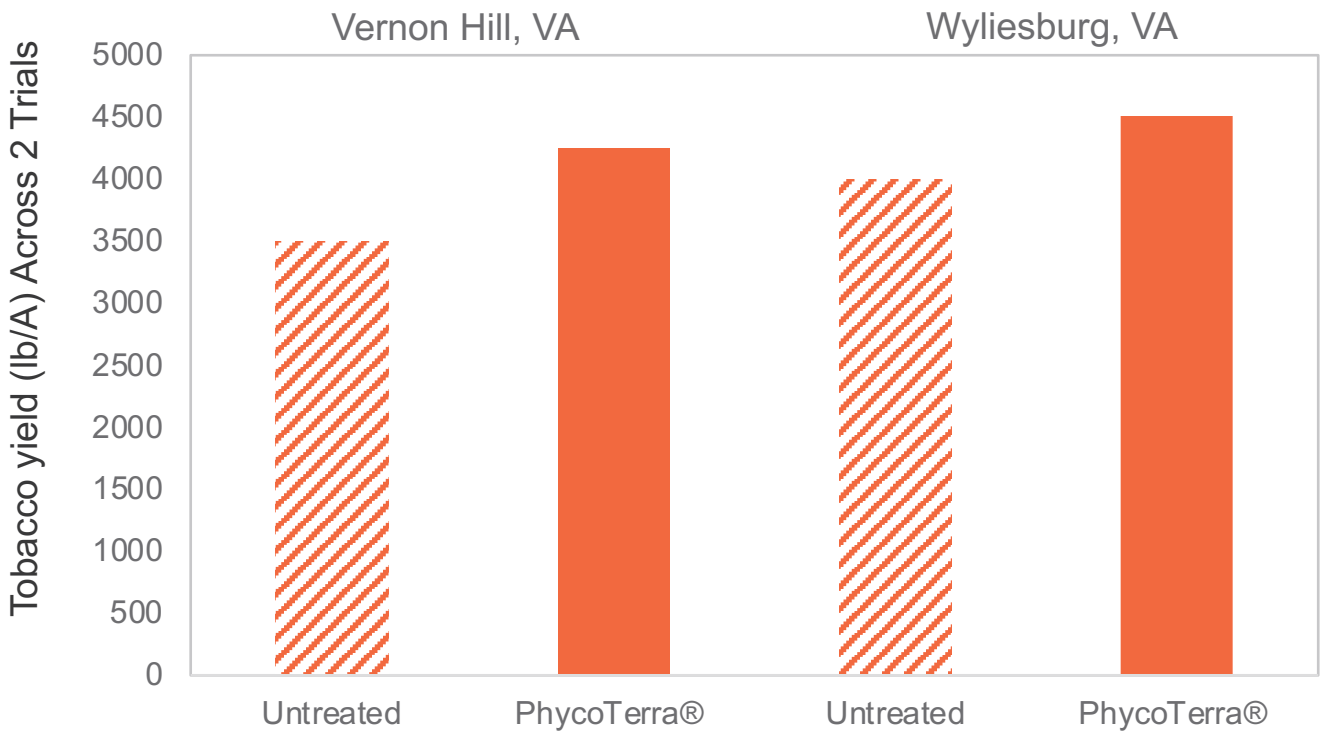
Romaine Lettuce, var. Valley Heart

Fertilizer Only | **Fertilizer + 3% PhycoTerra® Organic** | **Fertilizer + 5% PhycoTerra® Organic**

5 weeks post seeding/application

Tobacco

Vernon Hill & Wyliesburg, VA - Increased Weight, One Application at Transplant



Applied at 0.5 gal/A in transplant water

$1500-3000 more per Acre

(200% increase in quality score for 1st harvest)

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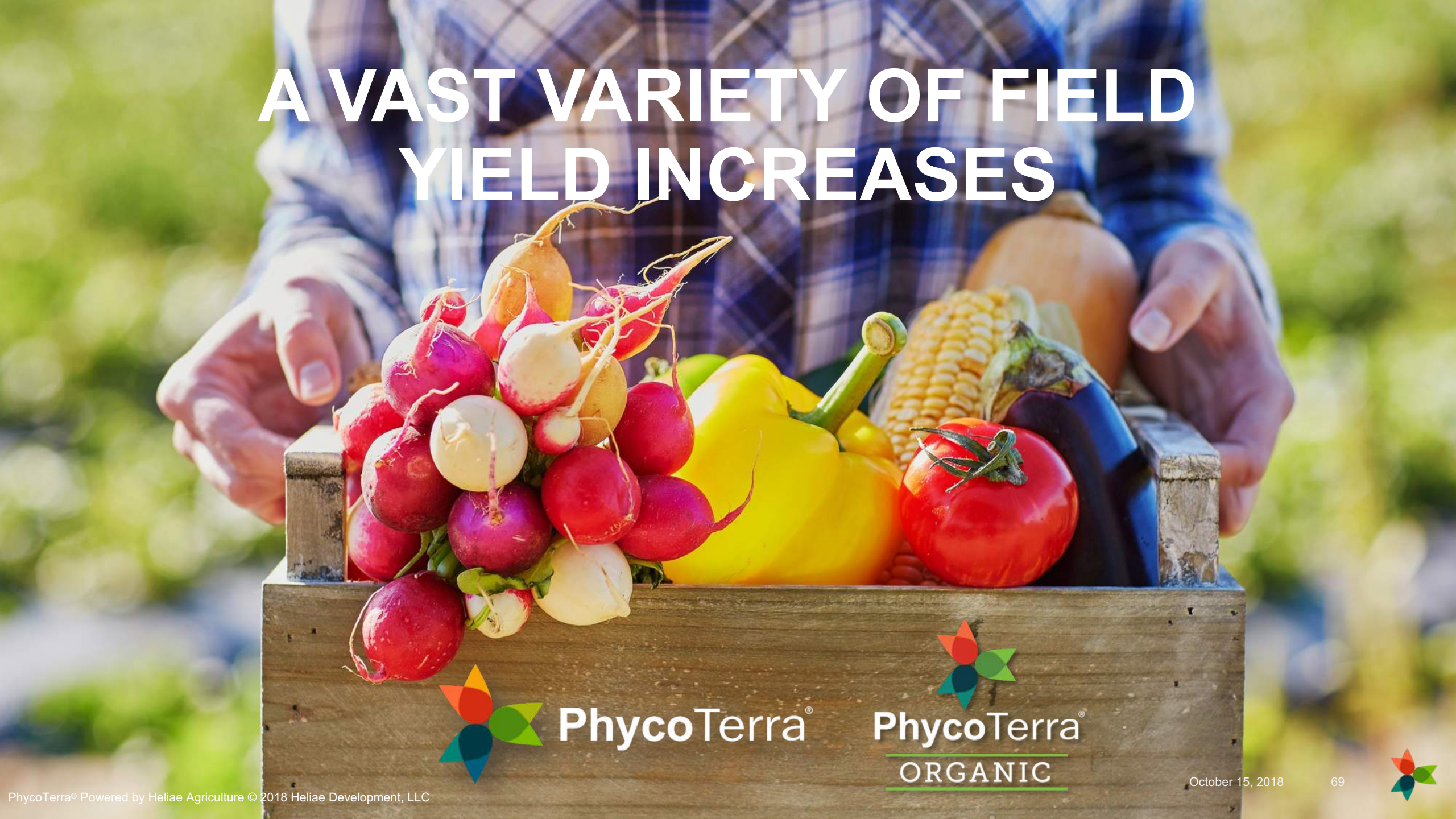
A VAST VARIETY OF FIELD YIELD INCREASES



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HOW CAN YOU BENEFIT?

We are here to work with you to maximize your ROI

INCREASED SOIL HEALTH, WATER, CANOPY & EARLY EMERGENCE

=

$$$

GROWER SAVES IN FIELD

DON’T WAIT!

Start now & grow smarter with PhycoTerra®
(800) 998-6536

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