



**SUMAGROW**

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**GROWING ORGANICALLY**



**“ IF THE WARS OF THIS CENTURY WERE FOUGHT OVER OIL, THE WARS OF THE NEXT CENTURY WILL BE FOUGHT OVER WATER. ”**

*Ismail Serageldin / World Bank Vice President*

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**WE DON'T NEED TO SAVE THE EARTH;  
IT WILL SURVIVE WITHOUT US.**

**WE NEED TO  
SAVE US.**

**“ IN THIS ERA OF TIGHTENING WORLD FOOD SUPPLIES, THE ABILITY TO GROW FOOD IS FAST BECOMING A NEW FORM OF GEOPOLITICAL LEVERAGE. FOOD IS THE NEW OIL. LAND IS THE NEW GOLD. ”**

*Lester R. Brown / Full Planet, Empty Plates*

## THE CHALLENGES

We are facing many challenges concerning the production of agricultural products, ensuring global food security, and managing our limited resources. As the world's population continues its upward march toward the expected 9.6 billion by 2050, the demand for high quantities of nutritious and affordable foods grown in sustainable and cost-effective manner is greater than ever before. Furthermore, this high-quantity and high-quality food supply should be grown in a way that supports our producers without further damaging the environment.

### WHAT WE ARE DOING IS NOT WORKING

For many agricultural producers, the solution to declining crop production has been to increase the use of fertilizer. Unfortunately, according to the USDA, food quality and quantity have declined despite this increase in nutrient application through fertilizers. Instead, what has risen



sharply are the often deleterious effects of over-fertilization: nutrient runoff pollutes waterways and groundwater and degrades farmland.

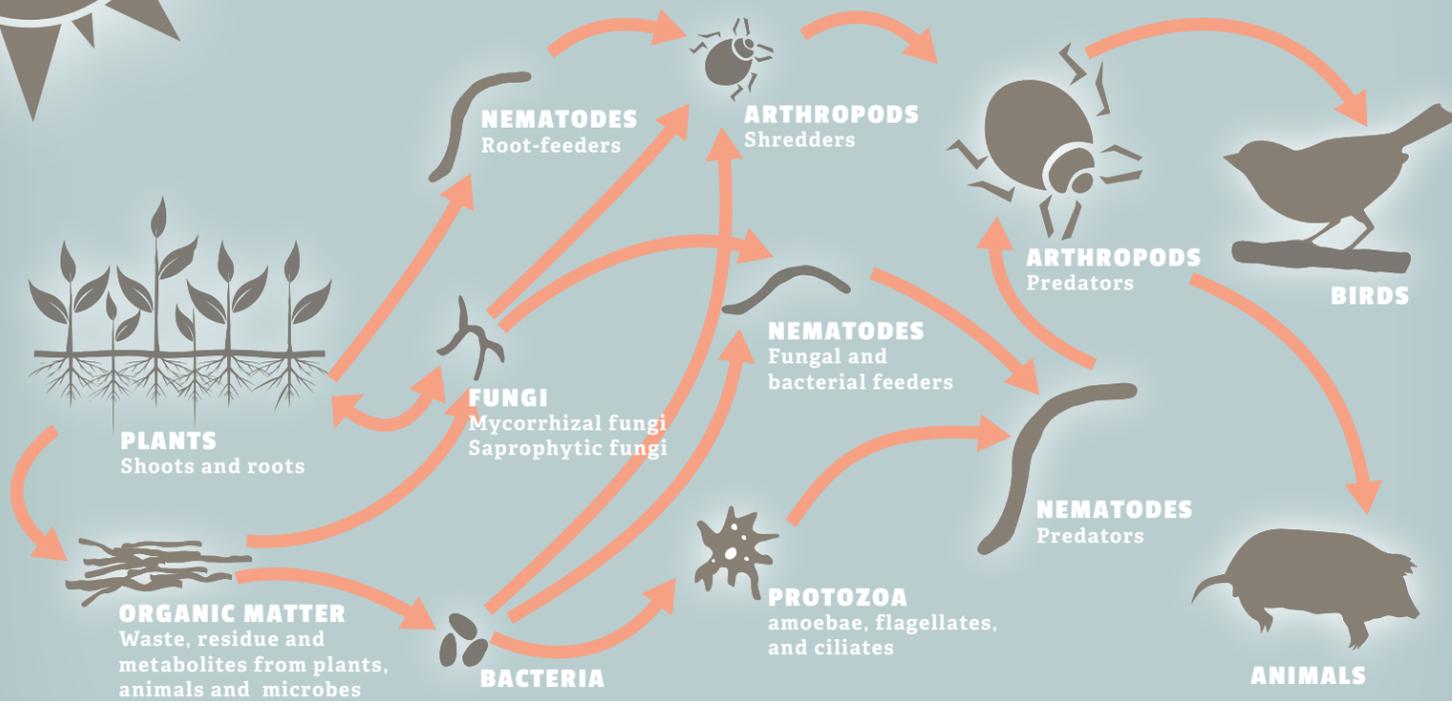
But organic producers already know this and understand that the foundation for any successful and nutrient rich crop is healthy, fertile soil. Customers are also catching on. The organic sector grew from \$3.2 billion in 2008 to \$5.5 billion in 2014 and continues to grow about 2.5 percent annually, demonstrating an increased demand for organic products as well as opportunities for growth.

However, as demand increases so must supply. In USDA organic surveys, producers report that achieving higher yields is one of the most difficult aspects of organic production.

Add in the additional labor costs, higher costs of organic inputs, increased crop losses, and longer waits for harvest and growing organically can be a challenge.

We understand these unique challenges that producers who grow organically face and have developed our products to address these challenges and allow the organic producer to maximize yields, reduce inputs and reduce losses. In the next few pages you will see how and why.

# THE SOIL FOOD WEB



## FIRST TROPHIC LEVEL:

Photosynthesizers

## SECOND TROPHIC LEVEL:

Decomposers

Mutualists

Pathogens, parasites, Root-feeders

## THIRD TROPHIC LEVEL:

Shredders

Predators

Grazers

## FOURTH TROPHIC LEVEL:

Higher level predators

## FIFTH AND HIGHER TROPHIC LEVELS:

Higher level predators

## SOIL NOT DIRT.

Fertile soil is thriving with living organisms and depends upon a sustainable management system to keep this fertility in balance. Thanks to advances in technology, we know that there can be 100 million to 1 billion bacteria in a single teaspoon of soil and several to several hundred yards of fungi.

These microorganisms are the foundation and are fundamental to any productive crop. We now understand, like never before, why they are there and the role that they play. They just might save the world.

Bio-Soil Enhancers is continuing to develop solutions to address the growing challenges in agriculture through the science of microorganisms.

# THE SUMAGROW® SOLUTION

## THERE IS A BETTER WAY

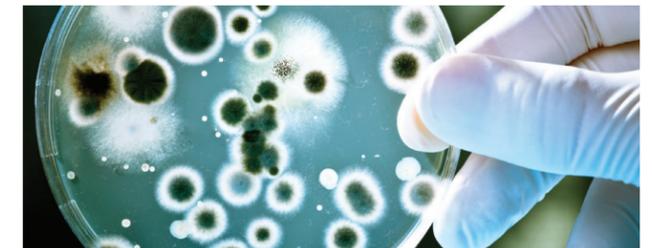
Products containing SumaGrow® yield high quality crops and grasses with less irrigation, reduced inputs and at competitive, stable pricing. Our award-winning formulations are designed for use on a broad spectrum of crops in diverse climates and varied soil types and conditions to achieve optimal crop performance.

Additionally, SumaGrow® has demonstrated the ability to bio-remediate many soil contaminants. The microorganisms contained in SumaGrow® products are capable of using chemical contaminants as a metabolic energy source, rendering many contaminants harmless or less toxic.

SumaGrow® products have been successfully utilized throughout the United States and in over 40 countries around the world for crop production, land reclamation, and research and development. Overwhelmingly, the results have demonstrated how the technology of SumaGrow® benefits the user, the plant, the soil, and the environment.

## ADVANTAGES AND BENEFITS INCLUDE

- Improved land water infiltration and holding capacity leading to reduced irrigation needs
- Improved fertilizer efficiency leading to reduced fertilizer usage, nutrient waste, and contamination
- Increased plant health for optimal crop performance and greater resistance to environmental stresses including extreme temperatures and drought
- Increased Brix or higher nutrition in plants, grasses, and foods
- Organic (OMRI listed products available)



## HOW IT WORKS

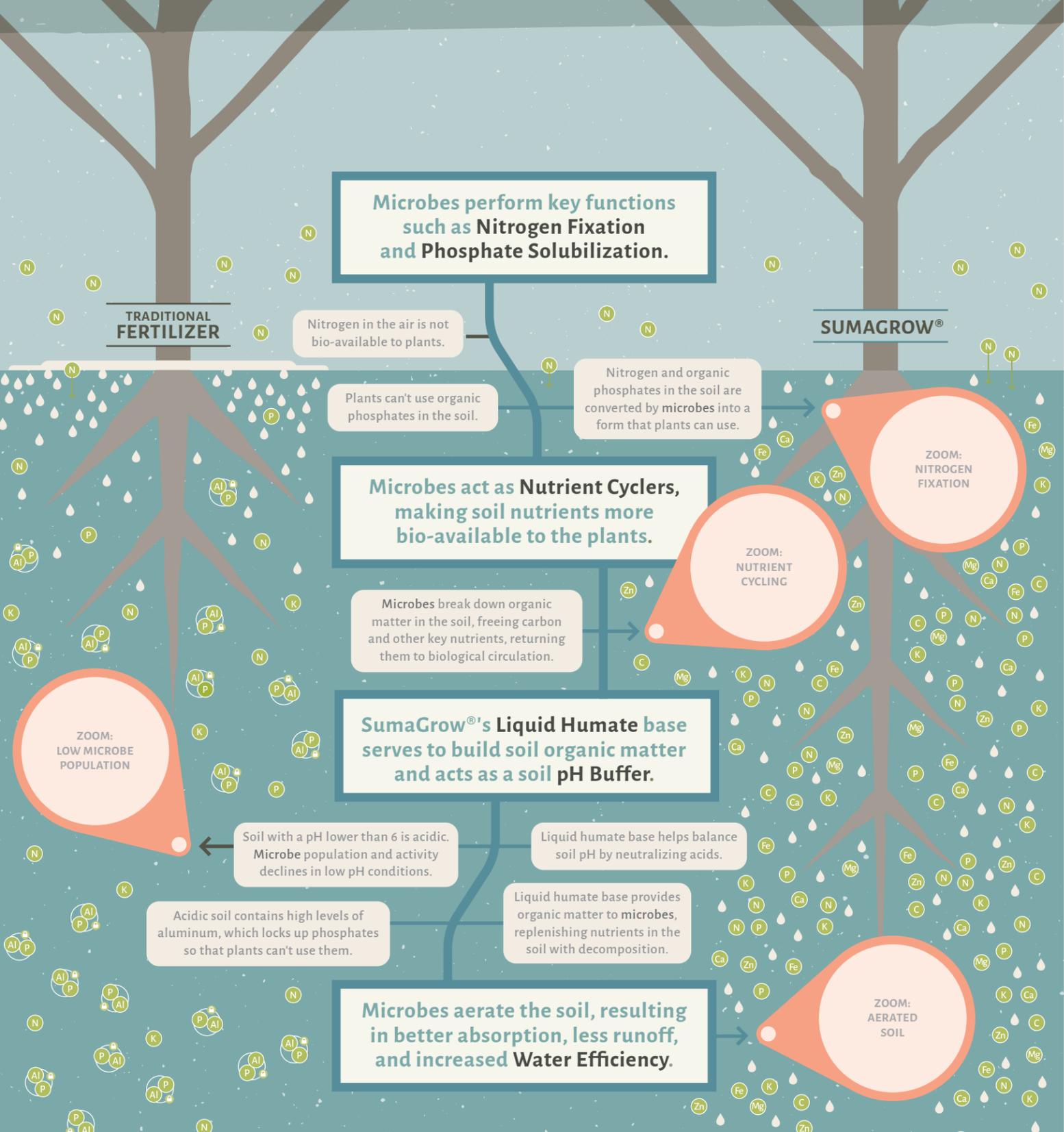
Crops will not grow without microorganisms.

There are billions to hundreds of billions of soil microorganisms in a handful of a healthy soil. These bacteria and fungi form symbiotic relationships with plant roots and cycle nutrients and water to plants. Reintroducing and maintaining the right bacteria and fungi in problem and depleted soils increases soil fertility and crop productivity while reducing the environmental impact of overfertilization.

SumaGrow® is a blend of soil-borne microorganisms selected for their abilities to achieve higher yielding, higher quality plants and grasses by restoring and maintaining soil health and fertility. Products containing SumaGrow® work within the root zone of the plant. Products containing SumaGrow® are all natural, organically based, free from genetically modified organisms, and have some of the highest microbial concentrations on the market. The microorganisms are suspended in liquid humates and have been functionally characterized, identified, and tested using a broad spectrum of crops.

By improving soil health, SumaGrow® has demonstrated the ability to significantly reduce agricultural inputs while simultaneously improving crop quality and yield.

# KEY MICROBIAL ACTIONS



# INNOVATION AT ITS BEST

While the idea of microbial inoculants for stimulating crop production is not new, the careful and deliberate design of a formulation that contains multiple, naturally occurring phylogenetic groups of organisms with complementary functionalities is significant. Putting these microorganisms together in a manner in which they retain viability over a long period of time at ambient temperature is innovation at its best.

*Microbes contained in SumaGrow® are both environmentally responsible and user friendly, promoting plant and soil health.*



## 5 REASONS SUMAGROW® REVOLUTIONIZES CROP PRODUCTION

- 1 The base product contains multiple different microbial strains compared to competitors with typically one strain, and rarely more than three strains.
- 2 The product has multiple functions compared to competitors with typically one function and rarely more than two functions. Having more than one function is relatively unique in the industry.
- 3 Unlike most counterparts that require refrigeration, SumaGrow® formulations retain viability over a long period of time at ambient temperature. This is significant when considering that most developing nations are known to have a lack of infrastructure to be able to transport products in a timely manner.
- 4 SumaGrow® products have a higher concentration or CFU (colony-forming units per milliliter) compared to their competitors with lower concentrations.
- 5 The product actually works!

The following field trial results and testimonials show the significant benefits gained when using products containing SumaGrow®. Though conducted on a variety of crops, the results reflect the benefits achieved when using products containing SumaGrow®.

# INCREASES YIELDS AND REDUCES FERTILIZER DEMANDS

Products containing SumaGrow® can help overcome the dependency on expensive organically-based fertilizers while maximizing crop production. Over fertilization destroys the health of the soil, damaging its ability to hold water, and encourages the run-off of nutrient rich top soil

from 15 to 60 percent, depending on the crop, soil condition and farm management program, while still achieving maximum crop yields. In many trials involving forage grasses, fertilizer rates have been reduced dramatically, often with better results than 100 percent fertilizer.



and applied fertilizers. Even organic fertilizers, like chicken litter, are prone to wash off in heavy rains and can negatively impact the environment.

Products containing SumaGrow® have demonstrated the ability to significantly reduce a standard fertilizer program

Over the next several pages we will demonstrate these benefits through field trial results conducted by universities, specialized testing facilities and independent consultants. Although not all of these results are from organic trials, they all compare crops using SumaGrow with no fertilizer to fertilizer only or a control with no inputs.

## FORAGE TRIAL – KANSAS

A study was conducted over five months by Dr. Allen Williams, PhD., a noted grass fed cattle expert, at the LHOP Ranch in Independence, Kansas owned by the Tallgrass Beef Company. The results showed the SumaGrow® product achieving a greater Dry Matter (DM) yield increase, higher brix levels and more grazing days in forage grass compared to two control plots; one treated with an organic, liquid broiler litter (LBL) and the other with nitrogen (46-0-0).

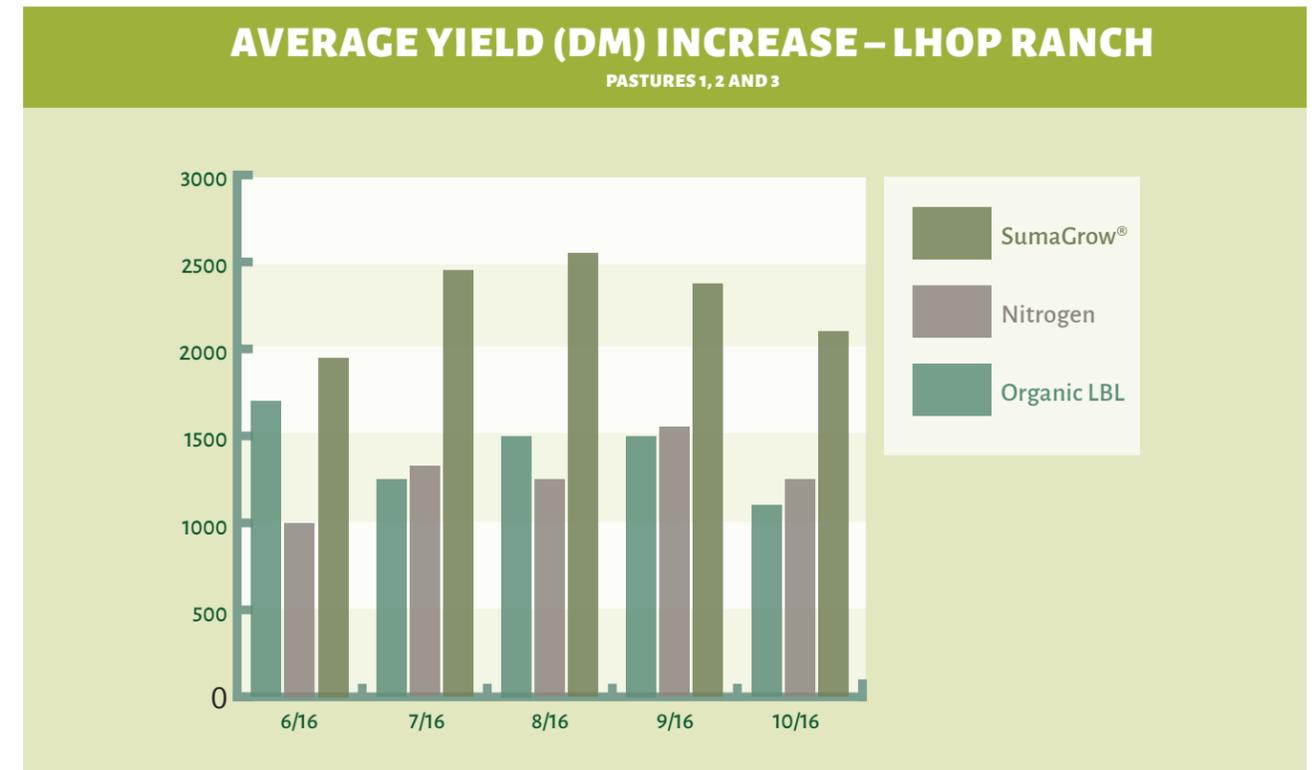
Approximately 200 acres were allocated to this demonstration project. Group 1 Treatment pastures were split into three equal sized grazing paddocks consisting of Kentucky 31 Fescue inter-seeded with Brassicas, Chicory, and White Clover (Pastures 1, 2, 3).

Group 2 Treatment pastures were split into three equal sized grazing paddocks of 33 acres each consisting of common

Bermuda grass inter-seeded with white clover (Pastures 1, 2, 3). The chart below pictorially shows the average yield



measurements from the Group 2 Treatment pastures which have lower overall DM average yields.



Forage DM yields averaged 28–40 percent higher for the SumaGrow® treated pastures compared to the LBL, and 23 to 62 percent higher for SumaGrow® treated pastures compared to the nitrogen treatments. Treatment results indicated advantages for SumaGrow® over both the organic LBL and the nitrogen treatments. As anticipated, the nitrogen application showed “quick hit” results which tapered off significantly after 30 to 45 days. The best residual impact was noted with the LBL and SumaGrow® with SumaGrow® outpacing the LBL throughout the entire 150 day trial period.

The below chart shows the average brix measurements for Bermuda grass and white clover (leaf) in the Group 2 Treatment pastures. These two grasses were the only grasses in common, for which data was available for all weeks during the test period, common to all three grazing paddocks.

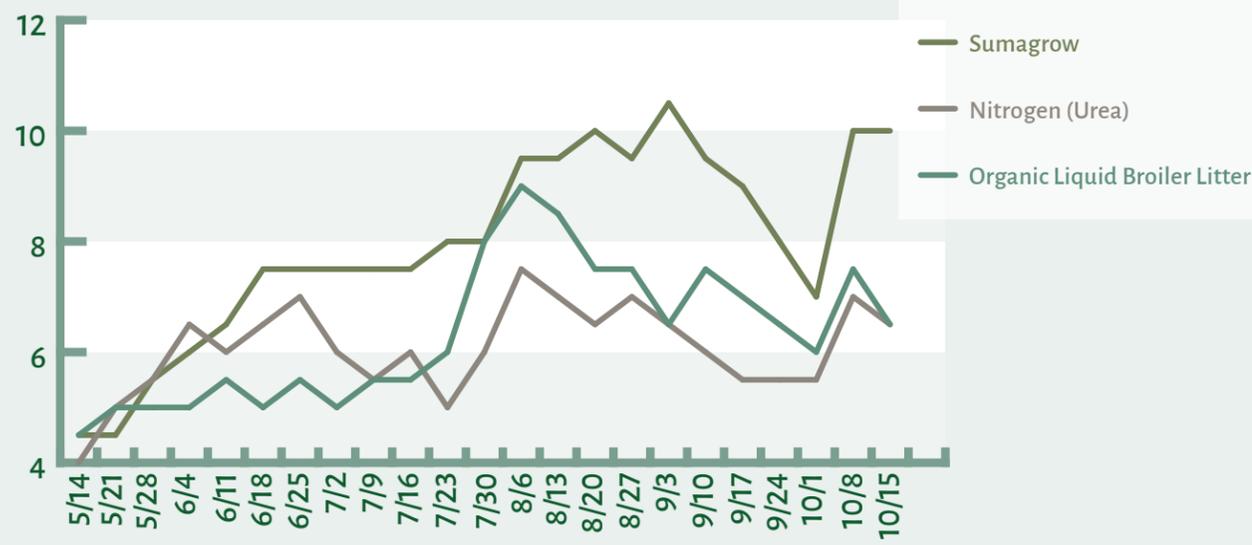
The results showed SumaGrow® achieving a greater increase in average overall brix levels compared to the control plots

treated with an organic, liquid broiler litter (LBL) and to control plots treated with nitrogen (46-0-0). The SumaGrow® brix levels were noticeably higher than the organic LBL or the nitrogen.

Finally, over the 150 day grazing period, SumaGrow® inside treated pastures provided 21 more grazing days compared to the liquid broiler manure and 33 more grazing days than the nitrogen treated pastures.

### AVERAGE BRIX LEVELS – LHOP RANCH

BERMUDAGRASS & WHITE CLOVER (LEAF) ONLY PASTURES 1, 2 AND 3



### FORAGE TRIAL – KENTUCKY

A study on BMR sorghum was conducted by Murray State University in Western Kentucky. The results showed a higher Average Daily Gain (ADG), a higher Animal Unit month (AUM), and a significant cost advantage for the SumaGrow® treated plots when compared to traditional nitrogen fertilization, raw milk, and no treatment.

The primary focus of this study was to determine the effectiveness of different methods of alternative pasture inoculation compared to traditional nitrogen fertilization (Grower Standard) on beef steer summer grazing performance and ADG. A twelve acre plot was used to measure three different methods of pasture inoculation. The variables measured were brix content, Average Daily Gain and overall animal performance. The 12 acre pasture was divided into four test plots containing 3 acres each. Each section received a different method of treatment with one serving as a control. The treatments regimens were:

- Treatment 1**  
Nitrogen application, in the form of Ammonium Nitrate (NH<sub>4</sub>NO<sub>3</sub>) at a rate of 60 units per acre per application (*Grower Standard*).
- Treatment 2**  
One gallon per acre of SumaGrow® (SG) applied at a split rate of 0.5 gallons per acre in May and 0.5 gallons per acre in June (*SumaGrow®*).
- Treatment 3**  
Two gallons per acre of raw milk (RM) applied at the 2 gallons per acre rate in May, June, July (*Raw Milk*).
- Treatment 4**  
A control plot with no applications of any fertilization products applied (*Control*).

Thirty-two cross bred steers were divided into four equal groups. Steers were randomly assigned to their respective treatment group. The steers weighed an average of 628 pounds at the beginning of the first grazing period.

BMR sorghum was planted no-till at a seeding rate of 19 pounds per acre. The four groups of steers were moved to fresh grazing paddocks when approximately 50 percent of the available forage DM in each paddock had been



consumed. Cost per acre for treatment and application costs was \$137.01 for the Grower Standard, \$40.00 for SumaGrow®, \$45.00 for raw milk, and \$0.00 for the control.

**RESULTS:**  
Growing conditions were relatively stable throughout the grazing period with adequate moisture for forage performance. However, temperature and humidity were challenging for the steers, particularly during the second grazing period in July and August.

The ADG were significantly higher for the steers grazing the SumaGrow® and the Raw Milk treatments compared to the Grower Standard and the Control treatments. Mean ADG values for the SumaGrow® and Raw Milk were 2.35 lbs/hd/d and 2.26 lbs/hd/d, respectively, while the ADG for both the Grower Standard and Control were 2.08 lbs/hd/d.

This would result in an additional gain per steer for the SumaGrow® treatment of 40.5 pounds for a 150-day warm season grazing period when compared to either the Grower Standard or the Control.

In calculating actual days grazed per number of head grazed per treatment over the summer grazing trial period, Animal Unit Months (AUM) were calculated. An AUM is defined for this trial as the number of 750 pound beef steers that one acre of forage can support for every 30 day period. The AUM for the SumaGrow® and the Raw Milk were significantly greater than the Grower Standard or Control treatments with AUM for the SumaGrow® and Raw Milk at 3.67 hd/ac/

mo compared to 1.67 hd/ac/mo for the SumaGrow® and 2.00 hd/ac/mo for the Control.

Per acre cost analysis for the treatment and application costs indicated an advantage of \$101.45 per acre for the SumaGrow® treatment compared to the Control, with a \$67.63 per acre advantage for the Raw Milk treatment compared to the Control. However, the Grower Standard treatment, due to the increased cost of NH<sub>4</sub>NO<sub>3</sub> showed a \$170.01 disadvantage compared to the control.

The SumaGrow® had the best overall performance with higher ADGs, increased AUM's, and better return on investment.

### FORAGE AND GRAZING PERFORMANCE

	BRIX	ADG (LBS)	AUM	COST/ACRE	ADVANTAGE
<b>SUMAGROW®</b>	4.50	2.35	3.67	\$40.00	+\$101.45
<b>RAW MILK</b>	4.75	2.26	3.67	\$45.00	+\$67.63
<b>GROWER STANDARD</b>	4.50	2.08	1.67	\$137.01	-\$170.01
<b>CONTROL</b>	4.00	2.08	2.00	\$0.00	-----

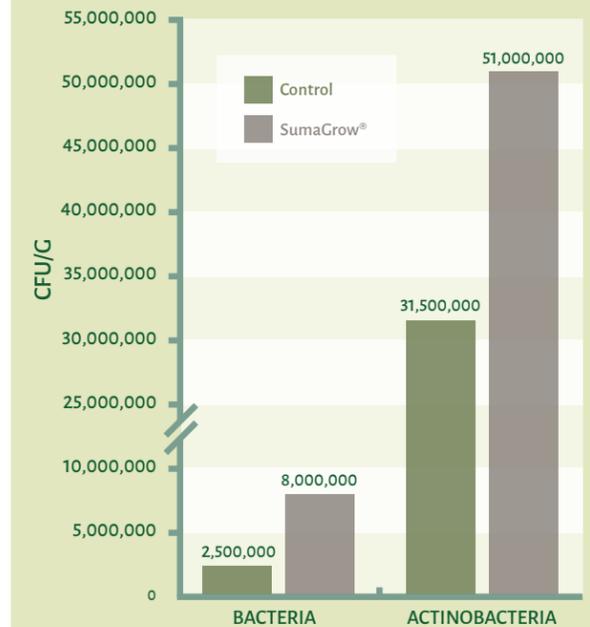
### ORGANIC BANANAS IN THE DOMINICAN REPUBLIC

Research was done in 2012 to determine the impact a product containing SumaGrow® had on strengthening the root system in organic banana plants in Mao, Dominican

Republic. One gallon of SumaGrow® was applied on first application, and .5 gallon on the following three applications. Soil, root and foliage samples were then tested.



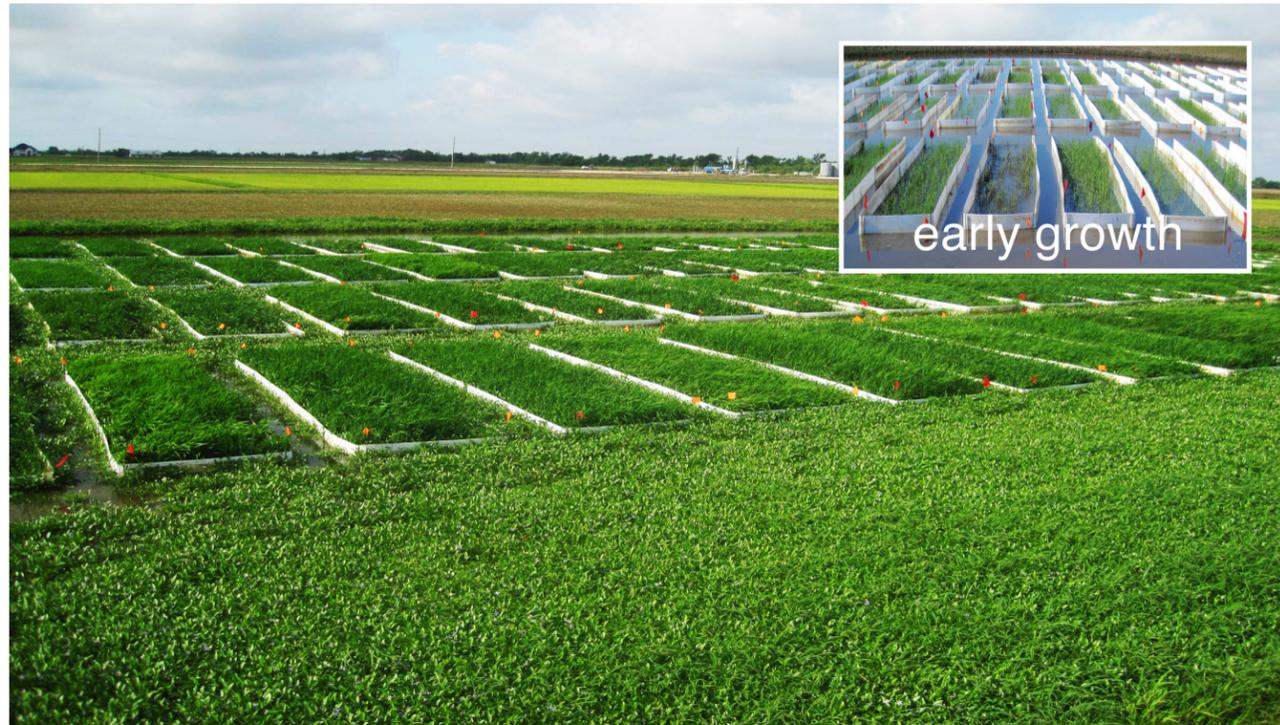
### PHYTOSANITARY DIAGNOSIS



### ROOT LAB ANALYSIS

	TOTAL ROOT	FUNCTIONAL ROOT	DEAD ROOT
<b>SUMAGROW®</b>	356	282	15
<b>CONTROL (NO TREATMENT)</b>	171	143	28
<b>CHANGE +/-</b>	+185	+139	-13

*The causes of banana root system deterioration are generally the same as those determining yield. Healthy roots have a correlation with higher yielding plants.*



## ORGANIC RICE IN TEXAS

Former USDA official Jodie Cammack, worked for the USDA in rice research and varietal improvement for 30 years. When first introduced to SumaGrow®, Cammack agreed to test SumaGrow® on a small border study of organic rice for the USDA. “I’ve used pelletized chicken litter, bone and blood meal and 10 - 15 different microbial products and compost teas,” Cammack said, “We tried a little bit of everything.”

One reason SumaGrow® appealed to Cammack was the reasonable pricing and recommended application rate. Compared to the recommended 8-10 gallons per acre of other products, SumaGrow®’s recommended 1-1.5 gallons per acre was more affordable and proved to be very effective.

Cammack applied SumaGrow® to eight plots of organic rice leaving eight plots untreated. Every rice plot treated with SumaGrow® grew quickly out of the water and was 1/2 inch

taller than the untreated plots. The untreated plots of rice were still underwater and stressed.

For the next three weeks, Cammack noted the SumaGrow® treated plots remained taller and thicker than the untreated plots. However, the true results showed in the harvest.

SumaGrow® treated rice averaged 980 lbs more per acre more than the untreated rice. That equates to an additional \$300 profit per acre.

## ORGANIC CORN IN MARSHALL, WISCONSIN

The use of a product containing SumaGrow® with the recommended 50 percent (on average) fertilizer reduction has shown to improve crop performance and increase yields. In the trial shown below, when the fertilizer application was reduced by 50 percent and a product containing SumaGrow® was added, the corn yields increased. It should be noted that even when the fertilizer application was not

reduced, when a product containing SumaGrow® was added it still out-performed the grower standard and increased profits, even with the additional input costs. However, the maximum yield increase and profit benefit were found when fertilizer was reduced by 50 percent when using a product containing SumaGrow®.

### CORN RESULTS

	YIELD (BU/ACRE)	INCREASE OVER GROWER STANDARD	TOTAL TREATMENT COST/ACRE	VALUE/ACRE AT \$15.90 PER BUSHEL	REVENUE PER ACRE	INCREASE PROFIT PER ACRE
<b>SUMAGROW®</b> + 50% GROWER STANDARD	115.00	+ 21%	\$91.87	\$1,828.50	\$1,736.63	+ \$329.88
<b>SUMAGROW®</b> + GROWER STANDARD	106.00	+ 11.6%	\$143.75	\$1,685.40	\$1,541.65	+ \$134.90
<b>GROWER STANDARD</b>	95.00	----	\$103.75	\$1,510.50	\$1,406.75	----

# INCREASES WATER EFFICIENCY THROUGH HEALTHIER SOIL

Soil compaction is a worldwide problem that is responsible for 25 to 50 percent yield reductions in some regions of the United States and Europe. According to the NRCS, “On-farm losses through land compaction in the USA have been estimated at 1.2 billion dollars.”

Good soil structure or tilth is fundamental for the soil’s ability to “hold” water. Heavily compacted soils have a reduced ability for water infiltration and drainage and contributes to land degradation, the eutrophication of surface water, and the contamination of ground water. Compacted soil forces the roots to exert more energy or force to penetrate the compacted layer to reach the vital nutrients and minerals, leading to reduced crop production and increased crop losses.



Farmers understand that water challenges will continue to increase and that irrigating crops will become more regulated and expensive on both ends of production—as an input and run-off.

The following field trials demonstrate the ability of products containing SumaGrow to decrease soil compaction, bio remediate contaminants, and maximize yields.

## HEALTHY SOIL PERFORMS FIVE VITAL FUNCTIONS:

- 1 **REGULATES WATER:** Soil helps control where rain, snowmelt, and irrigation water goes. Water and dissolved solutes flow over the land or into and through the soil.
- 2 **SUSTAINS PLANT AND ANIMAL LIFE:** The diversity and productivity of living things depends on soil.
- 3 **FILTERS POTENTIAL POLLUTANTS:** The minerals and microbes in soil are responsible for filtering, buffering, degrading, immobilizing, and detoxifying organic and inorganic materials, including industrial and municipal by-products and atmospheric deposits.
- 4 **CYCLES NUTRIENTS:** Carbon, nitrogen, phosphorus, and many other nutrients are stored, transformed, and cycled in the soil.
- 5 **SUPPORTS STRUCTURES:** Buildings need stable soil for support, and archeological treasures associated with human habitation are protected in soils.

## MDC FIELD TRIAL

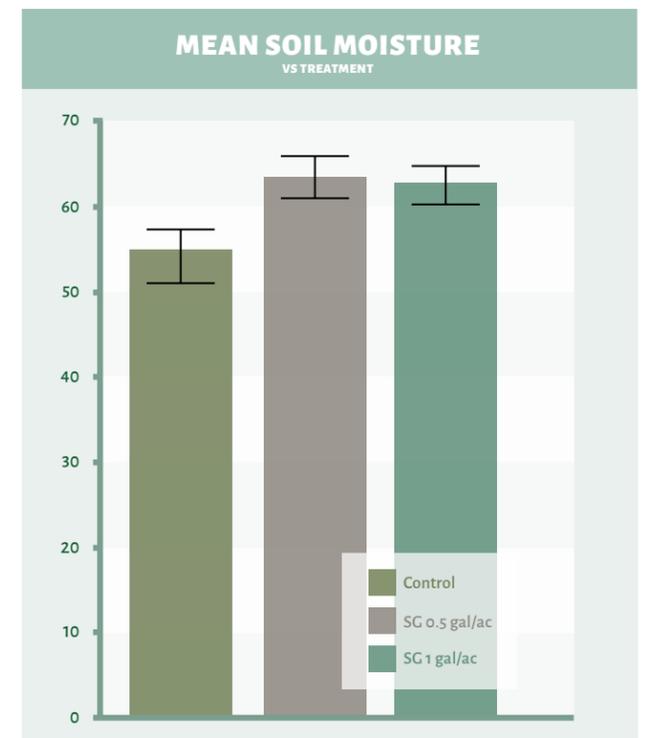
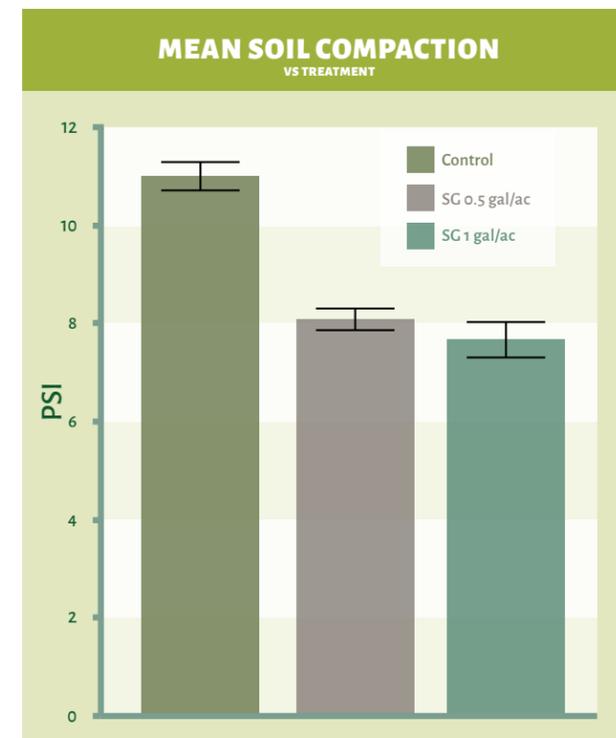
A study managed by the Missouri Department of Conservation (MDC) was conducted with SumaGrow® on the Ionia Ridge Conservation Area in Missouri. This 233 acre area lies within the Hi Lonesome Focus Area for recovery of the greater prairie chicken and native habitat for other grassland species. The study on this area focused on interests in pursuing the potential for soil microbial products to improve success of native tallgrass seedling establishment and also to evaluate the effect on stand persistence. This area was an active row crop and cattle grazing farm prior to the acquisition by the Missouri Conservation Department in 2008.

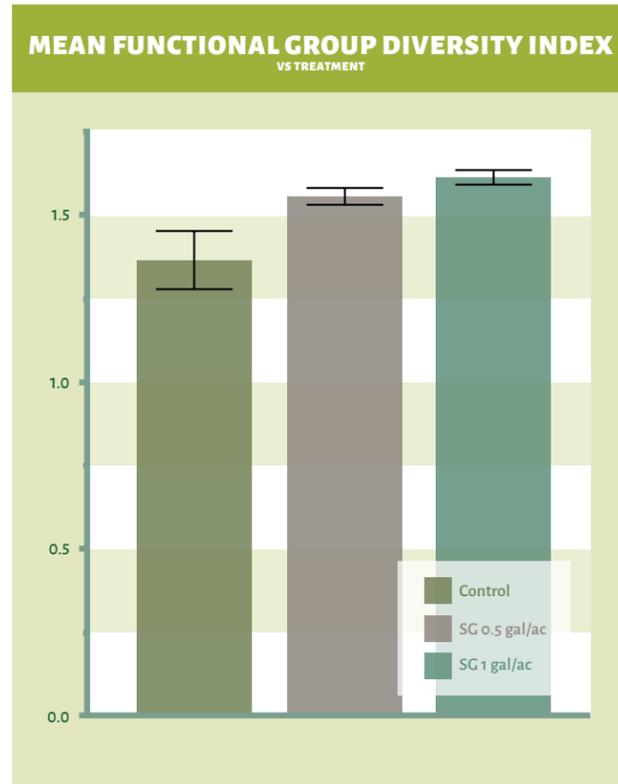
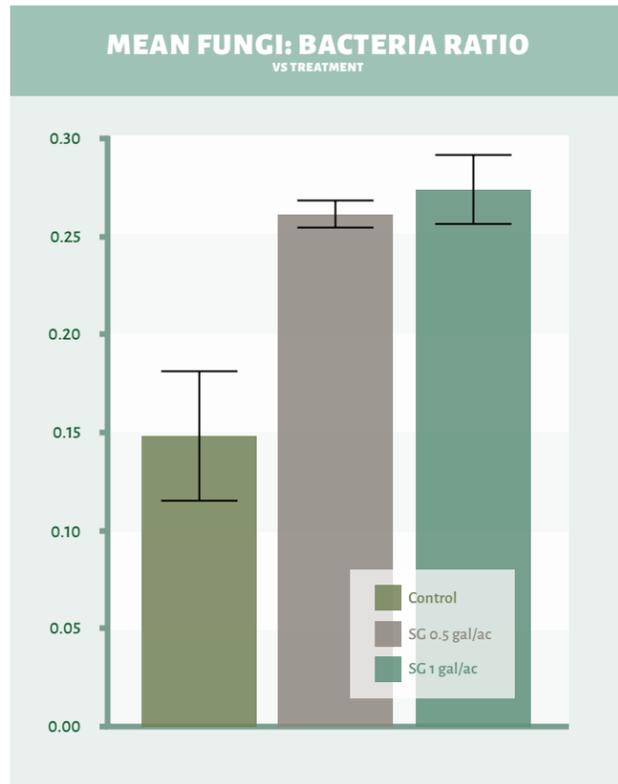
The main parameters of this study focused on the differences in the physical and biological properties of the soil between control and SumaGrow® treatment groups within the Conservation Area. When comparing soil treated with a product containing SumaGrow® with untreated



plots, the treated soil experienced a 15+ percent increase in soil moisture potential. This benefits forage production during either drought or excessive rainfall.

Rain and moisture are captured by the soil instead of remaining on the surface to volatilize off or run-off into streams and waterways, most likely taking valuable top soil and nutrients with it. For the grower who is struggling with muddy, overly wet soil, fertile ground dries out quicker as the water penetrates the soil instead of remaining on the surface, slowing down planting or damaging grasses.





Additionally, the study found a 26 percent reduction in soil compaction in the SumaGrow® treated soil. Reduced soil compaction means that the soil is softer and more aerated, so plant roots can grow more easily and reach deeper to tap the water and nutrients held within the subsoil.

This study found that SumaGrow® treated soil contained a higher functional group diversity index in relation to the microbial populations within the treatment areas. This can be taken to mean that the SumaGrow® treated areas had a more balanced microbial population, leading to more productive soil in the end.

The mean functional group diversity indices for the treatment groups were significantly higher for the SumaGrow® treated groups. The 1 gallon per acre rate versus the control had the highest mean functional group diversity (mean=1.61, p=0.0099\*), the 1/2 gallon per acre rate versus the control had the

second highest mean functional group diversity (mean=1.56, p=0.034\*), and there was no significant interaction between the SumaGrow® treatment groups in relation to mean functional group diversity (mean=1.37, p=0.47).

The mean fungal bacterial ratios for the treatment groups were significantly higher for the SumaGrow® treated groups. The 1 gallon per acre rate versus the control had the highest mean fungal bacterial ratio (mean=0.27, p=0.0029\*), the 1/2 gallon per acre rate versus the control had the second highest mean fungal bacterial ratio (mean=0.26, p=0.0054\*), and there was no significant interaction between the SumaGrow® treated groups in relation to mean fungal bacterial ratios (mean=0.15, p=0.33).

## ARISE RESEARCH AND DISCOVERY, INC. (2011)

The validation testing at the Arise Research and Discover Facility, a specialized testing facility in Eastern Illinois, was performed primarily to determine the effect of a product containing SumaGrow® on the amount of tile runoff and the percentage of nitrates contained in the runoff water.

The Formazon results also demonstrate that quality also improves for the soil which does not run-off. The Formazon test is akin to the speedometer reading of microbial activity in the soil – the higher the number, the better the soil's ability to supply plants with available nitrogen. The plots

	100% FERTILIZER ONLY	SUMAGROW® +100% FERTILIZER	% DECREASE	SUMAGROW® +50% FERTILIZER	% DECREASE
RUNOFF WATER 7/20 (GALLONS)	77.0	40.0	48.05%	36.5	52.60%
RUNOFF WATER 9/30 (GALLONS)	37.0	19.5	47.30%	16.0	56.76%
NITRATES IN RUNOFF 7/20	24.0	12.5	47.92%	15.5	35.42%
NITRATES IN RUNOFF 9/30	37.0	19.5	47.30%	16.0	56.76%

There were five test plots covered by this report; one control plot using the state-recommended amount of conventional fertilizer, two plots treated with a product containing SumaGrow® and 100 percent fertilizer, and finally two plots treated with a product containing SumaGrow® and 50 percent fertilizer.

The findings are significant. Both the SumaGrow® and 50 percent fertilizer (SG50) and the SumaGrow® and 100 percent fertilizer (SG100) decreased the amount of runoff water dramatically. SG50 reduced water runoff by an average of 54.68 percent and SG100 reduced runoff water by an average of 47.68 percent. Perhaps more importantly, the nitrates in the runoff water were significantly reduced, as well; SG50 reduced nitrates by an average of 46.09 percent and SG100 reduced nitrates by 47.61 percent, compared to the conventionally fertilized control plot.

treated with a product containing SumaGrow® increased the Formazon reading levels between 29 percent-42 percent.



## HOLDEN RESEARCH AND CONSULTING, CALIFORNIA

The following field trials were conducted by Holden Research and W Consulting in Camarillo, California to compare the growth and production effects from the use of a standard grower program (100 percent fertilizer) to one enhanced with a product containing SumaGrow®.

These particular trials were conducted on cabbage and broccoli.

The cabbage trial compared soil treated with 100 percent grower standard fertilizer to soil treated with 20 percent reduction in grower standard fertilizer amounts with the addition of a product containing SumaGrow®. Please note our standard application recommendation on average is a fertilizer reduction of 50 percent when treated with products containing SumaGrow®.

We will begin with the Penetrometer results; penetrometer testing measures the compaction or “hardness” of the soil. Softer soil equates to a higher capacity for holding water and a greater amount of water available to the plant. The penetrometer (at 300 psi) went from 6” for the grower standard replicates, treated with the standard fertilizer recommendation and without a product containing SumaGrow®, to 17.8” for the replicates treated with one gallon per acre of a product containing SumaGrow® and a 20 percent reduction in fertilizer inputs.

Moisture loss begins at the surface of the soil. This means that when the top six inches dry out, the grower standard roots are left without water. SumaGrow® treated roots still have almost 12 additional inches of soil with excellent moisture retention for cabbage growth and development. The reduced compaction is evident in the increase of root lengths. As the report conclusion states, “the root development as reported on both reading dates indicates

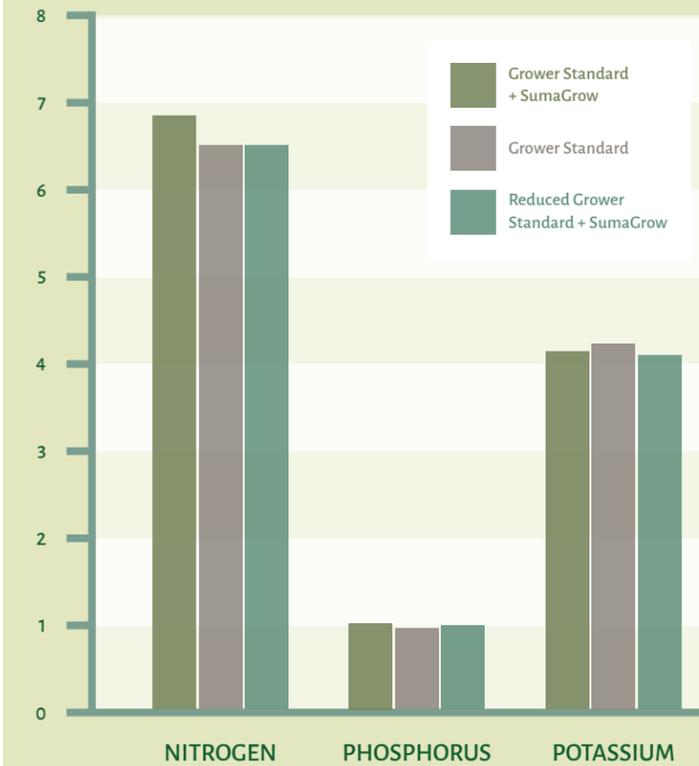
significantly better root development for the SumaGrow® treated crop over the grower standard crop of cabbage.”

Next, the trial on broccoli compared a product containing SumaGrow® in three different treatments: grower standard, or 100 percent fertilizer; grower standard with SumaGrow®; and finally, a 20 percent reduction in grower standard fertilizer with the addition of a product containing SumaGrow®. Again, our standard application recommendation is reducing fertilizer inputs by a minimum of 50 percent when treated with products containing SumaGrow®.

ORGANIC CARBON (%)	WATER PER ACRE (Gallons)
1%	14,400
2%	28,800
3%	43,200
4%	57,600
5%	80,000
8%	128,000

The results again demonstrated SumaGrow®’s ability to improve soil structure and health. The findings indicate

## PLANT QUALITY



significantly better root development for the reduced grower standard with SumaGrow® than the grower standard crop, with or without SumaGrow®.

Data was collected for soil pressure measurements with a soil penetrometer. The SumaGrow®-treated soil did not indicate pressures of 300 psi at as shallow of a depth as did the untreated soil. Further, the readings were significantly better the second time they were checked. Also, while the broccoli head weight was essentially the same for the first two treatments (153 and 152 grams), when a product containing SumaGrow® was added to a reduced fertilizer treatment, the yield increased by 9 percent (166.8 grams).

In addition to the quantity increase was an increase in the quality, evidenced by the plant analysis report (see chart).

## PLANT QUANTITY

	NOV. 8, 2012 (weight in grams)	NOV. 16, 2012 (weight in grams)
Treated with GROWER STANDARD 100% FERTILIZER	4.8	12.4
Treated with SUMAGROW + 20% FERTILIZER REDUCTION	8.4	25.0
<b>INCREASE IN ROOT MASS</b>	<b>75%</b>	<b>102%</b>

*The manufacturer believes the results would have been significantly better using Brix had the trial followed the recommended reduction of 10% when using products containing SumaGrow. As demonstrated in numerous other studies, fertilizer reduction is a necessity to obtain the maximum benefits when using a product containing SumaGrow.*

Even though nitrogen (N), phosphorous (P), and potassium (K) were reduced by 20 percent, the reduced fertilizer treatment resulted in the highest plant levels of N and P, and only marginally lower levels of K compared to the full fertilizer treatments. The report concluded that products containing SumaGrow® improve plant development, sizing and soil conditioning.

## JACK R. HAMMETT SPORTS COMPLEX, CALIFORNIA

The sports fields of Jack R. Hammett Sports Complex, owned by the city of Costa Mesa, CA, showed an impressive reduction in salts and chloride and an increase in nutrient content after a product containing SumaGrow® was applied.

According to the soil tests, less than three months after being treated with SumaGrow® the soil pH decreased to a healthier level and the chloride and salinity levels dropped 26 percent and 34 percent, respectively. Equally remarkable was that the soil moisture, or quantity of water contained in the soil, rose from 63 percent to 69 percent. These results were achieved without any significant rainfall.

Soil samples of the complex's sports fields were taken before and after treatment with a SumaGrow® containing product. Since the complex uses recycled water (treated wastewater), the pH and chloride level are constant concerns. Although chloride is an essential element, excess chloride damages plants (e.g. leaf burn and defoliation) and inhibits growth. As shown in the report, the sports field's chloride level of 210 far exceeded the target range of <150. After treatment with SumaGrow®, the chloride level decreased to 137, well within the target range. Equally important was the increase in soil moisture and decrease in soil absorption ratio (SAR), as indicated by the laboratory reports.

In short, there was more available water for optimum grass growth. Note the sports field's dramatic nutrient level increase across the board in the chart on the right.

NUTRIENT LEVELS			
DESCRIPTION	2011	2012	INCREASE
NITRATE	13	19	46.15%
PHOSPHORUS	42.2	65.4	54.98%
POTASSIUM	475	532	12.00%
IRON	29.1	38.66	32.85%
MANGANESE	.93	1.78	91.40%
ZINC	11.39	17.64	54.87%
COPPER	3.57	5.29	48.18%
BORON	.39	.58	48.72%
MAGNESIUM	351	384	9.40%
SODIUM	552	627	13.59%
SULFUR	57	62	8.77%

## MINNESOTA BLUE CORN TRIAL



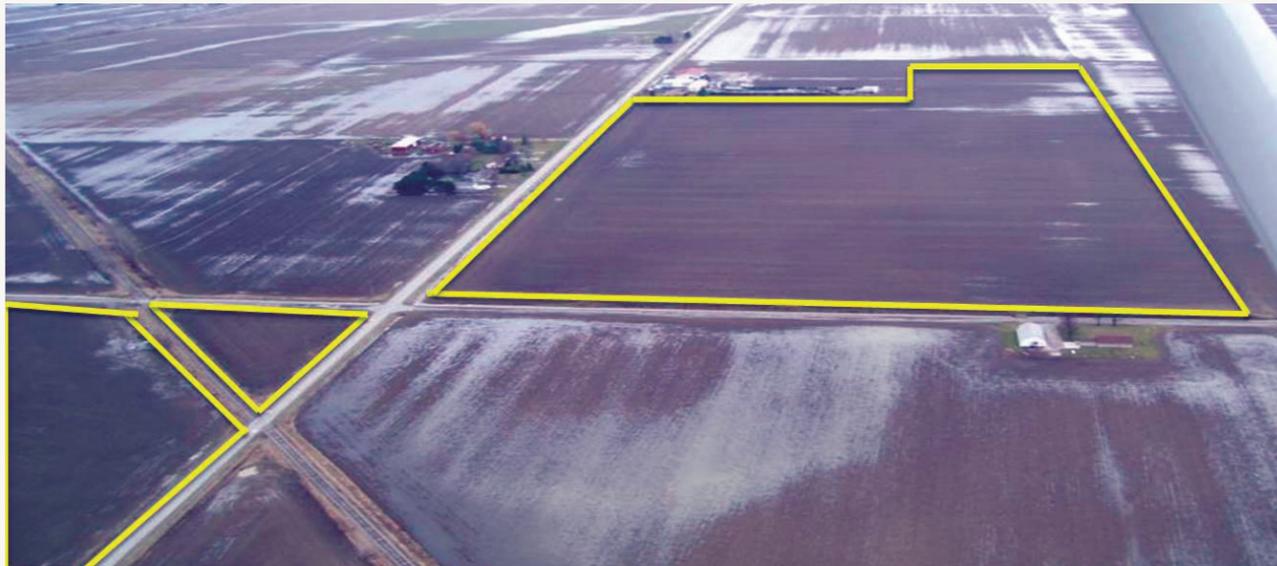
BLUE CORN PRELIMINARY RESULTS									
	SOIL COMP	SOIL TEMP	SOIL PH	SOIL MOIST	PLANT BRIX	CORN BRIX	EAR WEIGHT	EAR LENGTH	SOIL N
SUMAGROW®	5.5	69.62	6.86	60.62	10.62	11.93	285	8.88	189.37
CONTROL	7.4	69.25	6.57	58.12	6.77	7.56	210.62	8.02	163.75

## TESTIMONIALS

### HEALTHY SOIL HOLDS WATER

Bob Groulx farms 800 acres in Munger, MI. He has been using SumaGrow® products for five years and has treated corn, soybeans, wheat, and sugar beets, among other crops. Since using SumaGrow® products, Mr. Groulx has been using 100 percent less mineral fertilizers and micronutrients and 40 percent less nitrogen. He stated his plants have higher brix, increased yields, and faster

germination. Mr. Groulx shared aerial photos comparing his fields treated with a product containing SumaGrow® and the untreated neighboring fields several days after a heavy rain. The areas outlined in yellow were the fields treated with SumaGrow® inside products. The pictures speak volumes; healthy soil holds water.



## REDUCES CROP LOSSES GROWS HEALTHIER PLANTS

The best defense is a good offense. Healthier plants are naturally more resistant to many environmental stresses like extreme temperatures, transplant, disease, and drought. When growing organically, eliminating chemical inputs is a must, and reducing expensive organic inputs is always the goal. Many times however, it takes multiple applications of organic inputs to protect the crop—costing valuable time and money. Often, crop losses are still high.

Products containing SumaGrow® have demonstrated the ability to improve the health of a plant or grass as measured by its brix, increasing the plants ability to survive. High brix is commonly associated with higher sugar content. Sugar is the fundamental building block plants combine with soil minerals to make amino acids, proteins, hormones, and other plant necessities. High brix crops supply more trace minerals such as copper, iron, and manganese. Due to

greater mineral density and the inclusion of heavier trace minerals, high brix crops weigh more per unit than lower quality, low brix food. This adds up to a sweeter tasting, more mineral nutritious feed with lower nitrates and water content, and better storage attributes.

*Healthier plants are naturally more resistant to many environmental stresses like extreme temperatures, transplant, disease, and drought.*

The following field trials and testimonials, although not all organically grown, demonstrate valuable examples of SumaGrow®'s ability to achieve remarkable results in less than desired situations.



## TOBACCO FIELDS, NORTH CAROLINA

SumaGrow® treated tobacco fields in Virginia, North Carolina thrived despite several early frosts while the untreated fields were completely destroyed.

Thomas Elliott, owner of Elliott Farms, grows around 100 acres of tobacco among other crops. Elliott treated 30 acres of tobacco with SumaGrow® at the recommended



split application of one gallon per acre. Both treatments were foliarly applied (leaf as opposed to soil application).

The remaining acres were treated only with conventional fertilizer. The SumaGrow® treated fields had no disease or pest problems, not even the dreaded tobacco worm, despite having received no pesticide or herbicide application.

The leaves were golden all the way to the top and perfect for harvesting. The untreated fields were destroyed by the frost and are not harvestable.

Frost damage occurs when the water inside the plant freezes and forms ice crystals, puncturing the plant cell walls. Because SumaGrow® treated plants are more nutrient dense, they contain less water and are less likely to be damaged by freezing temperatures.

SumaGrow® is a organically based consortium of non-genetically modified microbes that improves the health of the soil, increases crop yields and reduces expensive input costs. Because SumaGrow treated crops are stronger and healthier, they are better able to resist extreme temperatures, high winds and drought. SumaGrow increases soil organic matter and helps to balance the soil ph, creating a vibrant microbial environment attractive to beneficial organisms and bugs.



SumaGrow® treated field



Field treated with traditional NPK Fertilizer



Field treated with traditional NPK Fertilizer



Field treated with traditional NPK Fertilizer + SumaGrow®

## CORN FIELD STANDS TALL DESPITE STRONG WINDS AND POOR SOIL

We always mention in our materials how crops treated with products containing SumaGrow® are more resistant to environmental stresses, like strong winds and challenging soil conditions, and the following field trials illustrate this product benefit.

In an ongoing corn field trial being conducted by the Southern Seed Company, the largest seed company in Vietnam, SumaGrow® treated corn plants stand tall despite being hit by dangerous winds. Also noteworthy is the fact that these are young plants (only one month old) and far more susceptible to environmental damage. The corn plants that were not treated with SumaGrow® were noticeably affected.

The farm manager commented that the SumaGrow® treated plants had broader leaves and stronger stalks. The comparison picture to the left shows how the SumaGrow® treated plant on the left is slightly taller, thicker and possesses a more developed root system.

Note that this trial is using 100% fertilizer with SumaGrow® and without SumaGrow®. In the following trial where fertilizer was reduced by 50 percent when using SumaGrow®

(our recommendation) an even greater difference is seen from the beginning.

In this trial, the Southern Seed Company chose the two worst plots on the farms. The field with SumaGrow® plus a 50 percent fertilizer reduction is on the worst plot while the field with 100 percent fertilizer (no SumaGrow®) is on slightly better soil. These plants are also one month old. You can see in the pictures that the SumaGrow® treated plants are already visibly taller and thicker than the plants treated with 100% fertilizer alone despite growing in poorer soil.

SumaGrow®'s award winning formulations have again demonstrated the ability to increase crop yields while reducing fertilizer inputs. Products containing SumaGrow® have been field tested by major universities, specialized testing facilities and independent growers throughout the United States and worldwide. Overwhelmingly, the results prove how the technology of SumaGrow® benefits the producer, the plant and the environment.

## SUMAGROW® MICROBIAL IMPACT ON STRAWBERRY PRODUCTION

The following information is an abbreviation of a field trial conducted by Holden Research and Consulting measuring the effects of SumaGrow® on strawberry production.



This trial was set up to compare the growth and production effects from the use of a standard grower program to one enhanced with SumaGrow® based products.

This trial indicated that the SumaGrow® product had no negative effects to the growing crop or the grower's irrigation system during the trial. The trial consisted of two test plots. The first test plot was SumaGrow® + 100% grower standard fertilizer. The second test plot consisted of grower standard fertilizer at 100% rate. The SumaGrow® treated with 100% of grower standard fertilizer test plot showed a numerical advantage in whole plant weight and root weight. Significant differences were noted and observed in favor of the SumaGrow® treated plot as compared to the grower standard fertilizer.

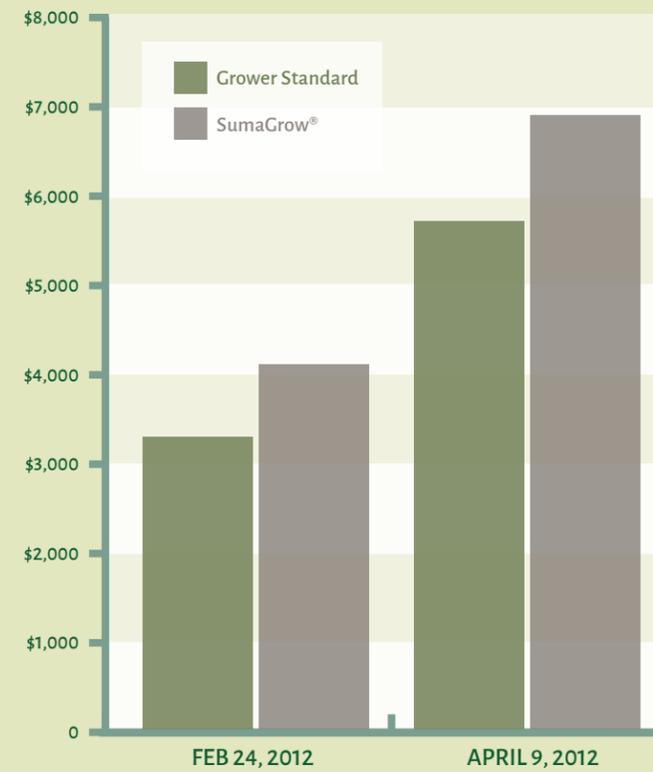
The SumaGrow® treated plot exceeded the grower standard plot in production by 203 flats. The SumaGrow® treated plot showed a net increase to the grower's bottom line of over \$1185 per acre. The SumaGrow® test plot had a better market utilization ratio averaging 78.6 percent as compared to the grower standard at 75.4 percent.

The SumaGrow® treated berries were heavier during the course of the season weighing at 29.6 grams and having a much higher brix level than the grower standard berries, while the grower standard weighted at 26.6 grams with a lower brix level. The SumaGrow® based program yielded positive returns to the grower by early season which continued to get better toward the end of the pick season.



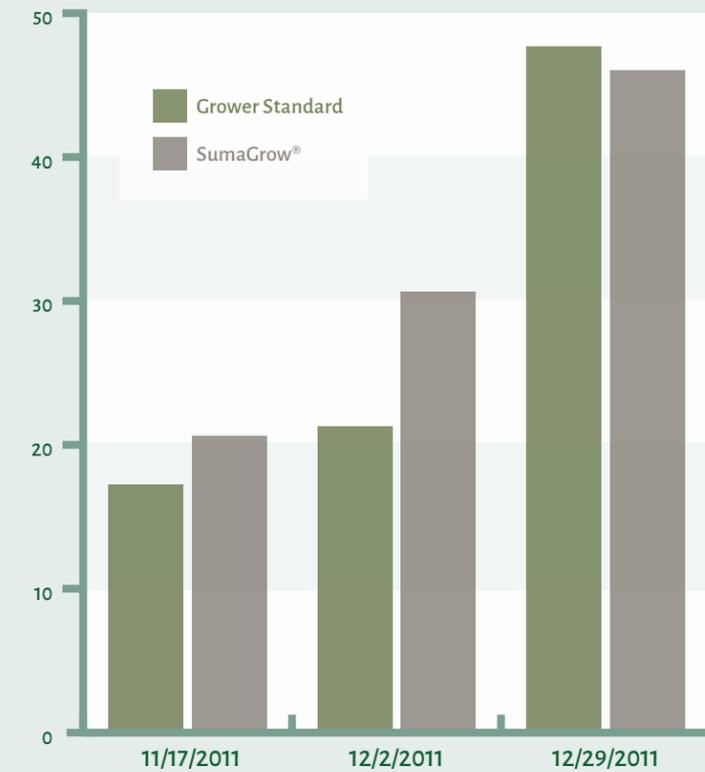
## NET RETURN PER ACRE

AFTER PICKING COSTS (LABOR, TRANSPORT, AND BOXES)



## AVERAGE PLANT WEIGHT

HIGHER AVERAGE WHOLE PLANT WEIGHT EARLIER IN THE SEASON.



## ORGANIC RICE IN TEXAS

The following is a comparative study of two rice farms in the vicinity of Beaumont, TX. Farm A is certified organic while Farm B is fertilized with conventional nitrogen based fertilizer. Farm A belongs to a son and his father respectively, while Farm B belongs to a neighbor. Both farms are joined to one another. The following information describes the BRIX



### FARM A:

-  **CERTIFIED ORGANIC**
-  **300 ACRES** treated with Tall Harvest SumaGrow® Inside using two split applications totaling 1.5 gallon per acre. The first application was applied immediately after green-up at the rate of one gallon per acre. The second application was applied at the rate of .5 gallon per acre six weeks after the initial application.
-  **300 ACRES** left untreated

## FARM B:

- APPROXIMATELY 100 ACRES treated with grower standard conventional fertilizer.
- EARLIER PLANTING: the rice was sown and fertilized 20 days earlier than Farm A

and dry matter data collected on May 24, 2011. The yield in terms of bushels per acre will be determined after harvest.

### A LATE APPLICATION

After participating in the Brix and comparative analysis of Farm B versus Farm A, the farmer of Farm B has now applied the product with SumaGrow® inside to 50 acres to determine the success of our products.

### RESULTS

Dry Matter—The following picture was taken 72 hours after extracting the plants on May 24, 2011.

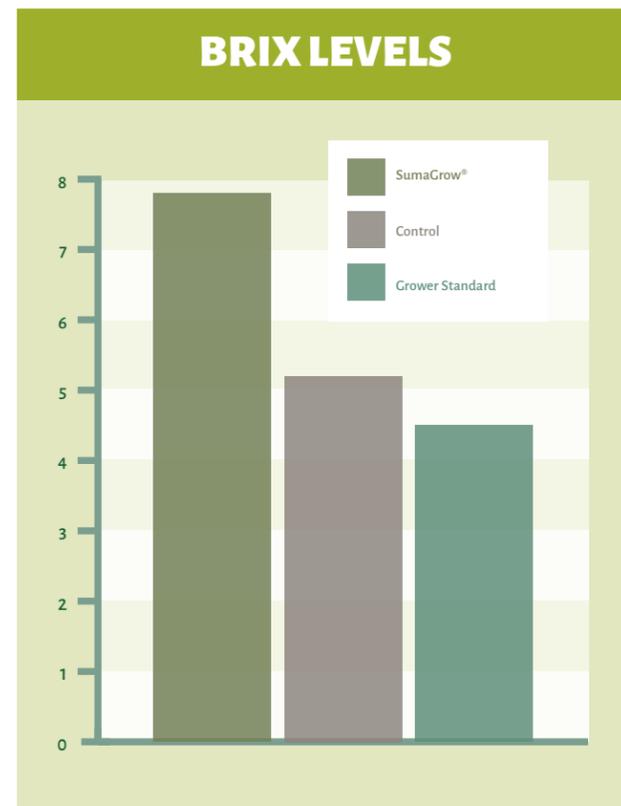


A sample taken from Farm B using conventional fertilizer showed a brix reading of 4.5 and was 67 percent water. A sample taken from the portion of Farm A treated with a

product containing SumaGrow® showed a brix reading of 7.76 and was 22 percent water. A sample taken from the untreated portion of Farm A showed a brix reading of 5.2 and was 16 percent water.

### BRIX VALUES

BRIX values in Rice from fields with a SumaGrow® treatment, control (no treatment) and grower standard fertilizer treatment.



## TESTIMONIALS

### CROP PRODUCED DESPITE SEVERE DROUGHT

In one of the worst droughts in 50 years Kevin Delap, a row crop producer who farms over 2,500 acres, said his corn “made” because of SumaGrow®. According to Delap, the neighboring farms had little to no crop left; “They just burned up.”

Delap initially purchased products containing SumaGrow® in 2011 in an effort to increase his bottom line. According to Delap, “Producers can expect to reduce their fertilizer input costs by a minimum of 50 percent in most cases.” Skeptical the first year, Delap continued his conventional fertilizer program along with the SumaGrow® containing product. He was extremely pleased with the yield results.

After his initial success, Delap followed closer to the recommended 50 percent fertilizer reduction schedule for 2012’s corn rotation and was delighted with the results. Delap said he used zero potash and phosphate and reduced nitrogen by 20 percent. Conventional fertilization programs can cost upwards of \$162 per acre for corn and other row crops. For large scale producers, that could easily translate into over \$400,000 per year, not including pesticide costs.

Reducing fertilizer when using products containing SumaGrow® is a pivotal benefit for producers, lowering input costs and reducing the risk of over fertilization. SumaGrow®’s microbial blend increases the effectiveness of fertilizers by capturing more of the mineral inputs for the plant’s use. This combined with the microbial concentration’s ability to extract atmospheric nitrogen and to “make available” nutrients that are already in the soil allows the producer to cut fertilizer applications by 50 to 100 percent and still produce a higher yielding and healthier crop.

“We are working with major universities and food producers to gather the vital field data needed to continue to grow the scope of our technology and to demonstrate the significant contribution SumaGrow® makes in improving crop quality and yield, and reducing fertilizer inputs,” said Wayne Wade, President of Bio Soil Enhancers, Inc., the manufacturer of SumaGrow®.

But for producers like Delap, whose family has been farming for generations, seeing is believing. And now his neighbors are

talking. “It took me 1 1/2 hours just to get from inside the bank back to my truck,” Delap said. “They all want to know what I’m doing.”



SumaGrow® treated field



untreated field

# SUMAGROW® AWARDS AND RECOGNITIONS

## 2016 – PITCH TANK WINNER

The microbial technology of SumaGrow® won the Pitch Tank award at the 2016 FreedomFest for its ability to increase crop quality and yield while decreasing fertilizer and water usage in agricultural production.

## 2016/2014 – MSGOVERNOR'S AWARD FOR EXCELLENCE IN EXPORTING

Bio Soil Enhancers, Inc. was awarded the Excellence in Exporting award for their success in maintaining or increasing export sales.

## 2015 – GOOGLE MOONSHOT

The microbial technology of SumaGrow® was selected as a candidate for a Google driven Solve for X “moonshot” project, a global initiative from Google seeking pioneers in science and technology who have audacious solutions for monumental challenges.

## 2014 – INC 500

Bio Soil Enhancers, Inc. ranked #2 on the 2014 Inc. 500 list of fastest growing private U.S. companies for the state of Mississippi and #4 overall for manufacturing. Additionally, BSEI was ranked #297 in the United States.

## 2013 – INC 500

Bio Soil Enhancers, Inc. ranked 2nd on the 2013 Inc. list of fastest growing private U.S. companies for manufacturing and 77th overall. Additionally, BSEI was named as the #1 fastest growing company for all categories in Mississippi.

## 2012 – HEMISPHERES MAGAZINE

In the 2012 “Green Issue” of the United Airlines inflight magazine, SumaGrow® was recognized as an eco-friendly alternative to chemical fertilizers.

## 2011 – BISON WORLD MAGAZINE

The technology of SumaGrow® was featured in the April 2011 issue of Bison World. The article supports its title “Improving The Green To Improve The Green”, “by demonstrating how products containing SumaGrow maximize forage quality and yields while reducing fertilizer demands.”

## 2011 – POPULAR SCIENCE GRAND AWARD WINNER IN THE GREEN TECH CATEGORY

“...microbes replace naturally occurring ones that are lost in over-farmed soil...microbes increase productivity by locking nitrogen in the soil and breaking down organic waste into useful nutrients. The treatment increases grass yield by 20 percent over standard fertilizer and...water runoff decreases by about half...”

## 2011 – STOCKMAN GRASS FARMER

An article published in the February 2011 edition of Stockman GrassFarmer highlighted SumaGrow® technology for showing “...great promise for increased forage and crop yields, improved brix levels, and significant reduction or elimination of chemical and other forms of fertilizers.”

## 2009 – POPULAR SCIENCE MAGAZINE

In an article entitled “The Future of Farming: Eight Solutions for a Hungry World,” SumaGrow® technology was featured as a solution to address the world’s ever-growing food needs.

## 2009 – FORBES.COM

“Bio Soil Enhancers develops organic solutions to improve crop yields and reduce the use of synthetic fertilizers...”

**SUMAGROW**



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