

MicrobeBio[®]

NATURE PHENOMENON





ISO/IEC 17065



For Organic Use

HUMAN AND PET SAFE



MICROBEBIO®

Have you ever wondered why some plants, flowers and other vegetations flourish and thrive, while others do not? Maybe you've walked through a forest, admiring how the trees soar in height and you find yourself thinking back to your own garden at home. Many people who grow their own crops reflect on this thought and are seeking answers to better their harvests. Although there are many different factors that go into this question, one of the most important aspects to look at is the soil in which the vegetation is growing in. In soil, there are unseen inhabitants of microorganisms that live and develop within the earth. Of the many diverse microorganisms, there are two that I would like to introduce to you today.

First, is a single celled minuscule microbe which is called Bacteria. While we know there are many different types of bacteria, we are solely focusing on the beneficial ecological aspect of this microorganism. Bacteria's function in the symbiotic relationship with the plant's roots is to carry out specific functions. One of these functions is to decompose different organic matters, which are then released for the plant's use when the bacteria's life span ceases.

Secondly, we will look at a beneficial fungus called Mycorrhiza and its functions. Like Bacteria, Mycorrhiza is also in a symbiotic relationship with the plant's roots. The roots of the plant provide the carbon that the fungus needs to grow, while in turn, the fungus transports both nutrients and water beyond which the roots can reach.

After looking at just two of the many different microorganisms living in the soil of the Earth, we can see just how vital it is to maintain a healthy foundation to get the most out of any yield of crops. The problem is that in today's society, through modern means of agriculture, we unintentionally deconstruct the natural microorganisms that are most beneficial to the future sustainability of any harvest. What happens through this deconstruction of our soil's natural state, is that eventually all of the beneficial microorganisms that live in the soil which help the plants flourish, is completely removed. When this happens, the vegetation life is more susceptible to negative effects such as diseases and pests. An additional adverse effect caused from the destruction of microorganisms in the soil, is the soil's inability to hold the maximum amount of water. As a result of this, watering the plants becomes more expensive and far less effective due to the incapability of the soil's water retention.



HOW CAN MICROBEBIO[®] PRODUCTS HELP?

At MicrobeBio[®] we are dedicated to restoring the essential microorganisms to the soil, to create eco friendly and sustainable farming. In doing this, we have come to realize and appreciate the functionality of these microorganisms and have incorporated the beneficial aspects of them in our products. When introducing MicrobeBio[®] products to the new environment of the plant's roots, the newly added microbes act to support and cooperate with the existing microbes, rather than competing with them. Together, the microorganisms are able to work accordingly in unison to cultivate the natural substances needed such as enzymes, natural hormones, acid and different types of biochemicals.

Two types of the Biochemicals plants create are called "Primary Metabolites" and "Secondary Metabolites". Primary Metabolites are created and used by plants to aid in both growth and development, while Secondary Metabolites are used to fulfil specific functions of the plant. Because Primary Metabolites serve as one primary function, they present themselves in all plants to aid in their growth. Secondary Metabolites are unique,

and the functions they serve will differ between each specific type of plant. Secondary Metabolites can affect important aspects such as the smell of the flowers, flavors of the fruits produced, but most importantly – the health of the soil.

MicrobeBio® products are packed full of rich dynamic inputs such as MicrobeBio® Bacteria, MicrobeBio® Fungi, MicrobeBio® Actinobacteria, MicrobeBio® Protozoa, and MicrobeBio® Algae, all of which are vital to create a healthy soil environment for crops to prosper. These different ingredients are crucial to the soil, as each of them carry out specific and critical tasks to better the plants. While some act to recycle and reuse material, others function to regenerate and facilitate growth. Certain others inhibit and equalize, and more; some are mobilizers, producers, or decomposers. Regardless of their functions and complexities, our customized mix is a special blend of biological catalysts, designed to not only work together harmoniously to cultivate the proper nutrients in the soil, but also cycle them along with many other essential requirements that plants have in their roots. As a result, this improves the overall health and vigor, all while maintaining the quality of the soil, and the productivity – perpetually!

MICROBEBIO® PROMISES

When MicrobeBio® products are used, our customer's trust is in the attention given to their soil's microbiological needs in any geographic location needs these varying microorganisms to ease the burden from high demands of large yields. Using MicrobeBio® products alone or in programs will promote plant health and are safe. You can use MicrobeBio® products alone or with one another in programs, liquid, and granular - on any crops! The MicrobeBio® liquids penetrate the plant's microscopic pores in the leaves, so phyto-nutrients are directly available to the plant. The MicrobeBio® products enrich soils with sugars and proteins for energy and extending microbe activity. MicrobeBio® products can be used on any pre-planting treatments, directly to the seeds to create a richer soil base, and over-the-top which then generates far superior harvests.

MICROBEBIO® PRODUCTS HAVE THE CAPABILITY TO:

- Protect and rehabilitate the soil to improve the crop.
- Heal and Protect the soil for future generations of crops.
- Reduce negative environmental impacts.
- Effectively break down organic matter which increases both carbon and nutrient bioavailability in the soil.
- Both control and reduce salinity and heavy metals in the soil.
- Provide a greater resistance to both plant diseases and pests.
- Provide a balanced and proportionate number of microbes that improve biochemical processes such as; The Carbon Cycle, The Nitrogen Cycle, Mineralization, The Production of Phytohormones, Balances pH, and Decomposition.
- Increase development of micronutrients such as Iron, which can be utilized by plants.
- Increase the drought resistance while decreasing irrigation by improving the moisture retention capacity in the soil.
- Increase strong root vitality which leads to improved seed germination.
- Increased efficiency in crop yield production, which leads to generation of more profit.
- Maintain consistent results throughout the duration of the crop cycle, Reduce the metabolic stress, and Achieve greater genetic potential.
- Reduction of cost for seed in nitrogen-based fertilizers.
- Increase in Brix levels, which leads to greater tasting produce.
- Easy application and is Non-Toxic as well as Non-GMO.

MicrobeBio® is far superior than other leading brands. We are unique in the fact that we use innovative Microbial Technology to deliver the microorganisms needed in the soil. MicrobeBio® products contain beneficial microbes which improve both the life and energy of the soil throughout the duration of the growing season, regardless of any preexisting condition of the soil. MicrobeBio® products holds, converts and stabilizes the increase in nitrogen for the soil, and continuously delivers the needed nutrients to the plants. The microorganisms in MicrobeBio® products will repair the deconstructed soil overtime, which can help reduce the use in herbicides, insecticides and fungicides. MicrobeBio® products preserves the soil condition for long-term usage and helps replenish life to the existing soil.





WHY CHOOSE MICROBEBIO®

In order to develop the very best product line, **MicrobeBio**® was formed by a collective team of top soil microbiologists from around the world, all of whom came together to give their best to this line, in order to formulate our proprietary microbial formula, much like microbes do for their host plant.

Our two-core beliefs are Sustainable and Regenerative Agriculture, and we have followed the disciplines of both for over two decades, developing and refining proven technologies with great passion, and giving those technologies the ‘staying power’ and consistency they need to truly make a difference.

Firmly rooted (pun intended) in the promotion of biological farming, or “microbe farming”, techniques, this philosophy states that plants and their specific microorganisms co-evolved right from the beginning. Thus, in order to thrive and reach their full potential in both growth and production, all plants in a non-native soil must be paired with their familiar microbial partners.

Our core team consists of various experts in the field of microbiology, plant pathology, agronomic consultants and a large, multi-national network of distributors. Together, and with great pride, our team not only creates but also distributes our products and represents **MicrobeBio**® to the world. It is also a point of pride that



MicrobeBio[®] products have an efficacy that's been proven and verified in private laboratories, by extensive university testing and by the accreditation of various third-party users. Our affiliates around the globe represent a company with products that greatly improve soil health, and significantly increase plant vigor.

Indeed, for farmers worldwide, the guesswork of trial-and-error has been eliminated when it comes to soil inoculation on a microbial level, as they use our 500+ strains of unique, proprietary microbes from our culture laboratory. As we learn from nature, and also our valued partners, **MicrobeBio**[®] is both honored and humbled to be a cog in the sustainability movement wheel.





SIGNIFICANT ADVANCEMENTS IN BIO-PRODUCTS

Unfortunately, bio-product advancement has slowed to a crawl in the last few decades due to the efficacy of synthetic or chemical products. Also, three of the major inoculants being used today were first discovered in the 18th and 19th century, including *Trichoderma* in 1794, *Bacillus Subtilis* in 1872 and, since the early days of the Egyptian empire, *Mycorrhizae*.

At **MicrobeBio**[®] we're changing this paradigm. More than fifty plus of our proprietary strains are new microbiology discoveries, which scientific breakthroughs have allowed us to combine in a stable form to produce first-of-their-kind products that the agricultural market has never seen before. In fact, no other product anywhere has our unique combination of newly discovered enzymes, natural plant growth hormones and strains.

The reason we do what we do, and our starting premise when we began **MicrobeBio**[®], is this; in combination, several different microbes can make a much bigger, better and more effective difference than a single microbe working alone. With microbes working in tandem, their unique enzymes are catalysts that greatly increase terpene levels and, concomitantly, provide an industry staying power and high efficacy that sets **MicrobeBio**[®] products apart.





ENVIRONMENT

How soil microbes battle climate change – Indeed, soil microbes are our microscopic partners in protecting our environment by regenerating soils to become the primary resource for accumulating carbon. The amount of carbon that global soils currently hold are three times higher than those existing in the atmosphere. In fact, global soils are able to store much more carbon than that. A recent study by NATURE suggests that greenhouse gas concentrates can be significantly reduced by 50-80% by increasing carbon storage in the globe's farmland soils.

At **MicrobeBio**[®], we believe that the most advanced technology to be found anywhere on earth comes from the earth itself. Natural soil microbes is the only technology currently available on earth for a natural biological solution to enhance the sequestration of carbon, or CO₂ storage. **MicrobeBio**[®] may support plants to recover from degraded conditions. Also, they might help plants to endure high temperature as well as drought which are caused by climate change. Moreover, soil microbes may increase plant's ability to fight insect and pests whose communities are foreseen to increase because of climate change.

By providing beneficial microbes for soil, **MicrobeBio**[®] is not only putting efforts to increase the sustainability of agriculture, but also to make the world a greener place.

REDUCING THE EFFECT OF SOIL SALINITY

When put into the soil, the bacteria will start multiplying which breaks down organic matter and transforms it into organic acids. The acids then start to combine with various matter in the soil including salt. This is known as chelating. Chelation is when a coating is formed around matter such as salt and metals. This coating allows plants to absorb more nutrients from it while taking in less salt. As the bacteria continues to multiply and chelate, water starts to penetrate deeper in the soil while also removing salt downward. This chain reaction allows water to reach deeper in the soil while also removing salt from topsoil and moving it deeper into the ground giving your plants access to more nutrients.



HEALTHY SOIL

Thick white roots mean one thing; healthy plants due to healthy soil conditions. Without them, excellent production simply can't happen, and that's why **MicrobeBio**[®] products were initially designed (and have a great efficacy) to remedy a wide variety of soil health problems. Once inoculation has occurred with **MicrobeBio**[®], you can rest assured that, during the full duration of the crop cycle, plant roots will stay totally white and fibrous.

MICROBEBIO[®] vs CHEMICAL FERTILIZERS

MicrobeBio[®] products do not contain any access salt that could damage the soils natural nutrients. Chemical fertilizers contain high levels of salt and overdependence may cause more harm than good in the long run.

MICROBEBIO[®] vs COMPOST

Composting has many shortcomings compared to **MicrobeBio**[®]. Specifically, compost cannot usually be used on a commercial basis due to lack of materials, while **MicrobeBio**[®] can be used on any plot of land; large or small. Compost can carry risk of bacteria such salmonella. **MicrobeBio**[®] only introduces beneficial bacteria and microbes that feed off of bad bacteria. Furthermore, composting creates salinity problems which can have negative impacts on the health of your soil; while **MicrobeBio**[®] is designed to combat salinity and make your soil healthier to produce bigger and healthier crops.

PROFITABLE FOR FARMERS

Because it reduces many negative factors, **MicrobeBio**[®] increases the most important positive factor; profits. Treatment costs are lowered because plants have stronger resistance to pests and disease. Conventional fertilizer use is lowered, because soil once contaminated or dead, becomes fertile again. **MicrobeBio**[®] thus helps produce healthy, vibrant crops that produce bigger yields while also increasing the nutritional value of the soil. This leads to more sustainable farmlands, reducing costs. In short, MicrobeBio's proprietary technology increases profits because less fertilizer and pesticides are needed to produce more crops.



THE ACTION MODE OF MICROBEBIO®

When **MicrobeBio**® microbes are applied to the soil, they immediately begin to colonize the rhizosphere or ‘root zone’ of your plants, multiplying at a prodigious rate in the first forty-eight hours and producing literally trillions of microbes. Within ten to fifteen days any small carbon particles in the rhizosphere will be tuned into insoluble, microscopic particles of nutritious humus. It is recommended that carbon be added to the soil as a nutritive, which will combine with the microbes to form a ‘biofilm’ around the roots. Enzymes, hormones, chemicals and other signaling molecules will be the result of this biofilm, due to the “saprophytes” found in **MicrobeBio**®.

Similar to what earthworms accomplish, saprophytes break down carbon, turning it into nutrient-rich humus at a faster rate, increasing macro and micro-nutrient absorption while using less water, and increasing quality and yield due to higher terpene levels produced from larger, stronger, healthier root masses.

No other product on the market today creates such a rapid formation of terpenes, humus formation and mineralization, as well as root growth and yield increase, than **MicrobeBio**®. This is due to the abundant number of microbes found in our proprietary combination, giving **MicrobeBio**® products the efficacy unmatched, even in side-by-side trials.

THE SCIENCE OF MICROBEBIO®

MicrobeBio® Microbial Formula significantly reduces soil erosion, runoff and fertilizer usage while improving water efficiency and holding capacity resulting in decreased water usage, which in turn increases nutritional value for higher yields and crop production in several ways:

Nitrogen Fixation at a Biological Level - Microorganisms assimilate nitrogen in the atmosphere into organic compounds.

Solubilization of Phosphates - Phosphates bound in the soil are solubilized, allowing plants to more easily uptake them.

Mineralization and Immobilization - Healthy plant hormones are increased, as well as the storage of soil carbon, greatly increasing nitrate nitrogen availability to plants. This creates a nutrient reservoir that plants can access, comprised of organic bio-stimulants in the soil.

Production of Phytohormones - Using bacteria, **MicrobeBio**® significantly reduces the salinity of your soil, enhancing it greatly.

Balancing the pH of your Soil - The organic bio-stimulants found in **MicrobeBio**® make your soil more porous, even under extreme environment conditions, allowing for better aeration, infiltration and drainage of the soil. Leaching is also greatly reduced due to buffering of the pH, as well as improving aggregation of soil particles.

Increased Saprophytic Competence - The microbes in **MicrobeBio**® are helped by saprophytes, which consume dead and decomposing matter. This allows **MicrobeBio**® products to perform better as it allows our microbes to better compete with both native soil microbes and other organic bio-stimulants.

THE NUTRIENTS

Plants are complex organisms that require many different forms of nutrients that are important for optimal growth and a healthy plant. Soil, minerals and plant life work together to allow you to grow the most nutrient filled food possible. Our billions of microbes help make this process easier and more efficient.

The synergy of the Science of **MicrobeBio**[®] builds a symbiotic relationship between soil plant and microbes by delivering the full spectrum of essential nutrients including the primary macronutrients, secondary macronutrients, micronutrients and non-mineral elements. Through the Science of **MicrobeBio**[®], plants are able to easily uptake nutrients for optimal growth.

7 N Nitrogen	15 P Phosphorus	19 K Potassium					
Primary Macronutrients							
12 Mg Magnesium	16 S Sulfur	20 Ca Calcium	1 H Hydrogen	6 C Carbon	8 O Oxygen		
Secondary Macronutrients			Non-Mineral Elements				
5 B Boron	17 Cl Chlorine	25 Mn Manganese	26 Fe Iron	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	42 Mo Molybdenum
Micronutrients							
Semimetal	Halogen	Transition Metal	Alkaline Earth	Nonmetal			

Our microbial soil amendment transforms all compound and complex nutrients for optimal plant growth, health and resistance to pest, nematode and fungal diseases. The microbes, especially Azotobacter, found in Microbial Fertilizer, naturally transforms nitrogen from the air into usable nutrition for the soil. They also produce siderophores, which are small, high-affinity iron chelating compounds secreted by microorganisms, making iron available for plant uptake. The Pseudomonas, Lactobacillus, and Trichodema found in our product solubilize Phosphate, Molybdenum, Boron, Carbon, and Iron; and the Bacilli solubilize Silicate and Zinc, making all of these rich nutrients available for plant health and optimal growth. Bacillus, Clostridium, and Azotobacter, are known to produce a variety of extracellular enzymes that break down organic matter in the soil to provide the best nutrients essential to plant growth.

THE BENEFITS

- Increased efficiency in crop production - significant increase in yields
- More effective breakdown of organic matter – greatly increase carbon and nutrient level in soil
- Control/reduce salinity and heavy metals in soil
- Increase drought resistance and decrease irrigation by improving moisture retention capacity in the soil
- Increase root vitality - better seed germination
- Significant reduction in cost and the need for nitrogen-based fertilizers
- Greater resistance to pest and diseases
- Increased formation of micro-nutrients, especially iron, which can be up taken by plants in general
- Significantly increase in BRIX level – greater tasting produce
- Reduce adverse environmental impacts
- Heal and protect soil for future generations
- Easy to apply, non- toxic, non-GMOs
- Generate more profits for farmers/users



MicrobeBio[®] VigorBoost[™]




MADE IN USA

MICROBEBIO[®] VIGORBOOST[™]

MicrobeBio[®] VigorBoost[™] contains 50 plus strains of highly concentrate beneficial microbial spore which enhance soil life. Our microbes help nutrient-uptake in plants, improve plant vigor, and stimulate microbial and bio-diversity activity in the soil which contribute to drought tolerance and increase plant performance. VigorBoost[™] works synergistically with organic nutrients to help improve soil sustainability. Each unique beneficial microbe strain is critical as they play an important role as recyclers, regenerators, facilitators, inhibitors, mobilizers, producers, equalizers, decomposers, and predators in the cultivation of essential nutrients which improve plant vigor, soil quality and productivity.

To understand the nutrient-uptake process in plants, consider the way probiotics strengthen our health as humans. Similarly, endophytes strengthen the health of plants, allowing them to adjust to environmental changes faster than genetic adaptation will permit. Thus, endophytes can help plants survive extreme conditions such as droughts, high temperatures, insufficient nutrients and even environmental toxins. Ultimately, adding the right microbes to your soil not only increases your plant's nitrogen absorption capability but allows plants to naturally thrive within human-created growing environments.

VigorBoost[™] fertilizer produces outstanding results since its nutrients are released quickly yet continue to feed for several months. This scientific formula provides optimal levels of primary essential plant nutrients such as micronutrients and multi-minerals. VigorBoost[™] ensures organic nutrients are completely broken down and then released in the soil for plant roots to absorb them as they are needed. Feeds for several months. Great for every plant in the garden or crop.

THE BENEFITS:

- Increase efficiency in crop production – significant increase in yields
- More effective breakdown of organic matter – greatly increase carbon and nutrient level in the soil
- Control/reduce salinity and heavy metals in soil
- Increase drought resistance and decrease irrigation by improving moisture retention capacity in the soil
- Increase root vitality – better seed germination
- Significant reduction in cost and dependent on nitrogen-based fertilizers
- Greater resistance to pest and diseases
- Increase formation of micronutrients, especially iron, which can be up-taken by plants in general
- Significantly increase in Brix level – better tasting produce
- Reduce adverse environment impacts
- Heal and protect soil for future generations
- Easy to apply, non-toxic, non – GMOs
- Generate more profits for farmers/users

MicrobeBio[®] VigorBoost[™]



MICROBEBIO[®] VIGORBOOST[™]

MicrobeBio[®] VigorBoost[™] contains 50+ beneficial soil microbes which enhance soil life. Our microbes help nutrient-uptake in plants, improve plant vigor, and stimulate microbial and bio-diversity activity in the soil which contribute to drought tolerance and increase plant performance. VigorBoost[™] works synergistically with organic nutrients to help improve soil sustainability. Each unique beneficial microbe strain is critical as they play an important role as recyclers, regenerators, facilitators, inhibitors, mobilizers, producers, equalizers, decomposers, and predators in the cultivation of essential nutrients which improve plant vigor, soil quality and productivity.

BENEFITS:

- Increase efficiency in crop production – significant increase in yields
- More effective breakdown of organic matter – greatly increase carbon and nutrient level in the soil.
- Control/reduce salinity and heavy metals in soil.
- Increasing drought resistance and decrease irrigation by improving moisture retention capacity in the soil.
- Increase root vitality – better seed germination
- Significant reduction in cost and dependent on nitrogen-based fertilizers
- Greater resistance to pest and diseases
- Increase formation of micronutrients, especially Iron, which can be up-taken by plants in general.
- Significantly increase in Brix level – better tasting produce
- Reduce adverse environment impacts
- Heal and protect soil for future generations
- Easy to apply, non-toxic, non – GMOs
- Generate more profits for farmers/users

APPLICATION

- Apply 1 kg per hectare. Apply 3 to 4 application per season.

DILUTION

- Brew the product for at least 24 hours into 5 liters of non-chlorine water to activate the microbes.
- Dilute the brewed mixture into at least 250 liters of non-chlorine water to treat 1 hectare.
- When the mixture is applied into the soil, the delivered organisms will continue to multiply.

SPRAY INSTRUCTION

- During each stage of growth, the diluted MicrobeBio[®] VigorBoost[™] Solution is sprayed directly into the soil or used for foliar feeding.
- For an optimal yield, apply the diluted MicrobeBio[®] VigorBoost[™] Solution at late afternoon and avoid direct sunlight.

ATTENTION: Please read and follow SDS instructions for safety precautions, cleaning, and maintenance of PPE (Personal Protective Equipment). (General use: detergent and hot water)
Not for human consumption. Keep out of reach of children.

NON – PLANT FOOD INGREDIENTS

Beneficial Bacteria: 2 x 10⁸ Colony Forming Units (CFU) per gram (each)

Analysis	Specification
- Bacillus Subtilis.....	2.00 x 10 ⁸
- Bacillus Amylolaquefaciens.....	2.00 x 10 ⁸
- Bacillus thuringiensis.....	2.00 x 10 ⁸
- Azobacter chroococcum.....	2.00 x 10 ⁸
- Streptomyces lydicus.....	2.00 x 10 ⁸
- Rhizobium japonicum.....	2.00 x 10 ⁸
- Thiobacillus sulfoxidans.....	2.00 x 10 ⁸

* All microbes are considered naturally-derived, nonpathogenic, non-toxic, non-GMO, non-hazardous and non-corrosive.
* All microorganisms are not considered to be pathogenic for livestock or poultry.

BATCH NUMBER:

EXPIRATION DATE:



Warranty Limitations: The information contained on this label is believed to be accurate and reliable. There are no warranties that extend beyond the guaranteed analysis on the face hereof. All claims against guarantee are limited to replacement of product or refund of purchase price, or otherwise specified by law. The buyer/user acknowledges and assumes all liability resulting from the use of this material. Timing, method of application, weather, crop conditions, and other factors are beyond the control of the seller. MICROBEBIO[®] DISCLAIMS ALL OTHER WARRANTIES WHATSOEVER, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTY OR MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. In no event shall MICROBEBIO[®] be liable for damages resulting from the use of this product and/or any special consequential or incidental damages of any kind.

website: www.microbebio.com email: info@microbebio.com

Net Contents:

MicrobeBio[®] VigorBoost[™]



1 kg



25 kg



1 ton super sack



MicrobeBio®

HYDRO™
ACTIVATOR

MICROBEBIO[®] HYDRO ACTIVATOR[™]

This liquid bio-fertilizer is an excellent natural organic matter with primary nutrients (NPK), slow-released Nitrogen sources, more than 40 minerals, and beneficial microorganisms that can be applied to the root zone of plants and/or sprayed directly onto leaf surfaces throughout the growing season. Provide healthy bio-available source of food and energy for soil microbes. Our product improves the biogeochemical process such as carbon cycle, nitrogen cycle, mineralization, and decomposition. It has the ability to hold, convert, stabilize and increase nitrogen in the soil. Our products work from the soil up to the plant.

THE BENEFITS:

- Provide healthy bio-available source of food and energy for soil microbes
- Protection against extreme environment
- Stimulate plant growth and increased yield
- Deliver primary nutrients (NPK)
- Remediate salinity and heavy metal contamination in soils
- Regulate pH in acid or alkaline conditions
- Increase BRIX levels
- Increase organic matter in the soil to enhance strength and vigor of plants
- Increase Carbon source
- Increase Chlorophyll Content
- Enhance natural defenses against pests, and plant diseases
- Improve water retention and increase drought tolerance
- Improve soil structure
- Effectively break down nutrients to make available to plant roots
- Increase soil fertility
- Offer a source of burn-free nitrogen
- Enhance microorganisms in the soil

MicrobeBio®

HYDRO™ ACTIVATOR

MICROBEBIO® HYDRO ACTIVATOR™

This liquid bio-fertilizer is an excellent natural organic matter with primary nutrients (NPK), slow-released Nitrogen sources, more than 40 minerals, and beneficial living microorganisms that can be applied to the root zone of plants and/or sprayed directly onto leaf surfaces throughout the growing season. Provide healthy bio-available source of food and energy for soil microbes. Our product improves the bio-geochemical process such as carbon cycle, nitrogen cycle, mineralization, and decomposition. It has the ability to hold, convert, stabilize and increase nitrogen in the soil. Our products work from the soil up to the plant.

BENEFITS

- Stimulate biological activity by increasing microbial colony.
- Provide healthy bio-available source of food and energy for soil microbes.
- Stimulate plant growth and increased yield
- Deliver primary nutrients (NPK)
- Remediate salinity and heavy metal contamination in soils
- Regulate pH in acid or alkaline conditions
- Increases BRUX levels
- Increase organic matter in the soil to enhance strength and vigor of plants
- Increase Carbon source
- Increase Chlorophyll Content
- Enhance natural defenses against pests, and plant diseases soil
- Improve water retention and increase drought tolerance
- Improve soil structure
- Effectively break down nutrients to make available to plant roots
- Increase soil fertility.
- Offer a source of burn-free nitrogen.
- Enhance microorganisms in the soil the soil

ATTENTION: Please read and follow SDS instructions for safety precautions, cleaning, and maintenance of PPE (Personal Protective Equipment). (General use: detergent and hot water)
Not for human consumption. Keep out of reach of children.

GUARANTEE ANALYSIS

Nutrients	Specification
- Nitrogen (N).....	5.00%
- Phosphorus (P ₂ O ₅).....	4.00%
- Potassium (K ₂ O).....	2.00%
- Sulfur (S).....	0.88%
- Calcium (Ca).....	0.65%
- Magnesium (Mg).....	0.02%
- Sodium (Na).....	6.10%
- Zinc (Zn).....	<20 ppm
- Iron (Fe).....	59.8 ppm
- Manganese (Mn).....	<20 ppm
- Copper (Cu).....	<20 ppm
- Boron (B).....	<100 ppm

- Other properties:
- Organic matter: 27%
 - pH: 3.5
 - Density: 1.23 kg/l

MicrobeBio®



Warranty Limitations: The information contained on this label is believed to be accurate and reliable. There are no warranties that extend beyond the guaranteed analysis on the face hereof. All claims against guarantee are limited to replacement of product or refund of purchase price, or otherwise specified by law. The buyer/user acknowledges and assumes all liability resulting from the use of this material. Timing, method of application, weather, crop conditions, and other factors are beyond the control of the seller. MICROBEBIO® DISCLAIMS ALL OTHER WARRANTIES WHATSOEVER, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTY OR MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. In no event shall MICROBEBIO® be liable for damages resulting from the use of this product and/or any special consequential or incidental damages of any kind.

EXPIRATION DATE:

BATCH NUMBER:

website: www.microbebio.com email: info@microbebio.com

Net Contents:

MicrobeBio[®]

HYDRO ACTIVATOR[™]



2.5 gallons



275 gallons



55 gallons



11,600 gallons



MicrobeBio®

NATURE™
FOLIAR

MICROBEBIO[®] NATURE FOLIAR[™]

Nature Foliar[™] promotes robust and productive crop yields and drought tolerance by greatly enhancing a plant's ability to uptake nutrients. With this bio-elixir, the company assembled our most advanced synthesis of plant materials, micronized algae and beneficial microorganisms to accelerate the potency of this proprietary formula. Nature Foliar[™] ensures that nutrients are thoroughly available for absorption via small pores via leaf and root spheres at the microscopic level, which improve soil structure and sustainability with a much lower impact on the environment.

BENEFITS:

- Maintain consistent results over the crop cycle, reduces metabolic stress, and achieves optimal microbial genetic potential by providing a healthy source of food and energy for soil microbes.
- Promote seed germination and increases early vigor of seedlings
- Act synergistically with other endogenous hormones
- Support cell division and elongation
- Increase enzyme levels for the synthesis of nucleic acids, proteins, vitamins, and sugars
- Optimize photosynthesis and translocation of assimilates to economic plant parts
- Encourage stress resistance under adverse environmental conditions
- Improve quality of produce
- Expand chlorophyll content in leaves
- Enhance metabolic processes in plants
- Ameliorate the efficiency of plant nutrient and energy uptake and transport
- Promote robust yield and plant vigor
- Increase root development
- Greater resistance to pest and diseases

PARTIAL BENEFITS:

- Vegetative Growth
 - Seed dormancy and germination regulation
 - Photo morphogenesis for shade avoidance syndrome (SAS)
 - Greater photosynthetic efficiency
 - Delay senescence
 - Root development
- Reproduction
 - Regulation of Flowering
 - Improve male and female fertility
 - Greater seed development and seed filling
 - Higher fiber production
 - Faster fruit ripening
- Stress tolerance (of)
 - Salt and drought
 - Thermo-tolerance
 - Oxidative stress
 - Pathogen resistance
 - Heavy metals and Herbicide/Pesticide
- Other functions
 - Enhance nitrogen metabolism
 - Protective gene expression
 - Increase metabolic efficiency
 - Nutrition alteration capabilities
 - Improve plant growth regulation



MicrobeBio®



NATURE™ FOLIAR



MICROBEBIO® NATURE FOLIAR™

Nature Foliar™ promotes robust and productive crop yields and drought tolerance by greatly enhancing a plant's ability to uptake nutrients. With this bio-elixir, the company assembled our most advanced synthesis of plant materials, micronized algae and beneficial microorganisms to accelerate the potency of this proprietary formula. Nature Foliar™ ensures that nutrients are thoroughly available for absorption via small pores via leaf and root spheres at the microscopic level, which improve soil structure and sustainability with a much lower impact on the environment.

BENEFITS

Maintains consistent results over the crop cycle, reduces metabolic stress, and achieves optimal microbial genetic potential by providing a healthy source of food and energy for soil microbes.

- Promotes seed germination and increases early vigor of seedlings
- Acts synergistically with other endogenous hormones
- Supports cell division and elongation
- Increases enzyme levels for the synthesis of nucleic acids, proteins, vitamins, and sugars
- Optimizes photosynthesis and translocation of assimilates to economic plant parts
- Encourages stress resistance under adverse environmental conditions
- Increases fruit growth
- Improves quality of produce
- Expands chlorophyll content in leaves
- Enhances metabolic processes in plants
- Ameliorates the efficiency of plant nutrient and energy uptake and transport

ATTENTION: Please read and follow SDS instructions for safety precautions, cleaning, and maintenance of PPE (Personal Protective Equipment). (General use: detergent and hot water)
Not for human consumption. Keep out of reach of children.

GUARANTEE ANALYSIS

Nutrients	Specification	Derived from: Sulfate of Potash, Soy Protein Hydrolysate, Fermented Plant Extract, Hydrolyzed Fish, Homobrassinolide, Marine Microalgae, and Phosphoric acid.
- Nitrogen (N).....	3%	
- Phosphate (P ₂ O ₅).....	1%	
- Soluble Potash (K ₂ O).....	3%	
		Other properties: pH: 4.0 to 8.0

Warranty Limitations: The information contained on this label is believed to be accurate and reliable. There are no warranties that extend beyond the guaranteed analysis on the face hereof. All claims against guarantee are limited to replacement of product or refund of purchase price, or otherwise specified by law. The buyer/user acknowledges and assumes all liability resulting from the use of this material. Timing, method of application, weather, crop conditions, and other factors are beyond the control of the seller. MICROBEBIO® DISCLAIMS ALL OTHER WARRANTIES WHATSOEVER, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTY OR MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. In no event shall MICROBEBIO® be liable for damages resulting from the use of this product and/or any special consequential or incidental damages of any kind.



MicrobeBio®



EXPIRATION DATE:

BATCH NUMBER:

website: www.microbebio.com email: info@microbebio.com

Net Contents:

MicrobeBio[®] NATURE FOLIAR[™]



2.5 gallons



275 gallons



55 gallons



11,600 gallons



MicrobeBio®

**NATURE™
ACTIVATOR**

MICROBEBIO[®] NATURE ACTIVATOR[™]

A multi-step manufacturing process is used for combining select crop residuals with other organic and natural ingredients for improving characteristic functions of soils such as carrying out biocatalytic activities that govern nutrient recycling. MicrobeBio[®] Nature Activator[™] is a unique blend of naturally derived nutrients with a customized combination of proprietary biostimulants and advanced biological inputs plus humic substances consisting of humic acid and fulvic acid.

This product is an organic granular biofertilizer slow release that contains primary, secondary, and micro-nutrients, organic matter with available organic nitrogen sources, biostimulant, advance biological, humic acid, fulvic acid, mineral elements to stimulate microbial activity in plant growth, and beneficial microorganisms throughout the growing season, no matter the crop or condition of the soil. Our product improves the bio-geochemical process such as carbon cycle, nitrogen cycle, mineralization, and decomposition. It has the ability to hold, convert, stabilize and increase nitrogen in the soil. This product is easy to use for broadcasting as a direct nutrient contact to seeds and roots across the entire field.

THE BENEFITS:

- Increase organic matter and carbon source
- Increase chlorophyll content
- Enhance natural defenses
- Improve water retention
- Improve soil structure
- Stimulate biological activity by increasing microbial fertility
- Provide healthy bio-available source of food and energy for soil microbes
- Keep microbes moist and alive in extreme conditions
- Ensure that organic nutrients are thoroughly available for root absorption
- Stimulate plant growth and increased yield
- Deliver primary nutrient source of food for plants
- Remediate salinity and heavy metal contamination in soils
- Regulate pH in acid or alkaline conditions
- Increase BRIX levels

MicrobeBio®

NATURE™ ACTIVATOR

MICROBEBIO® NATURE ACTIVATOR™

A multi-step manufacturing process is used for combining select crop residuals with other organic and natural ingredients for improving characteristic functions of soils such as carrying out bio-catalytic activities that govern nutrient recycling. MicrobeBio® Nature Activator™ is a unique blend of naturally derived nutrients with a customized combination of proprietary bio-stimulants and advanced biological inputs plus humic substances consisting of humic acid and fulvic acid.

BENEFITS:

- Stimulate biological activity by increasing microbial colony.
- Provide healthy bio-available source of food and energy for soil microbes
- Ensure that organic nutrients are thoroughly available for root absorption
- Stimulate plant growth and increased yield
- Deliver primary nutrient source of food for plants

- Remediate salinity and heavy metal contamination in soils
- Increases BRIX levels
- Increase organic matter and Carbon source
- Increase Chlorophyll Content
- Enhance natural defenses
- Improve water retention
- Improve soil structure

ATTENTION: Please read and follow SDS instructions for safety precautions, cleaning, and maintenance of PPE (Personal Protective Equipment). (General use: detergent and hot water)
Not for human consumption. Keep out of reach of children.

GUARANTEE ANALYSIS

Nutrients	Specification
- Nitrogen (N).....	5%
0.75% ammoniacal nitrogen	
0.75% other water insoluble nitrogen	
3.50% water insoluble nitrogen*	
- Phosphate (P ₂ O ₅).....	1%
- Soluble Potash (K ₂ O).....	2%

*3.5% slowly available water insoluble nitrogen from alfalfa meal, marine algae and soy meal.

ALSO CONTAINS NON-PLANT FOOD

INGREDIENTS:

0.25% Humic substances derived from a natural source of peat (not extracted)
Yucca derived from desert plant extract surfactant to aid in the infiltration soils.

BATCH NUMBER:

EXPIRATION DATE:



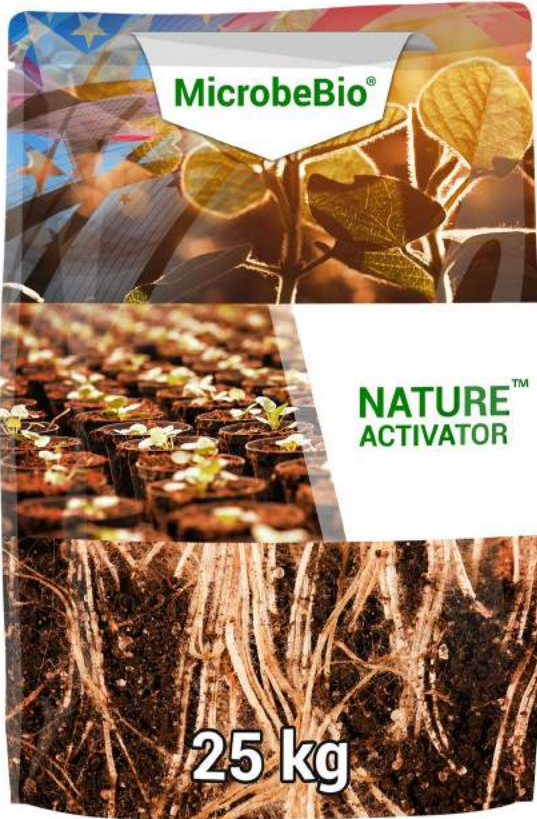
PLANT NUTRIENTS DERIVED FROM: Soy Meal, Alfalfa Meal, Marine Algae, and Sulfate of Potash

Warranty Limitations: The information contained on this label is believed to be accurate and reliable. There are no warranties that extend beyond the guaranteed analysis on the face hereof. All claims against guarantee are limited to replacement of product or refund of purchase price, or otherwise specified by law. The buyer/user acknowledges and assumes all liability resulting from the use of this material. Timing, method of application, weather, crop conditions, and other factors are beyond the control of the seller. MICROBEBIO® DISCLAIMS ALL OTHER WARRANTIES WHATSOEVER, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTY OR MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. In no event shall MICROBEBIO® be liable for damages resulting from the use of this product and/or any special consequential or incidental damages of any kind.

website: www.microbebio.com email: info@microbebio.com
Net Contents:



MicrobeBio® NATURE ACTIVATOR™



25 kg



1 ton super sack



MICROBEBIO[®]
EXCLUSIVE
INGREDIENTS

MicrobeBio® AlgaVigor™

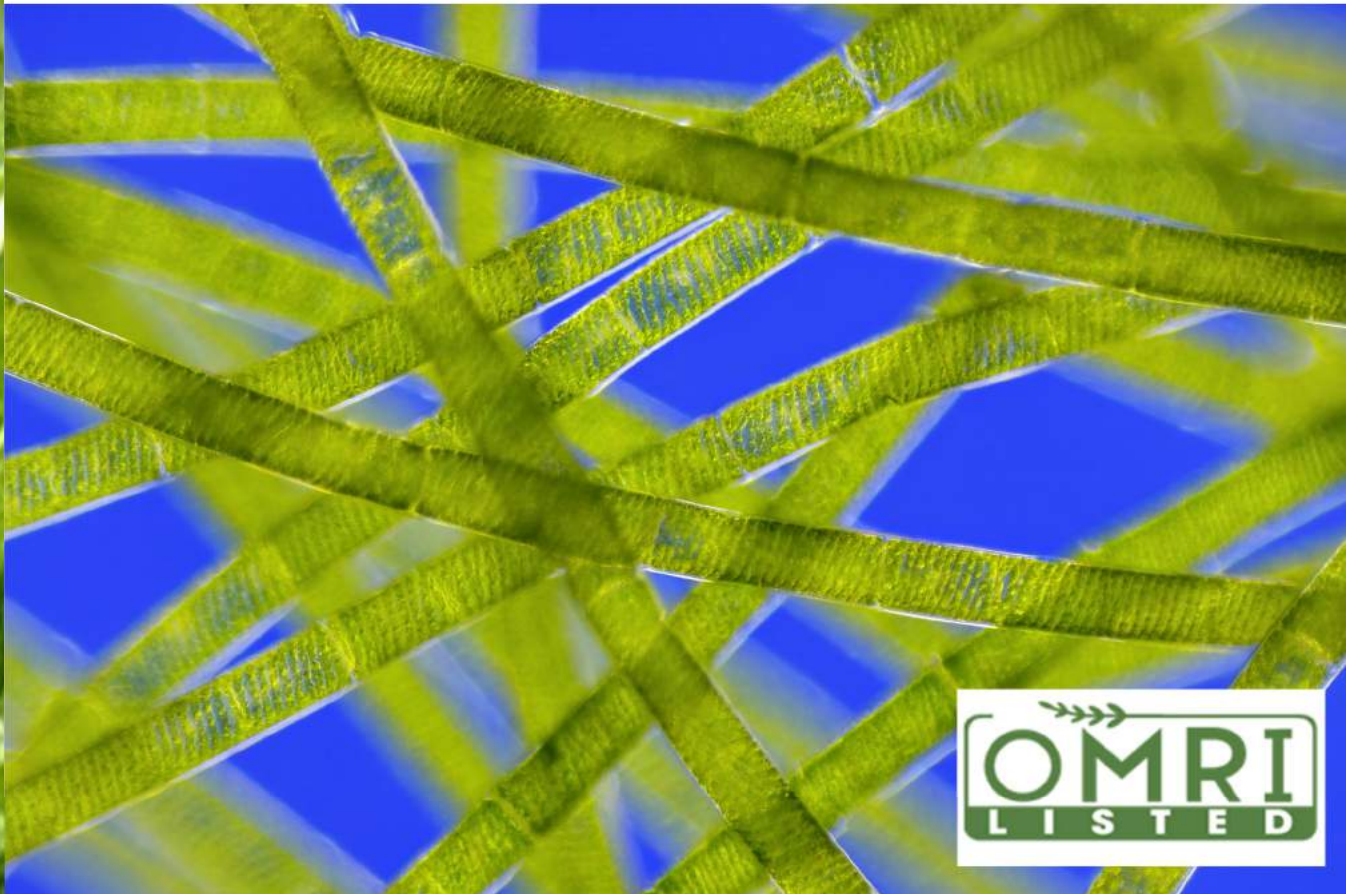
Category: 100% Water Soluble

Class: Low Rate Use Marine Microalgae

MicrobeBio® AlgaVigor™ is a proprietary marine microalgae phyto-nutrient: This whole-cell biomass provides plants available nutrients and a range of phytonutrients such as auxins, gibberellins and cytokines that greatly support the initial growth phases and overall plant well-being. Whole algae cells are mechanically harvested fresh with no added chemistry. Original cells are extremely small, often no larger than 5 microns and will not plug any sort of conveyance, application infrastructure or equipment. There are no limitations to its use on its own or with other plant protection, fertilizer or biostimulant liquid applications. Due to its original saline nature, when placed in any variant of fresh water, its cell structure will immediately deconstruct and mix thoroughly into the new media.

MicrobeBio® AlgaVigor™ is for clones, cuttings, seedlings in hydroponic applications and a growth catalyst for row crop and permanent crop agriculture. AlgaVigor™ is a plant nutrient biologically derived from a proprietary algae production platform. The algae are produced from special reactors using no more inputs than saltwater, trace minerals, sunlight, and ambient carbon dioxide.

Please freeze or refrigerate when not in use.



MicrobeBio[®] AloeVigor[™]

Meets International Aloe Science Council's (IASC) Certified Program Crop Fertilizers and Soil Amendments

Aloe vera contains more than 200 biologically active amino acids, vitamins, antioxidants, mineral, enzymes and sterols. This aloe not only exceeds the standards established by the International Aloe Science Council's (IASC) Certification Program for content and purity, but more importantly, ours is the only supplier to quantify and guarantee 10% polysaccharide (dry weight) retention through our unique patented process. This has enhanced the efficacy of aloe by increasing the polysaccharide content in the molecular range of 50,000 to 200,000 Daltons.

Aloe- Properties:

SOURCE	Purified Leaf	Mexico
SOLUBILITY	Soluble in Water	100% through 80 mesh
APPEARANCE	Light tan colored	Conforms
BOTANICAL SOURCE	Aloe barbadensis	Conforms
ABSORBANCE at 400 nm *	<0.5	0.071
TURBIDITY *	< 0.2	<1
pH *	3.5-5.0	4.5
MOISTURE	< 5%	1.9%
ASH	40%	26.96%
HEAVY METALS	< 10 ppm	< 10 ppm
TOTAL AEROBIC PLATE COUNT	< 10,000 CFU/g	Negative
MOLD and YEAST COUNT	< 1,000 CFU/g	Negative
COLIFORMS/PATHOGENS	Negative/25g	Negative
ALOE	< 8% Total Polysaccharides by dry weight	9.55%
Transportation Conditions		4°C to 38°C
Handling and Storage	For mixing with liquids keep dry, protected from sunlight	4°C to 25°C

* Analysis completed on powder diluted to 1% solids (single strength)



MicrobeBio[®] BeeVigor[™]

New Class: Very Low-Rate & Biodegradable PGR
Available as 0.1% End-Use
Registered as 1.0% Manufacturing Use for Reformulation

This MicrobeBio[®] BeeVigor[™] - a breakthrough 1% product is a new generation plant growth promoter and is derived from a chemical group, Brassinolides, considered to be one of the greatest scientific achievements in plant sciences. It took a team of USDA scientists a decade to isolate and synthesize the chemical structure natural to pollen. Only BeeVigor in the Brassinolides chemical group is HomoBrassinolide and therefore exclusively available through MicrobeBio[®].

The crystalline substance was found to be present in minute levels, 200 ppb, and discovered to interact synergistically with other plant growth substances to enhance both cell division and cell elongation and elicit profound physiological responses at sub-micromolar concentrations. MicrobeBio[®] BeeVigor[™] 100% natural origins, positive plant activity at extreme low-rates leaving no residual and efficacy without any persistence in the environment, is now available from MicrobeBio[®] who developed the market for this exciting product that the EPA granted tolerance exemption for, and therefore it can be used on all crops.

MicrobeBio[®] BeeVigor[™] may be used alone for 0.1% end use or as a manufacturing use product with other proven biostimulants, fertilizers and natural ingredients well-known for their benefits.



MicrobeBio® HumicVigor™

Category: Humic Non-synthetic

Class: Crop Fertilizer and Soil Amendment

A MicrobeBio® complex all natural, organic compound structure and formulation effective in almost any growing situation. This growth stimulant is an additive for any horticulture, turf, or agricultural application in which you wish to help promote improved growth, strength, and overall health.

This is not an ordinary humic acid product that is chemically-extracted from leonardite, lignite, or other coals. Rather, it is a 100% naturally-occurring humic acid source - along with exceptionally high levels of bacterial biomass that can increase nitrogen efficiency by up to 25%.

Our humic source is a geologically-unique peat North American deposit at what was the bottom of glacial lake ten thousand years ago. It replaces depleted soil carbon and absorbs nutrients to make them more available to root systems.

The formulation consists of micronized particles of this superior peat source suspended in water - and as such it can be safely applied with any commercial or agricultural spraying equipment without clogging. It is Organic Materials Review Institute (OMRI) Listed.



MicrobeBio® YuccaVigor™

Category: Wetting Agents

Class: Crop Management Tools and Production Aids

YUCCA VIGOR™ is OMRI and CDFA, OIM listed pure natural extract of the Mohave Yucca Plant (Yucca Schidigera), which is native only to the southwestern deserts of North America. YUCCA VIGOR™ is cold pressed under low pressure to ensure maximum activity and functionality of its active ingredient, steroid saponins. This special process has created a superior natural wetting agent that can replace common agrichemical surfactants. Additionally, the steroidal saponins provide multi-functional aide to a wide range of agriculture applications.

PROPERTIES

- CONCENTRATION: 47.5 Brix ± 1.0 @ 20° C: Brix measured with hydrometer
- APPEARANCE: Dark brown liquid
- TASTE: Bittersweet
- DENSITY: 1.210 – 1.240 (approximately 10 lbs. per gallon)
- PRESERVATIVES: NONE



REGULATORY:

YUCCA VIGOR™ is OMRI and CDFA, OIM listed for use in agriculture, allowed for use in organic agriculture* under N.O.P 205.605 and classified by EPA as a wetting agent exempt from the requirement of a tolerance under 40 CFR 180.1001 Mohave Yucca (Yucca Schidigera). Yucca schidigera is approved for use in food and beverages by the FDA under CFR 172.510, FEMA number 3121 * YUCCA VIGOR™ is not intended for human consumption.

KEY BENEFITS FOR PLANT FUNCTIONS AND FOR THE SOIL

Yucca is a hearty desert plant that has thrived for millions of years in adverse environmental conditions such as excessive heat, drought, UV stress and salt stress. When essential extracts are taken from plants adapted to such harsh conditions, many of these stress-reducing chemicals are harvested along with them.

Let's examine how Yucca can bolster crop yields by protecting plants from environmental stress.

Water absorption

Yucca plants are great at sequestering water. They are filled with natural wetting agents called saponins which are natural, steroidal-based chemicals that actually make water wetter by breaking the polarity of the water molecule. These wetting agents help keep the ionic molecules and organic molecules in suspension with each other, thereby aiding the plant with nutrient uptake.

Simply stated, if you add yucca extracts to your irrigation water, the water and nutrients can more easily enter the soil surface and spread to all the roots in the root zone. Since water disperses more evenly in the root zone, your plants will be able to use water more efficiently and can go longer between irrigation cycles without suffering adverse effects.

Protection Against Environmental Stress

Yucca also protect plants against damage from environmental stress with its organic molecules. In healthy environs, plants produce plenty of their own plant-protection agents. However, if they are exposed to excessive heat or UV light, their natural immune systems can become overwhelmed. That's when yucca can make a big difference with its plant-protection agents.

You see, in its desert environment, yucca produces powerful antioxidants which directly and indirectly effect the cell membranes of plants. For example, its antioxidants such as salicylic acid and vitamin C have a direct, protective effect on plants. Additionally, yucca produces signal molecules that stimulate plants to manufacture more of their own natural plant-protection agents.

Reduce Salt Level and Prevent Salt Buildup in the Soil

Yucca extracts help reduce salt buildup in the soil. Flowing water tends to find the path of least resistance and thus follows the same path during irrigation. When the soil dries between waterings, mineral salts build up in the root zone.

Since root growth follows the flow of water, it is possible for pockets of harsh mineral salts to begin to form and damage tender root hairs. Yucca extracts solve the problem by allowing the water to spread more evenly, washing away concentrated salts and preventing dry pockets from forming.

A large center pivot irrigation system is shown in a field. The system consists of multiple metal wheels connected by a central pipe, with numerous smaller wheels branching out to support the main pipe. The wheels are positioned on a green field, and the system is surrounded by a fine mist or fog. In the background, there are rolling hills and trees under a clear sky.

MICROBEBIO®

IN FIELDS

Trial Tests

FUNGAL PATHOGEN SEED

Greenhouse - USA



Fungal Pathogen Seed, Soil and Foliar Treatments Greenhouse Assays 09/2014

Objective:

MICROBEBIO™ was tested for its ability to out-compete and kill the most prevalent fungal pathogens in agriculture – *Pythium spp.*, *Rhizoctonia spp.*, and *Fusarium spp.* The microbial product was tested in (1) the soil, (2) as a seed treatment and (3) as a foliar application.

Conclusion:

MICROBEBIO™ was able to significantly and effectively control and kill fungal spores found in the soil and on the foliar portion of the plant. Plant stand counts were taken on day 14 and day 35 post germination. The microorganisms were able to demonstrate high efficacy and protection of the plants during this time period. Overall, the microorganisms demonstrated strong enzymatic killing to overcome and control fungal pathogens.

Table 1: Plant Stand Counts – *Pythium ultimum* fungal assay

Trial Seed	Fungal Pathogen	Treatment	Application Rate	% Survival 14 DAP	% Survival 35 DAP	% Survival Vs (+)Control Day 14	% Survival Vs (+)Control Day 35
Corn	<i>Pythium ultimum</i>	(+) Control Rovral + Ridomil	As Recommended	54.2	58.3	n/a	n/a
		MICROBEBIO™ (Seed Treatment)	3 oz per 100-Lb seed	87.3	86.3	+36	+38
		MICROBEBIO™ (Soil Treatment)	1 oz per 400g pot (soil)	84.3	82.3	+35	+29
		MICROBEBIO™ (Foliar Treatment)	1 oz per 400g pot (foliar)	81.3	80.3	+33	+27

Soil and Foliar Treatments = 2 liters per hectare

FUNGAL PATHOGEN SEED

Greenhouse - USA

Table 2: Plant Stand Counts – *Fusarium spp.* fungal assay

Trial Seed	Fungal Pathogen	Treatment	Application Rate	% Survival 14 DAP	% Survival 35 DAP	% Survival Vs (+)Control Day 14	% Survival Vs (+) Control Day 35
Corn	<i>Fusarium spp.</i>	(+) Control Rovral + Ridomil	As Recommended	68	63.5	n/a	n/a
		MICROBEBIO™ (Seed Treatment)	3 oz per 100-Lb seed	87.3	89.3	+22	+29
		MICROBEBIO™ (Soil Treatment)	1 oz per 400g pot (soil)	85.3	83.3	+20	+24
		MICROBEBIO™ (Foliar Treatment)	1 oz per 400g pot (foliar)	82.3	82.3	+17	+23

Soil and Foliar Treatments = 2 liters per hectare

Table 3: Plant Stand Counts – *Rhizoctonia solani* fungal assay

Trial Seed	Fungal Pathogen	Treatment	Application Rate	% Survival 14 DAP	% Survival 35 DAP	% Survival Vs (+)Control Day 14	% Survival Vs (+) Control Day 35
Corn	<i>Rhizoctonia solani</i>	(+) Control Rovral + Ridomil	As Recommended	70.3	66.7	n/a	n/a
		MICROBEBIO™ (Seed Treatment)	3 oz per 100-Lb seed	88.5	85.3	+21	+22
		MICROBEBIO™ (Soil Treatment)	1 oz per 400g pot (soil)	87.3	87.3	+19	+24
		MICROBEBIO™ (Foliar Treatment)	1 oz per 400g pot (foliar)	83.3	80.3	+16	+17

Soil and Foliar Treatments = 2 liters per hectare

AUBURN UNIVERSITY

Greenhouse Nematode Trials - USA

Crop	Target Nematode	Eggs/Gm Root MICROBEBIO™ (MICROBEBIO™)	Eggs/Gm Root Bayer CropScience (Aldicarb - <i>Temik</i>)
		% Nematode Reduction	% Nematode Reduction
Cotton	Root-Knot	96	99.5
Snap beans	Root-Knot	88	60.5
Potato	Root-Knot	94	96
Corn	Root-Knot	80.6	42.6
Pepper	Root-Knot	100	97.7
Lettuce* (In progress)	Root-Knot	68	0
Tomato	Root-Knot	89	80
Carrot	Root-Knot	75	52.5
Soybean	Soybean-Cyst	92.7	74.3
Squash	Root-Knot	92.3	76
Cucumber	Root-Knot	92.8	78.7
Watermelon	Root-Knot	90.8	68.8
Onion	Root-Knot	92.6	82.5
Citrus* (in progress)	Root-Knot	90	83.3
Bermuda grass (University of Florida)	Sting	90	63 (NemaCur)

AUBURN UNIVERSITY

Cucumber Nematode Trials – USA (2016)

Company	Treatment	Nematode	% Crop Yield Increase (Versus Untreated Control)
MICROBEBIO™	2 liters/hectare	Root-Knot	15%
Ambac Chemical Corporation (+ Chemical Control)	VAPAM (Sodium Metam) at Recommended Rate	Root-Knot	7%

Nematode damage was controlled and cucumber yield was improved through the application of MICROBEBIO™ at 2-4 liters/acre versus Sodium Metam (VAPAM) and the untreated negative control.

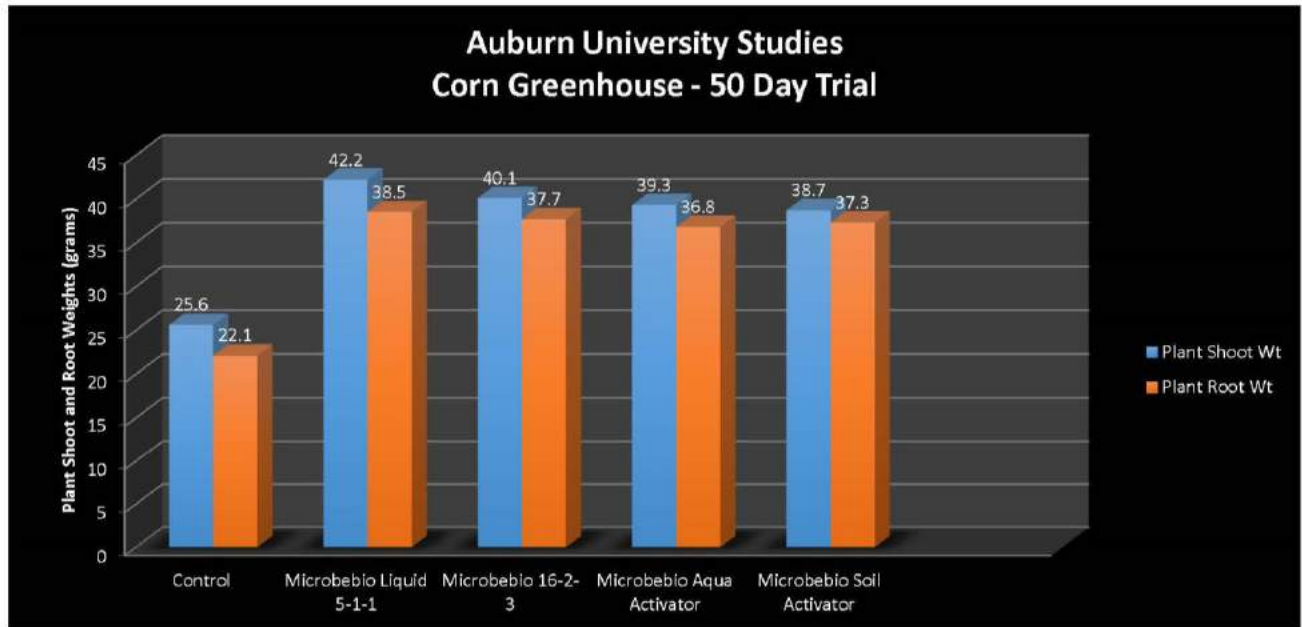
Tomato Field Trial Results:

75% - 90% reduction in nematodes versus the untreated control and a chemical competitor (Sodium Metam).

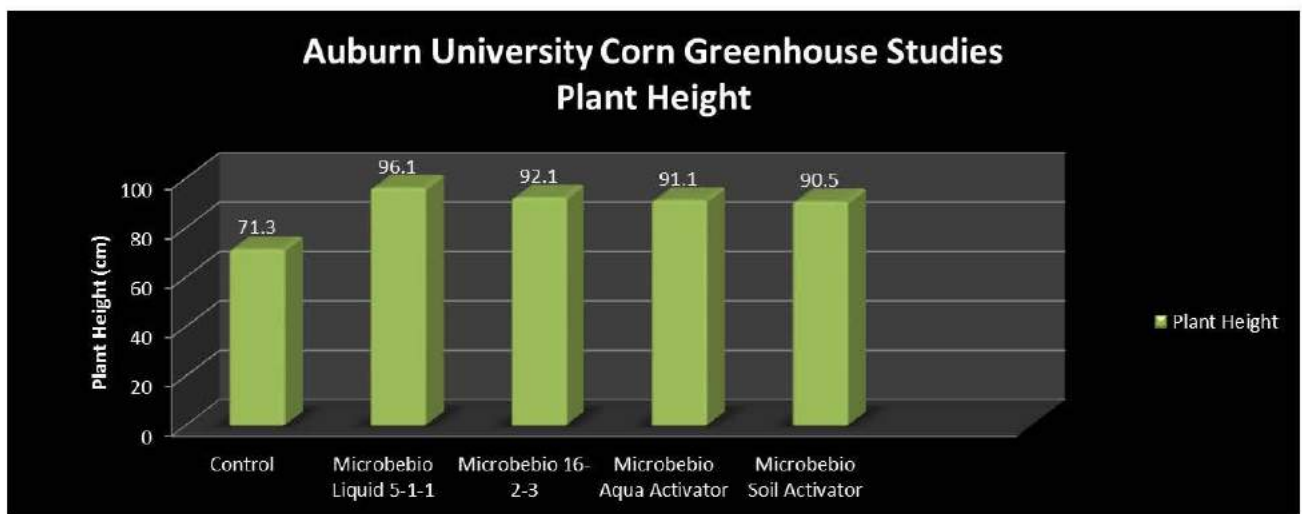
AUBURN UNIVERSITY

Trials – USA (2016)

Auburn University - March 2016					
	Control	Microbebio Liquid 5-1-1	Microbebio 16-2-3	Microbebio Aqua Activator	Microbebio Soil Activator
Plant Shoot Wt	25.6	42.2	40.1	39.3	38.7
Plant Root Wt	22.1	38.5	37.7	36.8	37.3



	Control	Microbebio Liquid 5-1-1	Microbebio 16-2-3	Microbebio Aqua Activator	Microbebio Soil Activator
Plant Height (cm)	71.3	96.1	92.1	91.1	90.5



UNIVERSITY OF FLORIDA

Bermuda Grass Outdoor Trials – USA (2011)

- Effects of treatments on population densities of sting nematodes

Company	Treatment	Target Nematode	% Reduction vs. Control (60 days)
n/a	Untreated Control	Sting	n/a
MICROBEBIO™	Bio Nematode Mgmt.	Sting	78%
Bayer CropScience	Nortica	Sting	20%
Bayer CropScience	NemaCur	Sting	12.5%

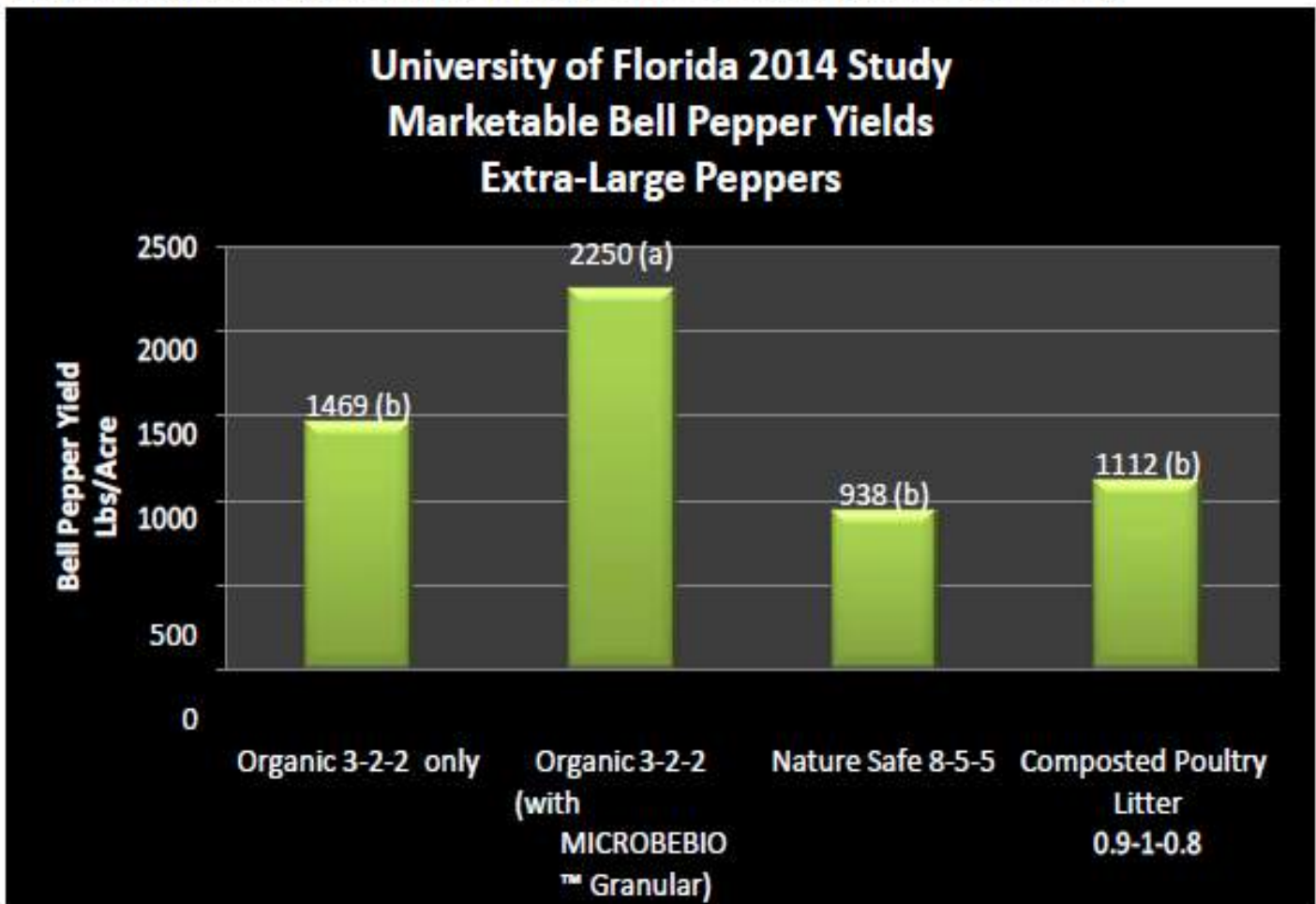
- Effects of treatments on population densities of root-knot nematode juveniles in soil (J2)

Company	Treatment	Target Nematode	% Reduction vs. Control (60 days)
n/a	Untreated Control	Root-Knot	n/a
MICROBEBIO™	Bio. Nematode Mgmt.	Root-Knot	44%
Bayer CropScience	Nortica	Root-Knot	2.4%
Bayer CropScience	NemaCur	Root-Knot	30%

UNIVERSITY OF FLORIDA

Bell Pepper Yields – 2014

Graph 1: Marketable Bell Pepper yield by fertilizer source (Extra-Large variety)

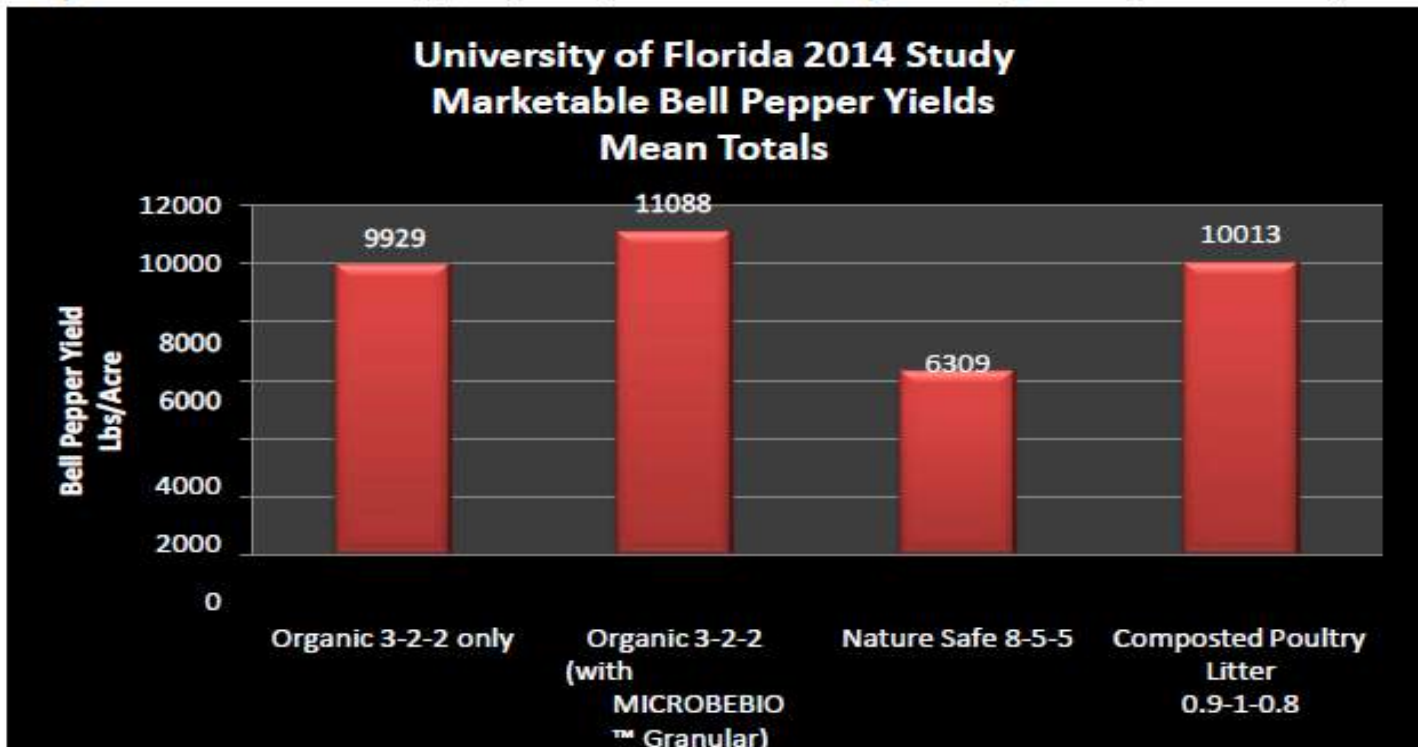


UNIVERSITY OF FLORIDA

Bell Pepper Yields – 2014

Total fertilizer comparisons of extra large Bell Peppers demonstrating a statistically significant difference between Organic 3-3-3 *with* MICROBEBIO™ Granular microbes versus Organic 3-3-3 *without* MICROBEBIO™ Granular, Nature Safe 8-5-5 and composted poultry litter in Lbs/acre. Statistical significances are shown as (a) and (b) codes to denote real differences in yield.

Graph 2: Marketable Bell Pepper yield by fertilizer source (Extra Large variety mean totals)



Total fertilizer comparisons of all bell pepper varieties (No.2, large and Extra Large) over four levels of nitrogen application. Organic 3-3-3 with microbes (MICROBEBIO™ Granular) out-performed all competitors in Lbs/acre.

UNIVERSITY OF FLORIDA

Bell Pepper Yields – 2014

Table 1: Bell Pepper vigor rating using a scale of 1-5

Treatments	Vigor Rating
3-3-3 (+ MICROBEBIO™ Granular microbes)	
100 Lbs/Acre	3.50 (b)
200 Lbs/Acre	4.50 (a)
300 Lbs/Acre	4.25 (a)
400 Lbs/Acre	5.00 (a)
	<i>P = 0.0062</i>
3-3-3 (- MICROBEBIO™ Granular microbes)	
100 Lbs/Acre	2.75 (b)
200 Lbs/Acre	3.50 (a b)
300 Lbs/Acre	4.05 (a)
400 Lbs/Acre	4.50 (a)
	<i>P = 0.0178</i>
Nature Safe 8-5-5	
100 Lbs/Acre	2.00
200 Lbs/Acre	2.25
300 Lbs/Acre	2.25
400 Lbs/Acre	2.25
	<i>No Significance</i>
Composted Poultry Manure 0.9-1-0.8	
100 Lbs/Acre	2.25 (b)
200 Lbs/Acre	3.50 (a)
300 Lbs/Acre	3.50 (a)
400 Lbs/Acre	4.00 (a)
	<i>P = 0.0355</i>



MICROBEBIO®

FIELD TEST

WHEAT FIELD TEST

LUSAKA, ZAMBIA



WHEAT FIELD TEST

LUSAKA, ZAMBIA



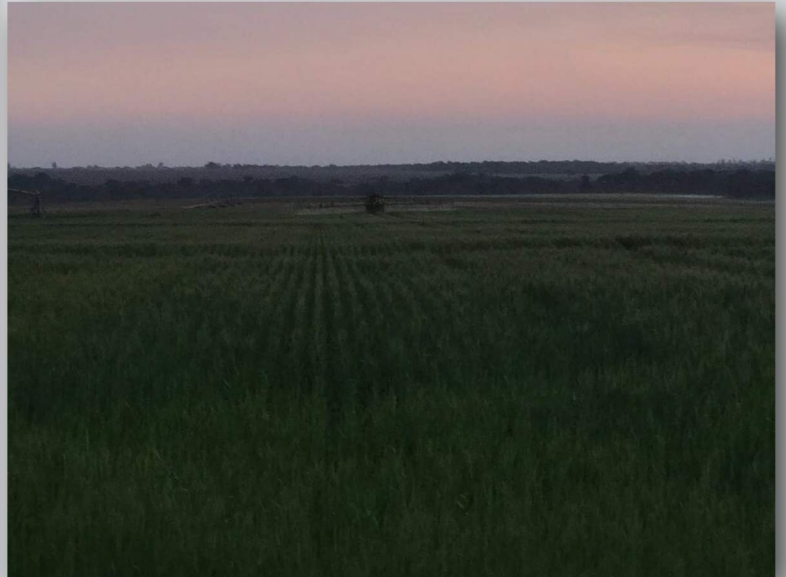
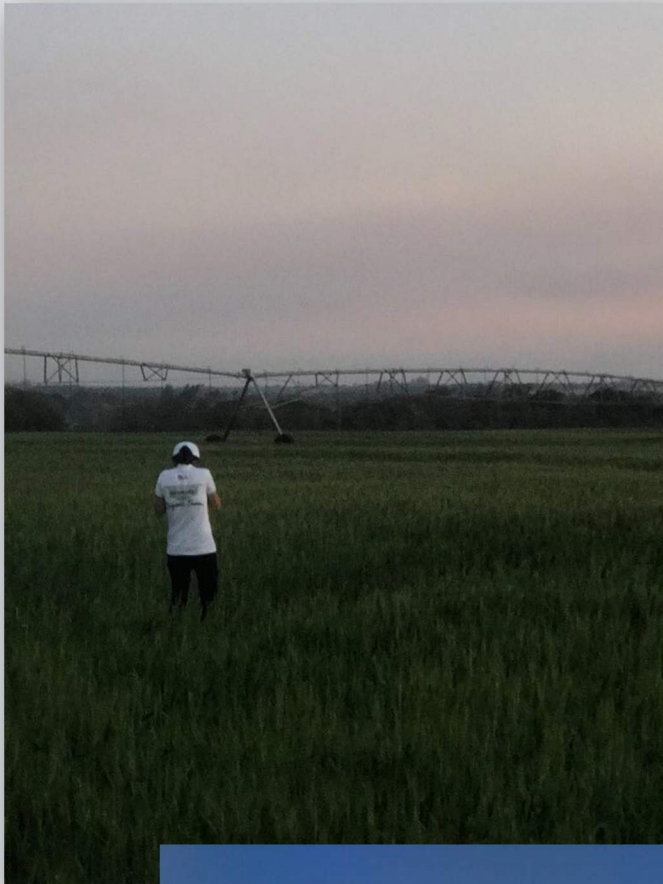
WHEAT FIELD TEST

LUSAKA, ZAMBIA



WHEAT FIELD TEST

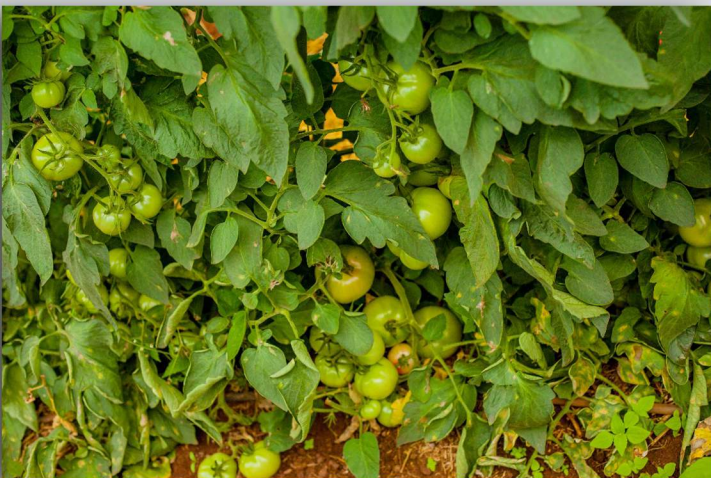
LUSAKA, ZAMBIA



MKUSHI FARM



MICROBEBIO® ZAMBIA TOMATO TRIAL



**York
Farm**

MICROBEBIO[®] ZAMBIA TOMATO TRIAL



**York
Farm**



MICROBEBIO[®] ZAMBIA TOMATO TRIAL



**York
Farm**

MICROBEBIO[®] ZAMBIA TOMATO TRIAL



**YORK
FARM**

MICROBEBIO® ZAMBIA TOMATO TRIAL

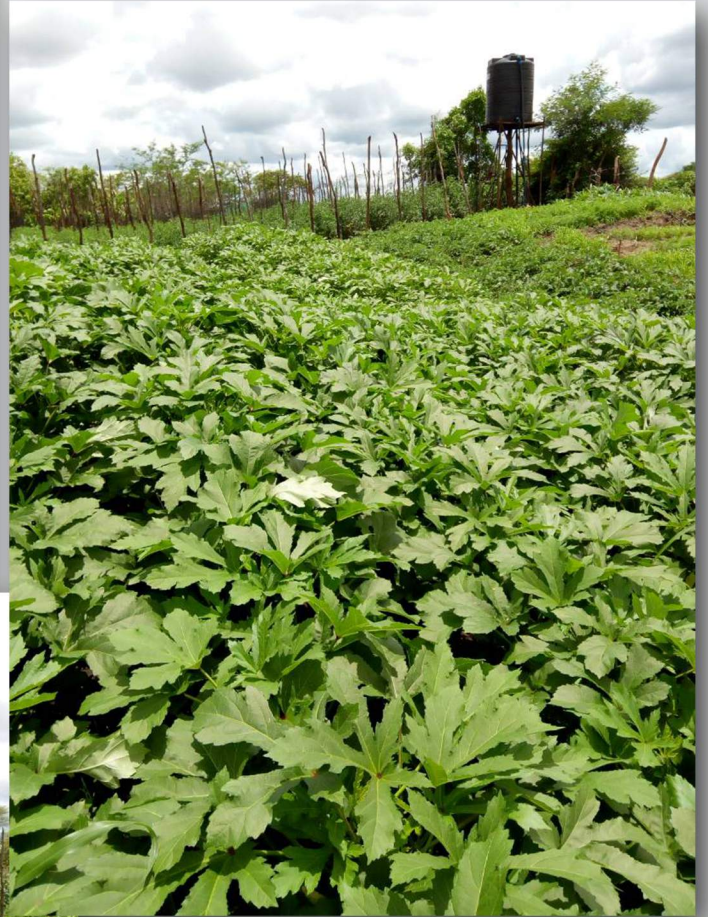
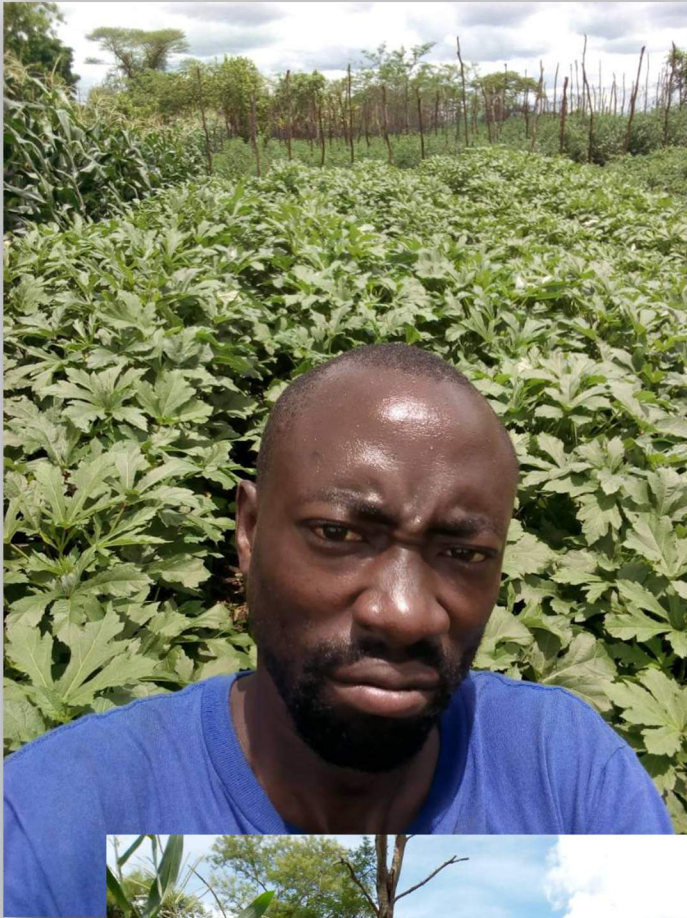


**YORK
FARM**

MICROBEBIO[®] ZAMBIA SOYA BEAN TRIAL



MICROBEBIO® ZAMBIA OKRA TRIAL



**MWALU
FARM**

MICROBEBIO[®] ZAMBIA MAIZE TRIAL



Control Field



MICROBEBIO[®] Field

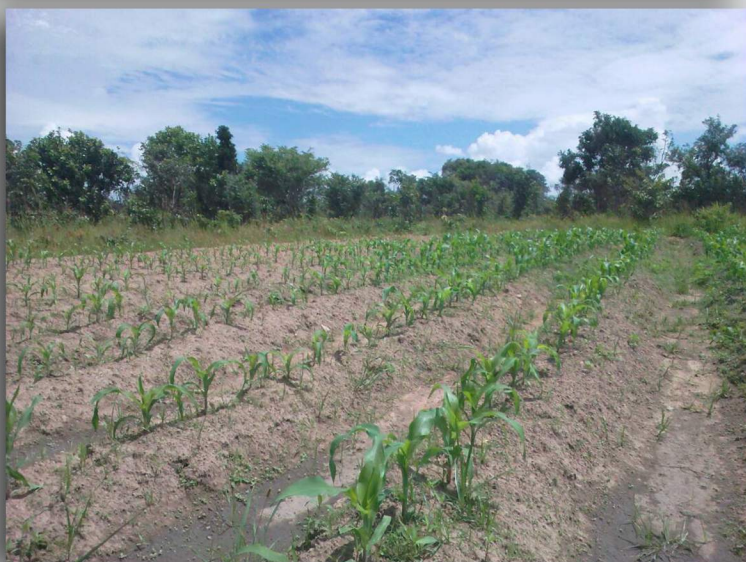
MWALU FARM

MICROBEBIO® ZAMBIA MAIZE TRIAL



MWALU FARM

MICROBEBIO[®] ZAMBIA MAIZE TRIAL



**MWALU
FARM**

MICROBEBIO® HOUSTON, TEXAS



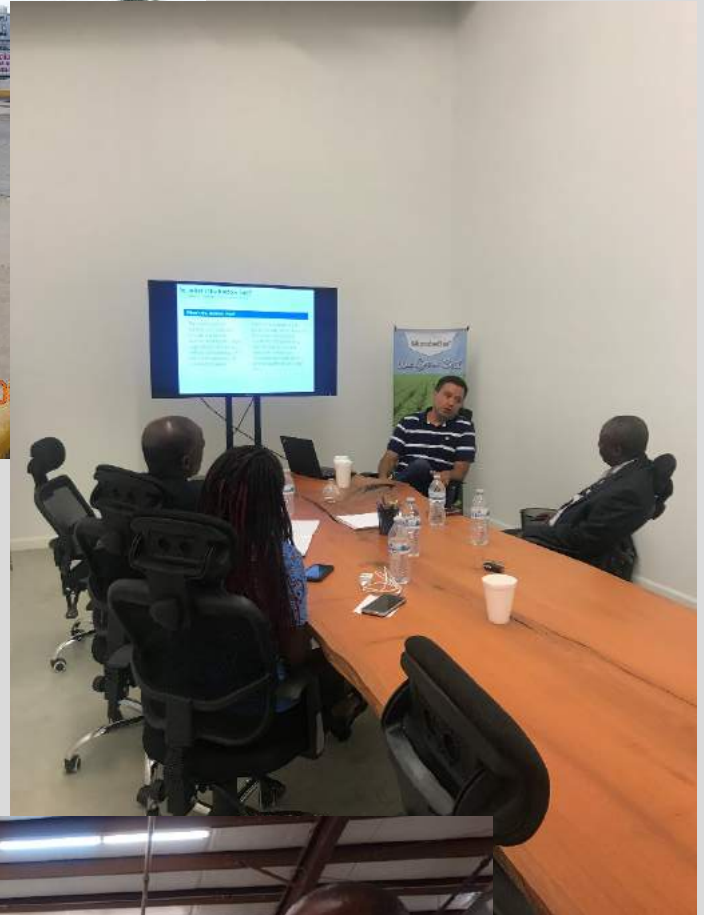
MICROBEBIO® HOUSTON, TEXAS



MICROBEBIO® HOUSTON, TEXAS



MICROBEBIO® HOUSTON, TEXAS



MICROBEBIO® HOUSTON, TEXAS



MICROBEBIO® HOUSTON, TEXAS



MICROBEBIO® HOUSTON, TEXAS



MICROBEBIO® HOUSTON, TEXAS



MICROBEBIO® HOUSTON, TEXAS



MICROBEBIO® HOUSTON, TEXAS



MICROBEBIO® STOCKTON, CALIFORNIA



MICROBEBIO® STOCKTON, CALIFORNIA



MICROBEBIO® STOCKTON, CALIFORNIA



MICROBEBIO® STOCKTON, CALIFORNIA



MICROBEBIO® STOCKTON, CALIFORNIA



MICROBEBIO® MODESTO, CALIFORNIA



MICROBEBIO® MODESTO, CALIFORNIA



MICROBEBIO® MODESTO, CALIFORNIA



MICROBEBIO® MODESTO, CALIFORNIA



MICROBEBIO® MODESTO, CALIFORNIA



MICROBEBIO® MODESTO, CALIFORNIA



MICROBEBIO[®] MODESTO, CALIFORNIA





Republic of Zambia

Ministry of Agriculture

Zambia Agriculture Research Institute

MICROBEBIO TECHNICAL REPORT

Mount Makulu Central Research Station

Private Bag 7

CHILANGA

Telefax 260-1-278130/380

zaridirector@zari.gov.zm

Contents

Introduction.....	3
Objectives of the Trials.....	4
Materials and methods	5
Aqua Activator Experiment	5
Super Soil Activator Experiment	7
Soil Vigor Experiment	8
Microbebio Bionematicide Experiment.....	9
Results and Discussion	12
Performance of soil vigor in soybean	12
Performance of Aqua Activator in maize	14
Performance of super soil activator in maize.....	16
Performance of X1 bionematicide in tomato	19
Conclusion	22
References.....	23

Introduction

The world is faced with an increase in demand for more food to be produced exacerbated by a rapid rise in population. This not only adds pressure on the current production systems but threatens to comprise the ability of future generations to meet their daily food requirements (Tilman et al, 2002; Foley, 2005). Chemical fertilizers and pesticides have in the last 50 years contributed towards increasing food production across several landscapes, including Africa (Matson, 1997). However, due to logistical and budget constraints many developing countries (especially in Africa) have been unable to meet the required threshold of fertilizer and pesticide inputs, essential to drive their food production to the levels of the western world. This has resulted in yield declines, crop damage due to pests, soil nutrient mining (Maston, 1997), which is accelerating soil degradation to alarming levels. To mitigate this, agrarian systems are slowly tilting towards more sustainable and environmentally friendly means of production while reducing dependency on synthetic fertilizers and pesticides. The aim of this school of thought is to reduce chemical inputs without negatively affecting crop productivity, but to do this, a technology that can allow even resource poor farmers to produce more with less, without having adverse impact on the ecosystem and production system needs to be considered.

Biostimulants such as soil enhancers, conditioners, activators, have in the recent past generated a lot of interest within the scientific community because they have been deemed to significantly increase yield. These microbial amendments, which mostly comprise plant growth promoting rhizobacteria, plant hormones, fungi, and algae, and when applied in small quantities increase yield (Sharma et al., 2013), they elicit responses in plants resulting in better nutrient uptake from the soil. However, it must be noted that the bioproducts may need to be used in combination with other inputs such as conventional fertilizers and pesticides, for more efficient crop management.

It is from this background that the Zambia Agriculture Research Institute (ZARI) was requested by COMESA/ACTESA to undertake an evaluation of bioproducts microbebio soil vigor, microbebio aqua activator, and microbebio X1 nematicide, for the purpose of introducing them as amendments in Zambia. Glasshouse pot studies were established to test their (microbebio products) efficacy for nematode control and yield increase for major crops (horticulture, cereals, and other grains) commonly grown in Zambia. Three test crops namely maize, soybean, and tomato were used in 60 day trials. The major findings from these trials indicate

that the products are able to perform as claimed by the manufacturer, however, further studies will be conducted in the field by ZARI to validate the preliminary results.

This report intends to communicate to COMESA and other stakeholders on the implications of using the microbebio products for crop production in Zambia.

Objectives

The overall objective for setting these experiments was to evaluate the efficacy of four microbebio powder and granular based bioproducts, as soil amendments and control agents for soil borne pest and pathogens, and yield increase to use for crop production in Zambia.

The specific objectives are as outlined below:

1. To determine the effect of soil vigor application on the yield of pot grown soybean plants.
2. To evaluate the effect of super soil activator application a granular microbe fertilizer on biomass production in maize.
3. To determine the effect of aqua activator application on maize yield.
4. To evaluate the efficacy of using microbebio X1 bionematicide as a control agent for soil borne nematodes.

Materials and Methods

Pot grown plants were used to evaluate the efficacy of the four microbebio products (soil vigor, super soil activator, aqua activator, and X1 bionematicide), using glass and screen house facilities at Mount Makulu Central Research, Chilanga, Zambia. The four bioproducts which were supplied alongside Material Safety Data Sheets (MSDS) were and stored in a cool dry place away from direct sunlight prior to testing.

Three test crops namely soybean (soil vigor), maize (aqua activator and super soil activator), and tomato (X1 bionematicide) were used. A field soil obtained from Mount Makulu Research station was used in this study.

Aqua Activator Experiment

Trial set up and management

The trials for aqua activator were conducted between March and June 2017 inside and outside the glasshouse for 50 days. A commercial early maturing maize (*Zea mays*) variety SC403 obtained from SEEDCO, was pregerminated for 72 hrs in the dark at room temperature prior to planting. The maize seedlings were carefully transplanted into polythene pots containing 10kg field soil sieved to a particle size of 2mm, and irrigated to field capacity (figure 1).



Figure 1: Left panel-Pots field with field soil from Mount Makulu, arranged in a complete randomized design and watered to field capacity prior to planting the aqua activator trial. Right panel-Pregerminated maize seedlings being given a final sprinkle of water before transplanting into pots

Two experiments were set up for this trial; the first experiment had six treatments arranged in a complete randomised design (CRD) with five replications (see treatment description below), the second study comprised two treatments (aqua activator and full rate NPK fertilizer).

T1 – Control

T2 – Microbebio aqua activator seed dressing + half rate NPK (100Kg/ha)

T3 – Microbebio aqua activator seed dressing + full rate NPK (200Kg/ha)

T4 – Microbebio aqua activator soil dressing + half rate NPK (100Kg/ha)

T5 – Microbebio aqua activator soil dressing + half rate NPK (100Kg/ha)

T6 – Full rate NPK (200Kg/ha)

The microbebio aqua activator solution was prepared by dissolving 1g of product in 260mL deionised water (which is equivalent to the application rate for one hectare), and added as a 1mL soil drench for T4 and T5 (figure 2), while the seedlings for T2 and T3 were dunked into the concentrate and planted immediately. Likewise, for the second study, the solution was prepared as described above but was applied as a soil drench only.

Repeat applications of the soil drench were done 20 and 40 days after planting (DAP) to T2, T3, T4, and T5 in the first experiment, while in the second trial only the sole aqua activator treatment received the dose as described above. Fertilizer was applied at planting according to treatment, calculated based on volume of soil contained in the pots.

All plants were kept well-watered by maintaining 80% evapotranspiration throughout the growing period up to harvest (50 DAP) by supplying 200mL of water every 2 days when the plants were small and 800mL as they grew larger. An incidence of fall army worm attack was observed in the early stages for both experiment, but was controlled with 5% EC cypermethrine, after which, there was no further occurrence.



Figure 2: Left panel - Aqua activator being applied as a soil drench to pot grown maize plants 20 days after planting. Right panel - Maize plants in the microbebio aqua activator experiment 23 days after planting.

Measurements and data analysis

At harvest, plants heights were measured using a tape from the base of the plant just above the soil to the growing tip and data was carefully recorded according to treatment. After excising the shoot, roots were washed under a stream of water with care taken not to lose root mass; root lengths were recorded for individual plants as above. Fresh root and shoot plant material were oven dried at 80°C in the oven until a consistent weight was obtained, prior to determination of root and shoot biomass production on dry weight basis. Analysis of variance to determine the effect of aqua activator on plant growth and biomass production for the maize across treatments was performed, at 95% confidence interval using Genstat statistical package. The data are graphically presented as means according to variables and treatments in the results section.

Super Soil Activator Experiment

Trial set up and management

In order to determine the effect of the super soil activator on biomass yield in maize, the same variety was used as above was established outside the glasshouse facilities at Mount Makulu. A CRD study involving three treatments (described below) with seven replications was set up for 40 days in 10 litre pots containing field soil from the research station, processed as described above.

Treatment 1 - super soil activator sole

Treatment 2 - super soil activator + half rate NPK fertilizer (100Kg/ha)

Treatment 3 - full rate NPK fertilizer (200Kg/ha)

Fertilization and plant management was done in a similar manner as described in the aqua activator experiment.

Measurements and data analysis

Forty days after planting, the shoot and root biomass, plant heights, and root lengths were measured (see description above). Analysis of variance with Tukey's post hoc HSD test for mean separation was performed at 95% confidence interval, to assess treatment performance and are presented in the results section.

Soil Vigor Experiment

Trial set up and management

To evaluate the performance of soil vigor, Lukanga a non-self nodulating soybean variety obtained from ZARI was grown in 5 litre polythene pots (planted on the same day as the maize) containing 5kg field soil and processed as described above. Seeds were selected for uniformity (size) and pre-germinated for 48 hrs in the dark at room temperature. The seedlings were then transplanted into pots irrigated to field capacity prior to planting and arranged in a CRD with five replications, according to treatments described below:

Treatment 1 – Control

Treatment 2 – Rhizobium + full rate NPK

Treatment 3 – Soil vigor sole

Treatment 4 – Soil vigor + full rate NPK (200Kg/ha)

Treatment 5 – Soil vigor + half rate NPK (100Kg/ha)

All plants were grown under well-watered conditions (up to harvest) following the respective treatments. For Treatment 2, soybean inoculant containing a strain of *bradyrhizobium japonicum* (CAIT 102), was applied as a seed coating with fertilizer at the rate of 200Kg/ha supplied at planting respectively. The soil vigor was applied to treatments 3, 4, and 5 by firstly diluting 2g in 10mL deionised water, to make a concentrate, after which, the solution was

further diluted with 90mL DI water to make up to a volume of 100mL. The microbebio treatments were applied by adding 1mL of the solution as per treatment (figure 3), and were immediately followed by irrigation to field capacity (as described in the microbebio soil vigor information sheet). Full rate and half rate fertilizer treatments were applied as describe above to treatment 4 and 5 respectively.

The microbebio treatments were repeated 3 times at 20, 30 and 40 days after planting.



Figure 3: Left panel - Soil vigor and aqua activator solutions before application. Right panel – soybean plants arranged in a CRD according to treatments in the glasshouse.

Measurements and data analysis

Forty days after planting, shoot and root biomass were measured following the procedure described above. Analysis of variance with Tukey’s post hoc HSD test for mean separation was performed at 95% confidence interval to assess treatment performance and are equally presented in the results section.

Microbebio Bionematicide Experiment

Trial set up and management

Black soil was collected from rice fields at Mount Makulu and was left to dry for 48 hours, then the soil was sterilized for 30 minutes at 121°C. The cooled sterilized soil was transferred into 5Kg polythene pots and taken to the screenhouse in readiness for planting. Three tomato seedlings, variety tengeru, obtained from a nursery at the research station were transplanted at 15 cm spacing in a triangular pattern at a depth of 1cm into each pot. The plants were then arranged in a CRD comprising the following treatments:

- Trt1 Control: No Treatment + Inoculation of 60 Nematodes
- Trt2 Conventional Bionematicide + Inoculation of approx. 60 nematodes
- Trt3 Conventional Bionematicide + Inoculation of approx. 40 nematodes
- Trt4 Conventional Bionematicide + Inoculation of approx. 20 nematodes
- Trt5 Bionematicide + Inoculation of approx. 60 nematodes
- Trt6 Bionematicide + Inoculation of approx.40 nematodes
- Trt7 Bionematicide + Inoculation of approx. 20 nematodes

Nematodes were isolated from soil samples collected from a tomato farm in Chilanga (in close proximity to the research station) by sampling the top soil (0-20 cm). Samples were immediately placed in clean plastic bags and transported to Mount Makulu Entomology Laboratory for further processing. A modified Baerman funnel (extracting tray, wire mesh, filter paper and paper towels) was setup and used to extract the nematodes from the mixture of soil and macerated plant roots. A supernatant (water suspension) was collected and transferred into clean glass jars and left to stand for 30 minutes. Some of the remaining water was decanted and carefully transferred onto petri dishes for examination under a light microscope for the presence of nematodes (figure 4).



Figure 4: Nematodes being observed under a microscope.

The number of nematodes was established by using a counting dish and then transferred with a sterile syringe to the pots in order to achieve the following inoculation numbers per pot: 60, 40, 20, and control (no nematodes) nematodes, replicated 3 times. Basal fertilizer was applied to each pot at the recommended rate for tomato production in Zambia (figure 5).



Figure 5: Tomato plants arranged according to treatments in the greenhouse

A commercial nematicide was used alongside the X1 microbebio bionematicide applied as a soil amendment 30 days after the potted plants had been inoculated with nematodes, following the recommendations contained in the product information sheet.

Measurements and data analysis

Seven days after application of treatments, soil samples were collected from each pot to determine the number of surviving nematodes. The growth of plants was also monitored throughout the period paying particular attention to visual symptoms of nematode attack. Sixty days after transplanting, shoot and root biomass was determined by drying the plants in the oven at 80°C for 72 hours. The samples were immediately measured using a laboratory balance, data was analysed using Genstat statistical package with individual treatment means separated by Tukey's HSD test at 95% confidence interval.

Results and Discussion

Performance of soil vigor in soybean

The data on shoot and root biomass were analysed in a CRD to test statistically the differences among treatments combinations for soil vigor in soybean. Analysis of variance indicated that the differences between soil vigor and the recommended rhizobium with fertilizer treatment were not statistically significant for both shoot and root biomass (figure 6). However, addition

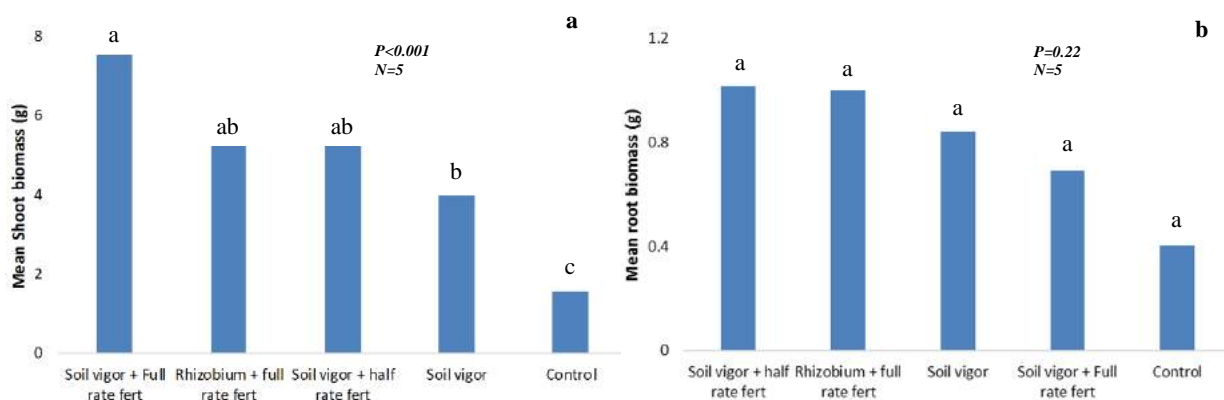


Figure 6: (a) - Mean shoot biomass for soybean plants treated with soil vigor 0, 20, and 30 DAP; (b) - Root biomass for different soil vigor, fertilizer, and rhizobium combinations. Data are means of 5 plants harvested 40 DAP, analysis of variance was performed, with Tukey's HSD test. Different letters indicate statistical differences at 95% confidence interval.

of soil vigor in combination with full rate fertilizer significantly increased biomass by 30%, when compared to the rhizobium + fertilizer application (current recommended practice for soybean production in Zambia). The results further suggest that soil vigor when applied as a sole application equally increased biomass two-fold, when compared to the control. This implies that the plants showed significant responses to soil vigor application thereby resulting in more biomass production, which is a proxy of grain yield and plant performance as influenced by availability of adequate nutrition. Despite not showing any statistical differences in root biomass, application of soil vigor considerably increased root dry matter production by 50% over the control. It can be argued that healthy root system results in more competitive plants that are capable of absorbing additional nutrients and water from the rhizosphere (Reynolds and Thornley, 1982; Bolinder et al. 1997).

A further analysis of shoot: root ratio data revealed that the soil vigor + full rate fertilizer increased shoot growth over the roots by 60%, possibly implying that the plants were exponentially responding to plant nutrient availability and uptake and perhaps allocating more

carbon towards above ground yield components (figure 7). This scenario might subsequently result in higher grain yields because the plants would be transpiring and photosynthesizing more, while having access to more light and nutrients. Soil vigor is an amendment that contains microbes, which are able to enhance plant nutrient uptake within the rhizosphere (<http://www.microbebio.com/product/microbebio-nature-vigor>).

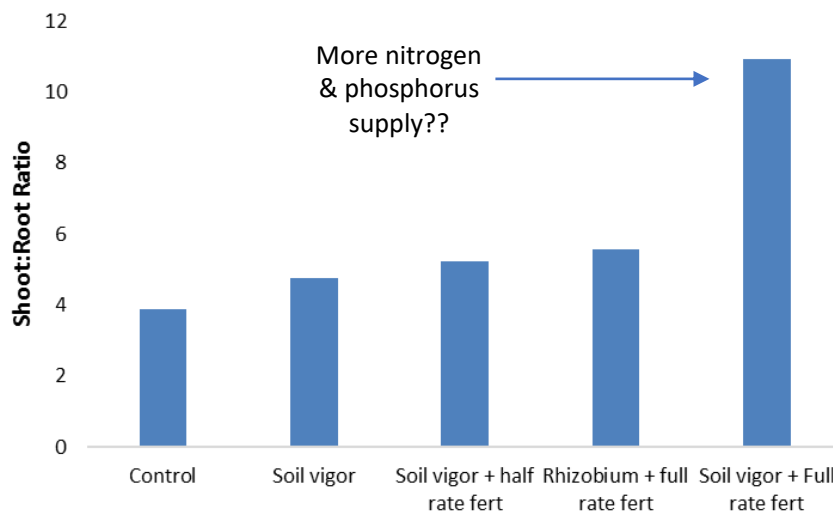


Figure 7: Shoot: root ratios for soybean plants treated with soil vigor, rhizobium, with and without fertilizer supplied at half and full rate were applicable. Data are means of 5 plants harvested 40 DAP.

Therefore, the results obtained from this study are consistent with the assertion by microbebio; for instance, a study involving *pisum sativum* and *phaseolus vulgaris* grown under varying nitrogen supply regimes, observed a strong positive correlation between increased shoot: root ratio and biomass production or yield (Andrews et al. 1999). For that reason, it is highly probable that soil vigor contributed to plant nutrient uptake within the rhizosphere for the soybean plants grown in pots (figure 8).



Figure 8: Rhizosphere showing the root architecture of a soybean plant taken from the pot study 40 days after planting.

Performance of Aqua Activator in maize

Analysis of variance performed on plant heights and root lengths data to test the effect of aqua activator on maize. The data did not reveal any statistical differences ($P>0.05$) between the means of plants treated with aqua activator and full rate fertilizer, for both variables (figure 9 a & b). A similar pattern was observed for shoot and root biomass yield, though the aqua activator treated plants outperformed the ones supplied with full rate NPK fertilizer (Figure 9 c & d). The plants did not show signs of nutrient deficiency throughout the experiment. It must be pointed out however, that control plants (data not shown) exhibited signs of severe phosphorus deficiency concomitantly with stunted growth when compared to the aqua activator and fertilizer treated plants. Conversely, a combination of fertilizer and aqua activator exhibited a very high plant growth vigor phenotype between day 10 and 40 (data not shown).

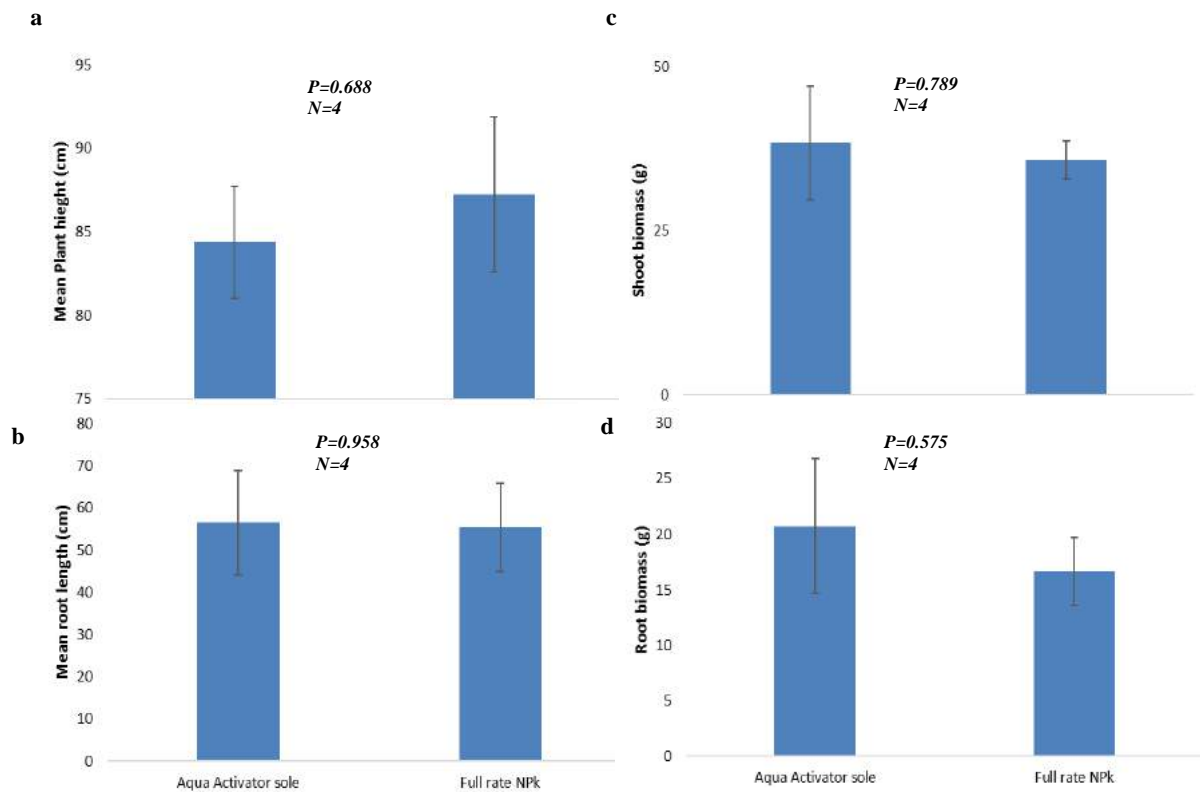


Figure 9: (a) – Plant heights for maize plants supplied with aqua activator and fertilizer; (b)- root length for the same maize plants as in (a); (c) shoot biomass; (d)root biomass. The aqua activator was applied as soil drench 0, 20, and 40 DAP. Data are means of 4 plants harvested 50 DAP, analysis of variance was performed to test the treatment effects at 95% confidence interval.

However, caution must be applied when interpreting these results because of the limited growth period by which the plants were subjected to, before being harvested. It would be interesting to observe how the aqua activator would perform under full scale field trials covering the entire growing period of maize. It must be emphasised here that there is a debate in the scientific community involving plant microbe-interactions, biostimulants, microbial soil amendments containing enhancers, conditioners etc., as to whether these can replace chemical fertilizers, with a number of scientist recommending a reduced fertilizer rate application over a sole application of the bioproduct. The latter view is particularly important to avoid excessive soil nutrient mining (if growing heavy feeder crops), which would then result in a negative effect on soil health and nutrient supply in the long term. It is undeniable that the aqua activator in this case demonstrated superior performance over the chemical fertilizer. As to whether this performance can be sustained is a question begging to be answered in subsequent trials.



Figure 10: Control plant showing signs of phosphorus deficiency, highlighted by red arrow. Adjacent plants were supplied with combinations of aqua activator with full and half rate NPK fertilizer respectively. Picture was taken 23 days after planting following the second aqua activator treatment.

Performance of super soil activator in maize

The performance of super soil activator was tested by analysing data for plant heights and shoot biomass collected 40 days after planting. Analysis of variance ($P=0.699$ and $P=0.88$) indicated no statistical differences among treatment means for plant heights and shoot dry matter respectively (figure 11 a and b). These results suggest that plant responses to super soil activator were positive. Interestingly, when shoot biomass is considered, combining soil activator with half rate NPK seemed to have slightly outperformed the full rate NPK treatment, though not statistically significant. This may require further investigation to establish the mechanisms by which plant nutrients are made available in the rhizosphere resulting from interaction between plants and microbes contained in soil activators, when supplied with sub-optimal chemical fertilizers.

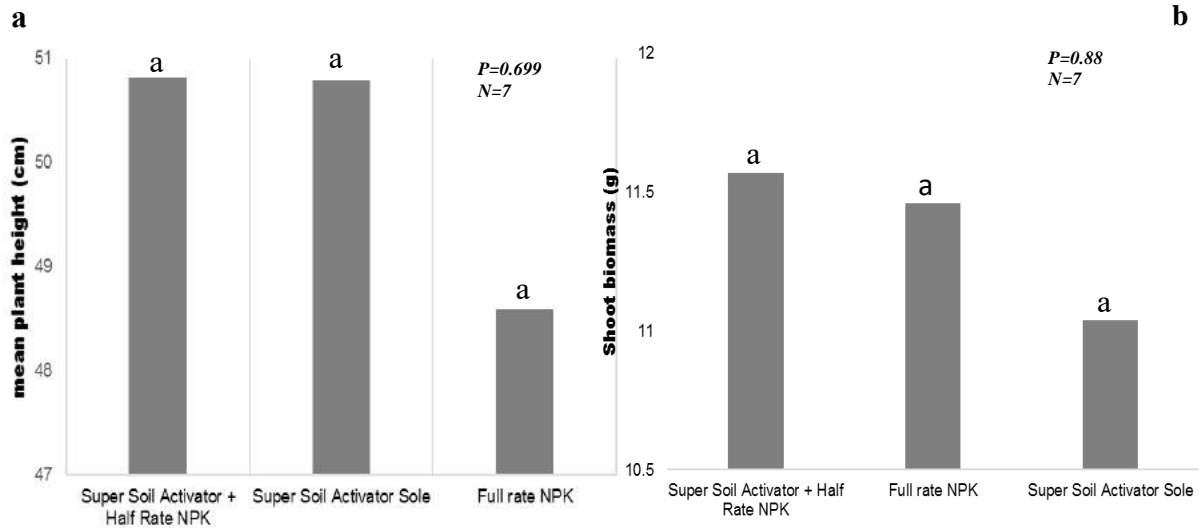


Figure 11: (a) – Plant heights for maize plants supplied with super soil activator and fertilizer; (b)- Shoot biomass for the same maize plants treated as in (a); The soil activator granules were applied at planting as described in the methods. Data are means of 7 plants harvested 40 DAP; analysis of variance was performed to test the treatment effects followed by Tukey’s HSD test at 95% confidence interval. Similar letters indicate no significant differences across treatments.

Further assessment of the roots was done to confirm whether soil activator contributed to below ground biomass accumulation. Interestingly, root length and root biomass data revealed similar trends in terms of performance to what was observed in the shoots (figure 12 a and b). Furthermore, there was a positive correlation ($r^2=0.79$) between root growth and shoot biomass accumulation. Therefore, for plants to be more productive (more biomass per input), as earlier argued, the root system needs to be well established for better nutrient and water uptake for the plant to be able to support above ground development (Wang et al., 2005; Mantelin, 2003). This can consequently lead to better biomass partitioning into essential yield increasing components (leaves and reproductive parts) in the plant. However, due to time constraints and the complexity involving mechanisms by which biostimulants such as soil activator contribute to nutrient uptake in plants, this study did not determine nutrient use efficiency (NUE), a more accurate estimate of productivity. Future studies should investigate this relationship to gain better understanding of what is happening within the crop production system.

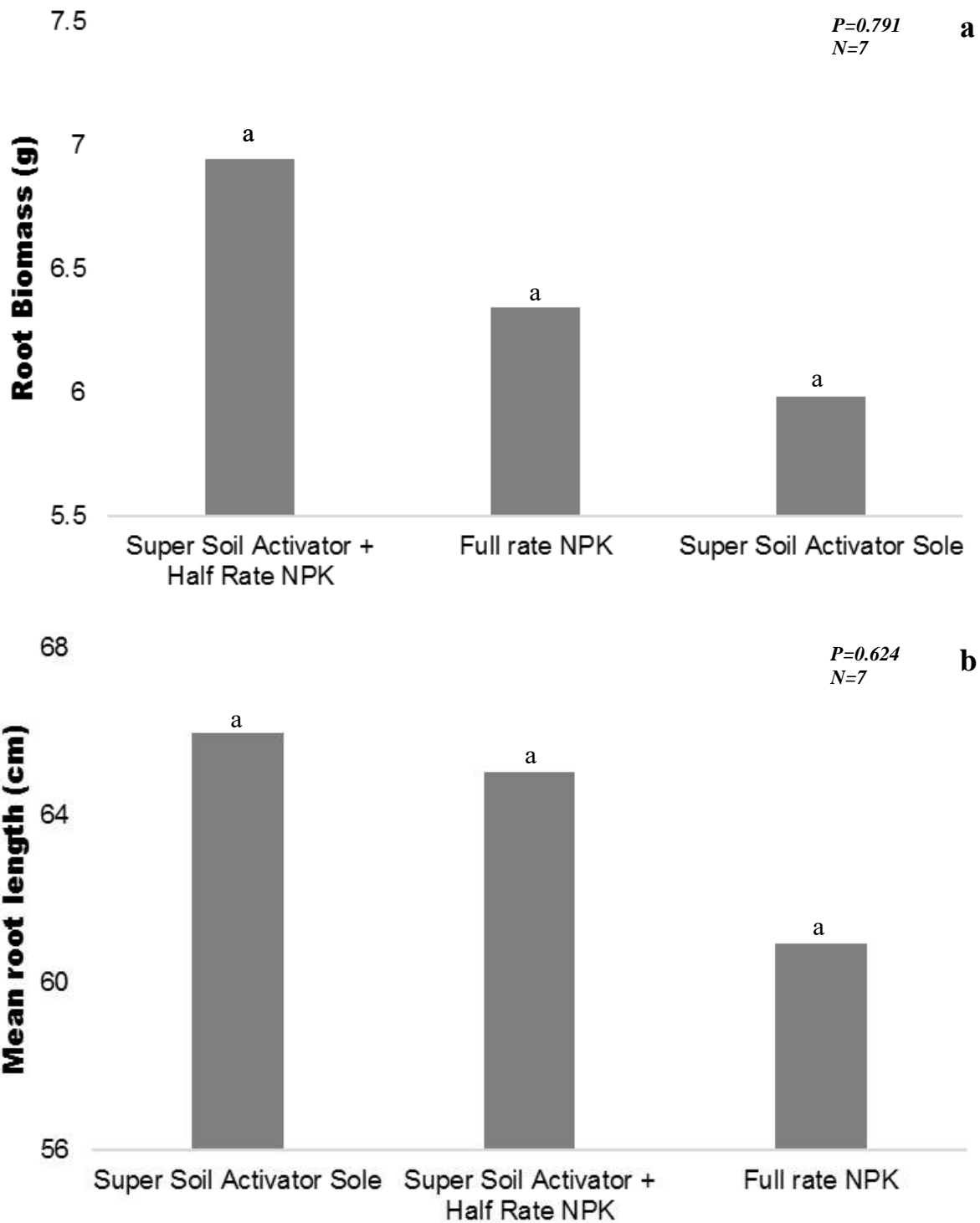


Figure 12: (a) – Root biomass for maize plants supplied with super soil activator and fertilizer; (b)- Root lengths for the same maize plants treated as in (a); The soil activator granules were applied at planting as described in the methods. Data are means of 7 plants harvested 40 DAP; analysis of variance was performed to test the treatment effects followed by Tukey’s HSD test at 95% confidence interval. Similar letters indicate no significant differences across treatments.

Performance of X1 bionematicide in tomato

To determine the efficacy of X1 bionematicide, its performance was evaluated against a commercially available synthetic control agent applied to the same set of tomato plants as described in the materials and methods. Soil samples collected from the inoculated pots (with nematodes, see methods) and observed under a microscope indicated inactive nematodes in both the commercial and bionematicide treated soils. This result seems to suggest that the nematodes were merely immobilized but did not die, possibly because the application of the bionematicide was only done once. It is worth noting that when plant roots were observed for gal formation, there was no evidence of attack or infestation. Further follow up investigations were then carried out in the laboratory, by plating soil samples on petri dishes and treating them with a normal, double, and triple dosage of X1 bionematicide respectively (applied as a solution to each petri dish). When observed under a microscope, the normal dosage did not seem to have an effect on the nematodes, but as the concentration doubled and tripled the parasites were either immobile or appeared to be dead. We therefore postulate that as the concentration of the fungal spores (contained in the bionematicide) increased, the nematodes were unable to maneuver through the growing mesh of growing mycelial fungi to penetrate the root tips, thus leaving the crop healthy.

Studies have likewise demonstrated that beneficial fungi and other biological control agents can induce defense responses in plants, compete for nutrients (with the pathogen), and exude compounds which can immobilize the pathogen in the rhizosphere, thereby limiting attack to the crop (Schouteden et al., 2015; Berruti et al., 2015; Igiehon and Babalola, 2017). However, it has been established that the timing of application is important to enable the beneficial microorganism to establish adequately in the soil for effective control to occur (Berruti et al., 2015). Our study observed the soils at 14 and 30 days after application of bionematicide, which may not have been sufficient for the active ingredients (microorganisms) work. We recommend that further studies involving X1 bionematicide be conducted in-situ, on fields with a known history of nematode infestation for a longer period. This would take some considerable time for the fungi spores to build up and start parasitizing the nematode pests whose life cycle is approximately 28-30 days in most species.

In general, plant growth was normal without displaying any symptoms of wilting and drooping of leaves caused by nematodes (figure 13). This can be correlated by the shoot and root biomass

data, which did not exhibit signs of nematodes having an impact on the growth of plants (figure 14 a and b).



Figure 13: Tomato plant showing no visible signs of nematode attack. picture was taken 40 days after planting

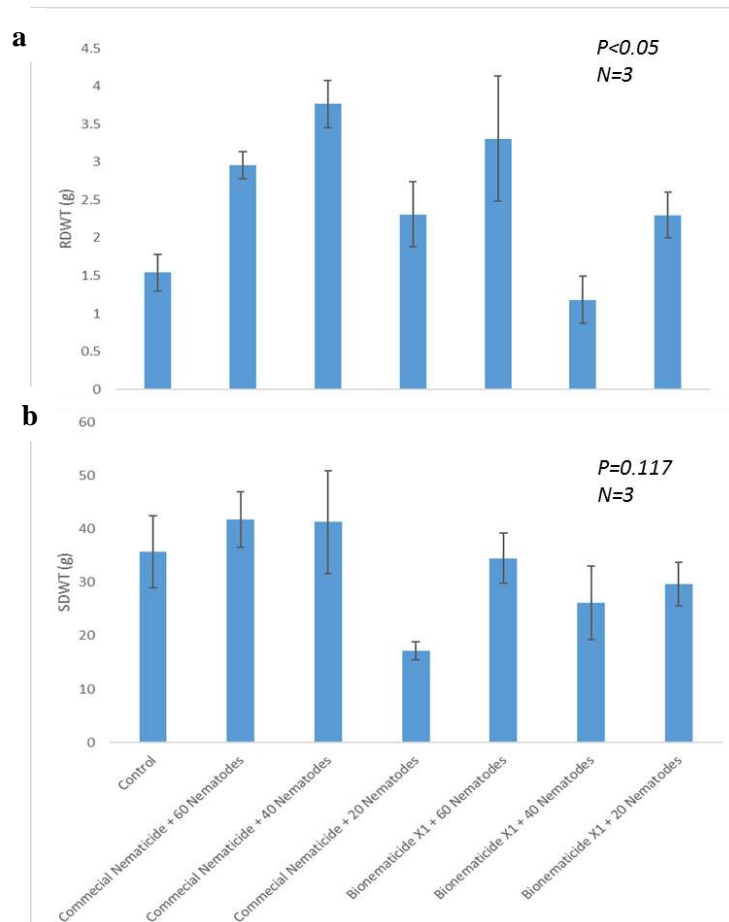


Figure 14: (a)-Root biomass for plants treated with X1 bionematicide and a synthetic nematicide, pot were inoculated with 20, 40, and 60 nematodes; (b)- Shoot weights for tomato plants treated as in (a); Data are means of 3 plants harvested 60 DAP; analysis of variance was performed to test the treatment effects.

Conclusion

This study set out to evaluate the efficacy of four microbebio powder and granular based products as soil amendments and control agents for soil borne pathogens. The research has also shown that super soil activator, soil vigor and aqua activator significantly increased plant biomass (root and shoot) when compared to the controls. Taken together, these results suggest that the three soil enhancers can perform in the field, thus putting more grain in the farmer's hands through efficient nutrient uptake and better agronomic efficiency (though not the scope of this study); subsequently making them producing more with less input. However, there is need to understand the long term impact on soils (organic pool, inherent soil fertility status), it would therefore be of paramount importance in the short term to combine the use of the product with a reduced fertilizer application rate for maximum benefits.

The second major finding was that the bionematicide X1 can be applied in fields where infestations by nematodes are relatively low as a control agent. As the population of the pathogen increase, the number of spores (from the product) would be augmented correspondingly with time. This governed by the right dosage, timing and frequency of application, may provide a novel product for the control of nematodes while at the same time contributing to increased yields. Lastly, this research provides a framework for the exploration of further research in fields with a history of nematodes as well as mechanisms, which control the mode of action. Bionematicides such as X1 when used as part of a complete pest management program can reduce crop damage by plant-parasitic nematodes.

References

Berruti, A., Lumini, E., Balestrini, R., Bianciotto, V., 2016. Arbuscular Mycorrhizal Fungi as Natural Biofertilizers: Lets Benefit from Past Successes. *Frontiers in Microbiology* 6.

Bolinder, M., Angers, D., Dubuc, J., 1997. Estimating shoot to root ratios and annual carbon inputs in soils for cereal crops. *Agriculture, Ecosystems & Environment* 63, 61–66.

Foley, J.A., 2005. Global Consequences of Land Use. *Science* 309, 570–574.

Igiehon, N.O., Babalola, O.O., 2017. Biofertilizers and sustainable agriculture: exploring arbuscular mycorrhizal fungi. *Applied Microbiology and Biotechnology* 101, 4871–4881.

Mantelin, S., 2003. Plant growth-promoting bacteria and nitrate availability: impacts on root development and nitrate uptake. *Journal of Experimental Botany* 55, 27–34.

Matson, P.A., 1997. Agricultural Intensification and Ecosystem Properties. *Science* 277, 504–509.

Reynolds, J.F., Thornley, J.H.M., 1982. A Shoot:Root Partitioning Model. *Annals of Botany* 49, 585–597.

Schouteden, N., Waele, D.D., Panis, B., Vos, C.M., 2015. Arbuscular Mycorrhizal Fungi for the Biocontrol of Plant-Parasitic Nematodes: A Review of the Mechanisms Involved. *Frontiers in Microbiology* 6.

Sharma, H.S.S., Fleming, C., Selby, C., Rao, J.R., Martin, T., 2013. Plant biostimulants: a review on the processing of macroalgae and use of extracts for crop management to reduce abiotic and biotic stresses. *Journal of Applied Phycology* 26, 465–490.

Tilman, D., Cassman, K.G., Matson, P.A., Naylor, R., Polasky, S., 2002. Agricultural sustainability and intensive production practices. *Nature* 418, 671–677.

Wang, Y., Mi, G., Chen, F., Zhang, J., Zhang, F., 2005. Response of Root Morphology to Nitrate Supply and its Contribution to Nitrogen Accumulation in Maize. *Journal of Plant Nutrition* 27, 2189–2202.

<http://www.microbebio.com/product/microbebio-nature-vigor>



**MINISTRY OF AGRICULTURE
ZAMBIA AGRICULTURE RESEARCH INSTITUTE**

Report on the effectiveness of BIORATIONAL X3 Biorational
insecticide against the Tomato Leaf Miner (*Tuta absoluta*) in
Potatoes

SEPTEMBER, 2017

Entomology Team
Mount Makulu Research Station
P. Bag 7
CHILANGA

INTRODUCTION:

The X3 BIORATIONAL insecticide is said to be effective against most lepidopteran (butterflies and moths) caterpillars by killing them after spraying.

In this trial to evaluate the effectiveness of the insecticide on the tomato leaf miner (*Tuta absoluta*), a potato field was selected because that's where there was infestation by the pest, at the time of evaluation and potatoes are in the same family as tomatoes, egg plants, e.t.c.

OBJECTIVE:

To evaluate the effectiveness of the X3 BIORATIONAL insecticide against the Tomato leaf miner (*Tuta absoluta*).

METHODOLOGY

- ✓ X3 BIORATIONAL insecticide was diluted at two concentrations of 30 and 40ml/ltrs of water in a potato field at Mr. Cassin's farm in Lusaka west
- ✓ A commercial insecticide known to be effective against the Tuta pest in the Solanaceous family of (Tomato, egg plants, Irish potatoes, etc.) was also evaluated at the same dosage formulations
- ✓ A Control treatment was also set up where only water was sprayed
- ✓ The numbers of live *Tuta absoluta* live larvae were recorded for each Treatment at both dilution formulations were recorded each of the three (3) weeks

RESULTS:

MR CASSIN'S POTATO FIELD ON FARM						
Chemical	REP	DILUTION	Tuta larva (WK 1)	Tuta larva (WK 2)	Tuta larva (WK 3)	Mean no. of larvae
X3	1	30ml/ltr	4	7	4	5
X3	2	40ml/ltr	1	3	2	2
COMMERCIAL	1	30ml/ltr	6	6	9	7
COMMERCIAL	2	40ml/ltr	4	2	3	3
CONTROL	1	WATER	23	18	14	18.3
CONTROL	2	WATER	19	15	20	18

- It was observed that amongst the three (3) treatments; X3, Commercial and Control, the mean numbers of live *Tuta* larva found were smallest in the X3 treatments at both dilution dosages of 30 and 40ml/16 ltrs of water.
- This was also demonstrated by the Control with the highest mean numbers for the live larvae of 18-18.3 insects. It showed that the pest was present and alive in the areas where the insecticides were not applied.
- The dilution of 40ml of insecticide/16 ltrs of water was seen to be killing more larvae than the 30ml/16ltrs of water in both the commercial and the X3 Biorational insecticide.
- This means that at higher concentration of the insecticide (40ml/16 ltrs water), the bigger larvae are also killed leaving fewer live larvae, whereas at lower concentration (30ml/16 ltr) only the young larvae are killed thereby leaving more live ones.

CONCLUSIONS AND RECOMMENDATIONS

- The X3 BIORATIONAL INSECTICIDE was observed to perform well by having a small number of the average number of live *Tuta* larvae in the three (3) weeks that spraying was conducted
- The X3 BIORATIONAL insecticide has shown to be effective against the *Tuta absoluta* at concentration dilution of 40ml/16 litres of water because it kills more larvae at this rate
- There's need to provide the information on the technical aspects of the X3 Biorational insecticide such as the insecticide user guide, active ingredients, pre-harvest interval (p.h.i), restricted entry interval (r.e.i), dosage or dilution formulations and so forth, by the suppliers of the insecticide
- There's need to pack the insecticide in smaller volumes to cater for small scale farmers and small fields apart from the big volumes of 5 ltr containers from which this was evaluated
- It is highly recommended that this experiment be carried out at the Mount Makulu Central Research Station in Chilanga during the rainy season especially when the environmental conditions are favorable for pest population build up. This will help give a comprehensive and holistic test for the insecticide different seasons under rain-fed conditions.



**MINISTRY OF AGRICULTURE
ZAMBIA AGRICULTURE RESEARCH INSTITUTE**

Report on the effectiveness of BIORATIONAL X6 Bio-pesticide
against the fall armyworm in wheat.

AUGUST, 2017

Entomology Team
Mount Makulu Research Station
P. Bag 7
CHILANGA

INTRODUCTION

BIORATIONAL X6 is a biological/botanical insecticide marketed by MICROBEBIO INC. United States of America. It contains *Beauveria bassiana*, Alkyloxypoly-ethylenoxyethanol and Pyrethrins. Chemical description: mixture of substances in liquid formulation. It's meant for the control of insect pests such as bollworms, armyworms and other moths.

Objective:

To test for the effectiveness of BIORATIONAL X6 Bio-pesticide liquid formulation against the fall armyworm larval pest attacking wheat.

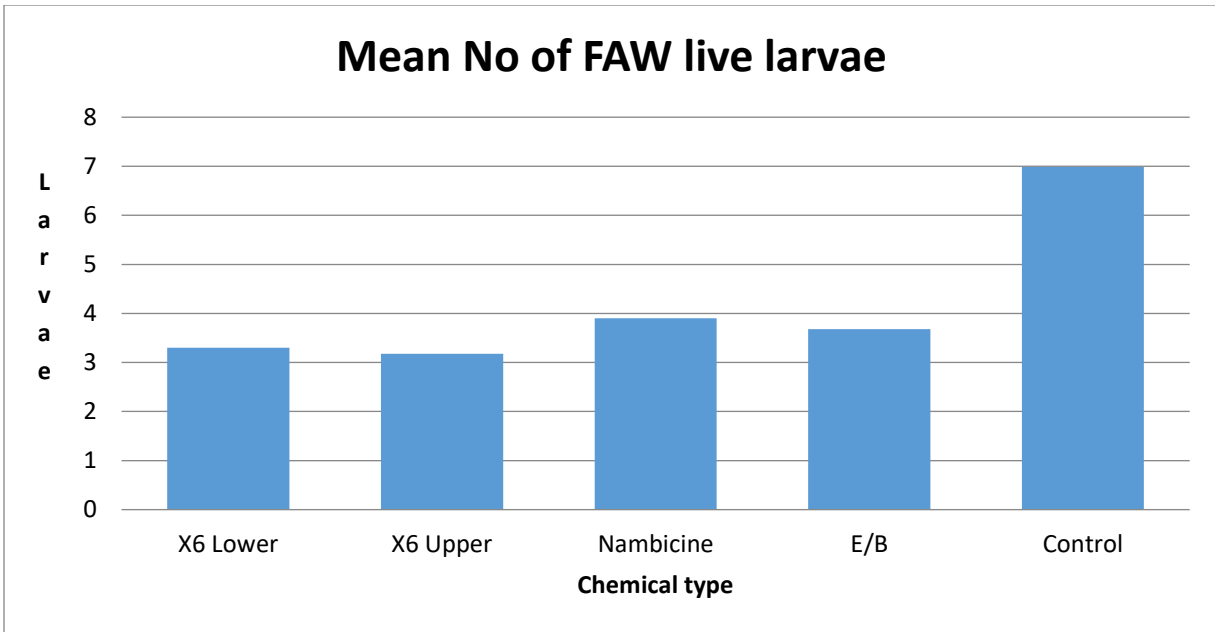
EVALUATION METHOD FOR THE BIORATIONAL X6 FOR ARMYWORMS' CONTROL

The X6 BIOPESTICIDE was being tested for effectiveness together with two (2) other test pesticides; **Emamectin benzoate and Nimbecidine**, from the Zambia National Service (ZNS) Airport farm's wheat field. The trial was conducted in the wheat fields where populations of fall armyworm caterpillars (larvae), were seen to be feeding and growing rapidly. All the Treatments were replicated four (4) times and all the replicates were sprayed with its respective pesticide treatment

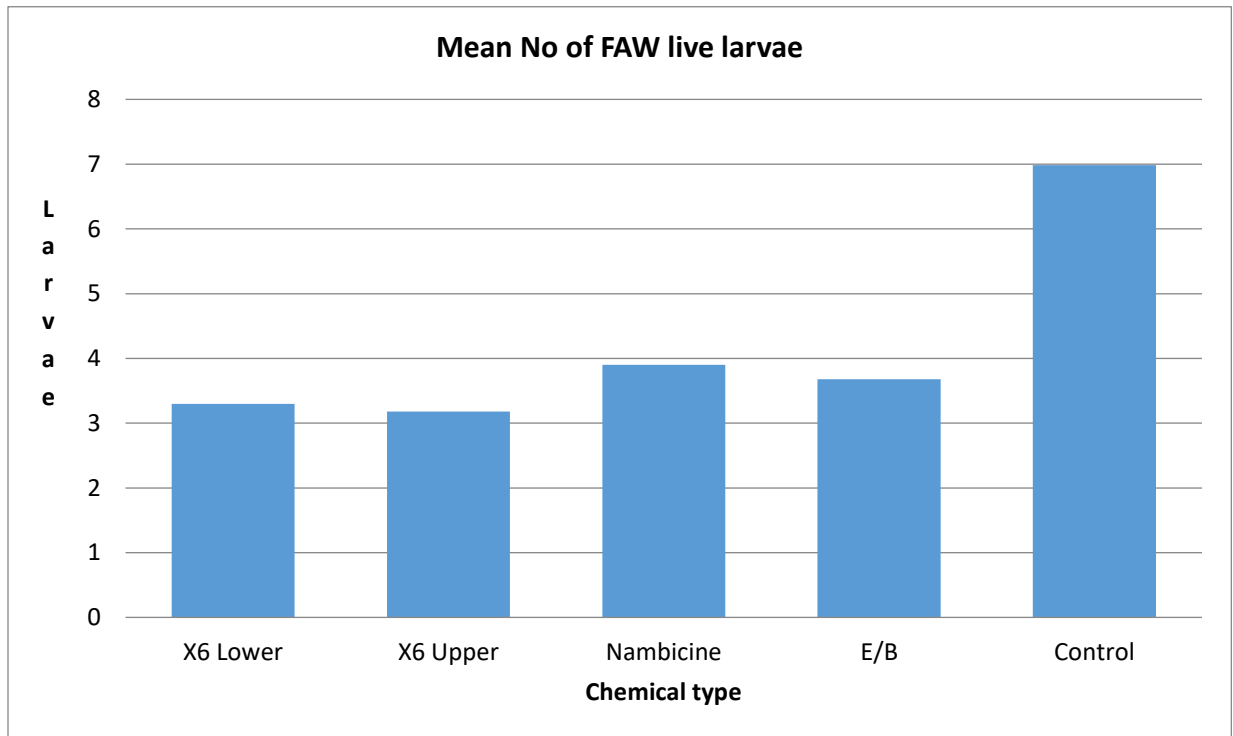
- ❖ For the X6 BIOPESTICIDE, the LOWER limit 6ml/Ltr and UPPER limit being 23.34ml/Ltr. These calculations were based on the recommendations on the product label
- ❖ The control experiment was WATER.
- ❖ All the experimental plots were to be sampled for the presence of live armyworm caterpillars (larvae) every after 10 days

The graph below indicates the performance of the BIORATIONAL X6 and two other pesticides during the last three weeks:

PESTICIDE	PESTICIDE APPLICATION	Block/Replication/No of larvae					
		Lower					
BIORATIONAL X6		1R1	2R1	3R1	4RI	Average	Control 1
	1st	6	5	6	4	4.6	6
	2nd	5	5	3	3	4	6
	3rd	4	5	2	3	3.5	5
	4th	2	2	0	1	1.25	4
						3.3	5.2
		Upper					
	1st	9	6	7	4	6.5	11
	2nd	4	5	2	1	3	15
	3rd	3	3	2	0	2	7
	4th	2	1	1	1	1.25	5
						3.18	9.5
Nimbidine		1R1	2R1	3R1	4RI	Average	Control 1
	1st	7	6	5	5	5.7	8
	2nd	6	6	4	3	4.7	6
	3rd	5	5	3	3	4	5
	4th	3	0	2	1	1.5	9
						3.9	7
Emamectine+ Benzoete		1R1	2R1	3R1	4RI	Average	Control 1
	1st	7	4	7	9	6.75	8
	2nd	8	4	2	6	5	5
	3rd	3	1	4	0	2	6
	4th	2	0	2	0	1	6
						3.68	6.24
SUMMARY OF MEANS							
X6 Lower	3.3						
X6 Upper	3.18						
Nambicine	3.9						
E/B	3.68						
Contol	6.985						



Results



Observations

- ✓ Lower dosage 6ml/l, it performed as well as upper dosage of 23.34ml/l
- ✓ X6 performed better than other pesticides by having the smallest average number (3.3), of live insect larvae over the whole period of pesticide application
- ✓ With each successive spray, the population was going down.
- ✓ Control had the highest number of live caterpillars (6.985) where only water was sprayed

- ✓ There was no significant difference amongst the means of the three (3) different pesticides. From the results collected, the X6 BIOPESTICIDE has shown to be an effective bio-pesticide of the fall armyworm and this is especially at lower concentrations and when the larvae are young.

Recommendations:

- It is recommended that the pest be controlled in its younger stages in order to reduce on the concentration of pesticide residues that are found in living organisms' tissues and the environment.
- The pesticides users should be encouraged to target the younger caterpillars for effective pesticides use and control.
- The trial should also be done in maize to see how it will perform in a different crop from wheat.

A close-up photograph of rice plants. The image shows several panicles (seed heads) of rice, which are yellowish-brown, indicating they are ripe. The panicles are surrounded by long, narrow green leaves. The background is a soft, out-of-focus green, suggesting a field of rice. The lighting is bright and natural, highlighting the texture of the rice grains and the veins on the leaves.

MICROBEBIO®

FIELD TEST

RICE FIELD IN VIETNAM

Spring: RICE 2018 (GIONG RIENG – TAN CHAU – PRIVATE TESTS)



RICE FIELD IN VIETNAM

Spring: RICE 2018 (GIONG RIENG – TAN CHAU – PRIVATE TESTS)



RICE FIELD IN VIETNAM

Spring: RICE 2018 (GIONG RIENG – TAN CHAU – PRIVATE TESTS)



RICE FIELD IN VIETNAM

Fall and Winter: RICE 2017 (CHO MOI – AN GIANG PROVINCE – 1ST AND 2ND VISITS)



RICE FIELD IN VIETNAM

Fall and Winter: RICE 2017 (CHO MOI – AN GIANG PROVINCE – 2ND VISIT)



RICE FIELD IN VIETNAM

Fall and Winter: RICE 2017 (CHO MOI – AN GIANG PROVINCE – 2ND VISIT)



RICE FIELD IN VIETNAM

Fall and Winter: RICE 2017 (CHO MOI – AN GIANG PROVINCE – 3RD VISIT)



RICE FIELD IN VIETNAM

Fall and Winter: 2017 (CHO MOI – AN GIANG PROVINCE – 4TH VISIT)



RICE FIELD IN VIETNAM

Summer Season: 2017 (CAN THO PROVINCE: 1st Visit)



RICE FIELD IN VIETNAM

Summer Season: 2017 (CAN THO PROVINCE: 2nd Visit)



VIETNAMESE – RICE

Summer Season: 2017 (CAN THO PROVINCE: 3rd Visit)



VIETNAMESE – RICE

Summer Season: 2017 (CAN THO PROVINCE: 3rd Visit)



TEA FIELD IN VIETNAM

Summer Season: 2017 (Unimex Tea Farm)



TEA FIELD IN VIETNAM

Summer Season: 2017 (LONG DINH TEA FARM)



FLOWER GREENHOUSE IN VIETNAM

Summer Season: 2017 (TIEN GIANG FLOWER EXPORT)



TOMATO GARDEN IN VIETNAM

Summer Season: 2017 (DON DUONG)



TOMATO GARDEN IN VIETNAM

Summer Season: 2017 (KIEN HUY – DALAT)



FLOWER GREENHOUSE IN VIETNAM

Summer Season: 2017 (DAISY FARM - DALAT)



FLOWER GREENHOUSE IN VIETNAM

Summer Season: 2017 (DAISY FARM - DALAT)



FLOWER GREENHOUSE IN VIETNAM

Summer Season: 2017 (DAISY FARM - DALAT)



FLOWER GREENHOUSE IN VIETNAM

Summer Season: 2017 (DIANTHUS FARM - DALAT)



CABBAGE FIELD IN VIETNAM

Summer Season: 2017 (DALAT)



CABBAGE FIELD IN VIETNAM

Summer Season: 2017 (DALAT)



CABBAGE FIELD IN VIETNAM

Summer Season: 2017 (DALAT)



CABBAGE FIELD IN VIETNAM

Summer Season: 2017 (DALAT)



DRAGON FRUIT FIELD IN VIETNAM

Summer Season: 2017 (DRAGON FRUITS –TIEN GIANG)



BLACK PEPPER FIELD IN VIETNAM

Summer Season: 2017 (BLACK PEPPERS – TAY NGUYEN)



BLACK PEPPER FIELD IN VIETNAM

Summer Season: 2017 (BLACK PEPPERS – TAY NGUYEN)



WATER SPINACH FIELD IN VIETNAM

Summer Season: 2017 (WATER SPINACH – HOCHIMINH CITY)



COCOA FIELD IN VIETNAM

Summer Season: 2017 (Mr. Thanh's garden – Ea Huar – Buon Don)



COCOA FIELD IN VIETNAM

Summer Season: 2017 (Mr. Thanh's garden – Ea Huar – Buon Don)



COCOA FIELD IN VIETNAM

Summer Season: 2017 (Mr. Soan's garden – Ea Wel – Buon Don)



COCOA FIELD IN VIETNAM

Summer Season: 2017 (Mr. Soan's garden – Ea Wel – Buon Don)



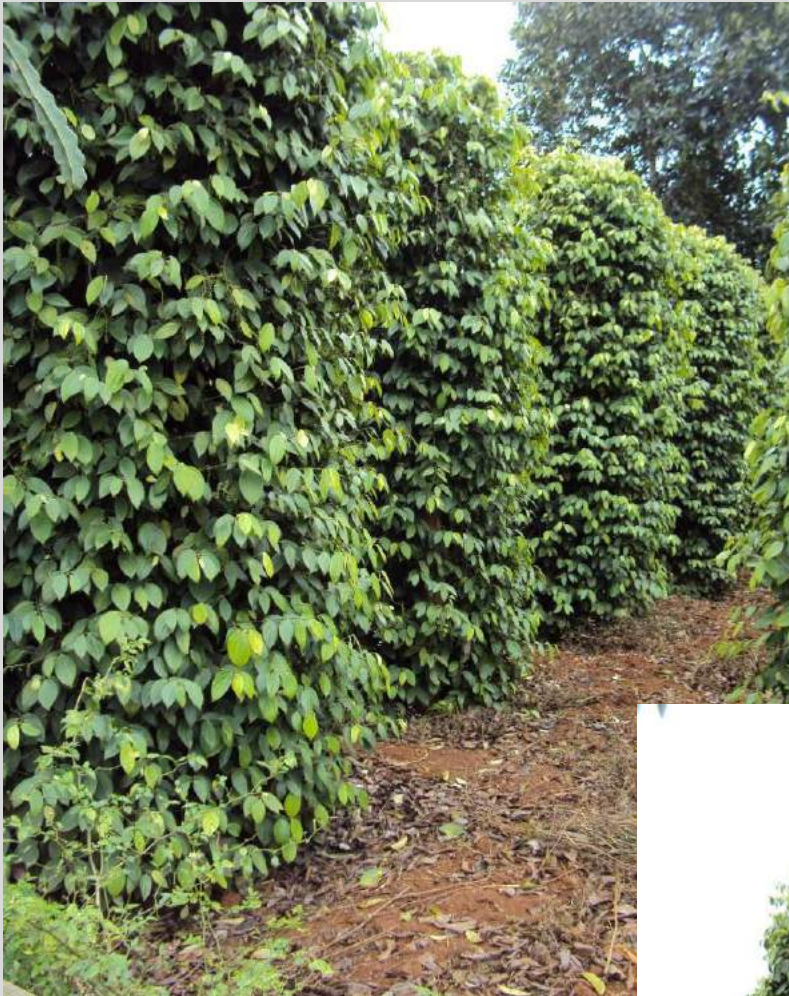
COFFEE FIELD IN VIETNAM

Summer Season: 2017 (Mr. Thuc's garden – Doan Ket – Buon Ho)



BLACK PEPPER FIELD IN VIETNAM

Summer Season: 2017 (Mr. Thuc's garden – Doan Ket – Buon Ho)



BLACK PEPPER FIELD IN VIETNAM

Summer Season: 2017 (Mr. Ngu's garden – Doan Ket – Buon Ho)



BANANA FIELD IN VIETNAM

2016



RICE FIELD IN CAMBODIA

Summer Season: 2017 (Mr. David – Kongpong Thom)



MANGO FIELD IN CAMBODIA

Summer Season: 2017 (Mr. David – Kongpong Spur)



LONGAN TREE IN CAMBODIA

2016



W/o MicroB



With MicroB

GREEN HOUSE IN PHILIPPINES

2016



GREEN HOUSE IN PHILIPPINES

2016



TOMATO HARVEST IN PHILIPPINES

2016



USA - CALIFORNIA – SAN BERNARDINO

2015



USA – TEXAS – HOUSTON COTTON FIELD

2015



USA – CALIFORNIA – INLAND EMPIRE – CABBAGE FIELD

2016



USA – CALIFORNIA – INLAND EMPIRE – CABBAGE FIELD

2016



USA – CALIFORNIA – HOME GARDEN

2017



USA – CALIFORNIA – HOME GARDEN

2017



USA – CALIFORNIA – HOME GARDEN

2017



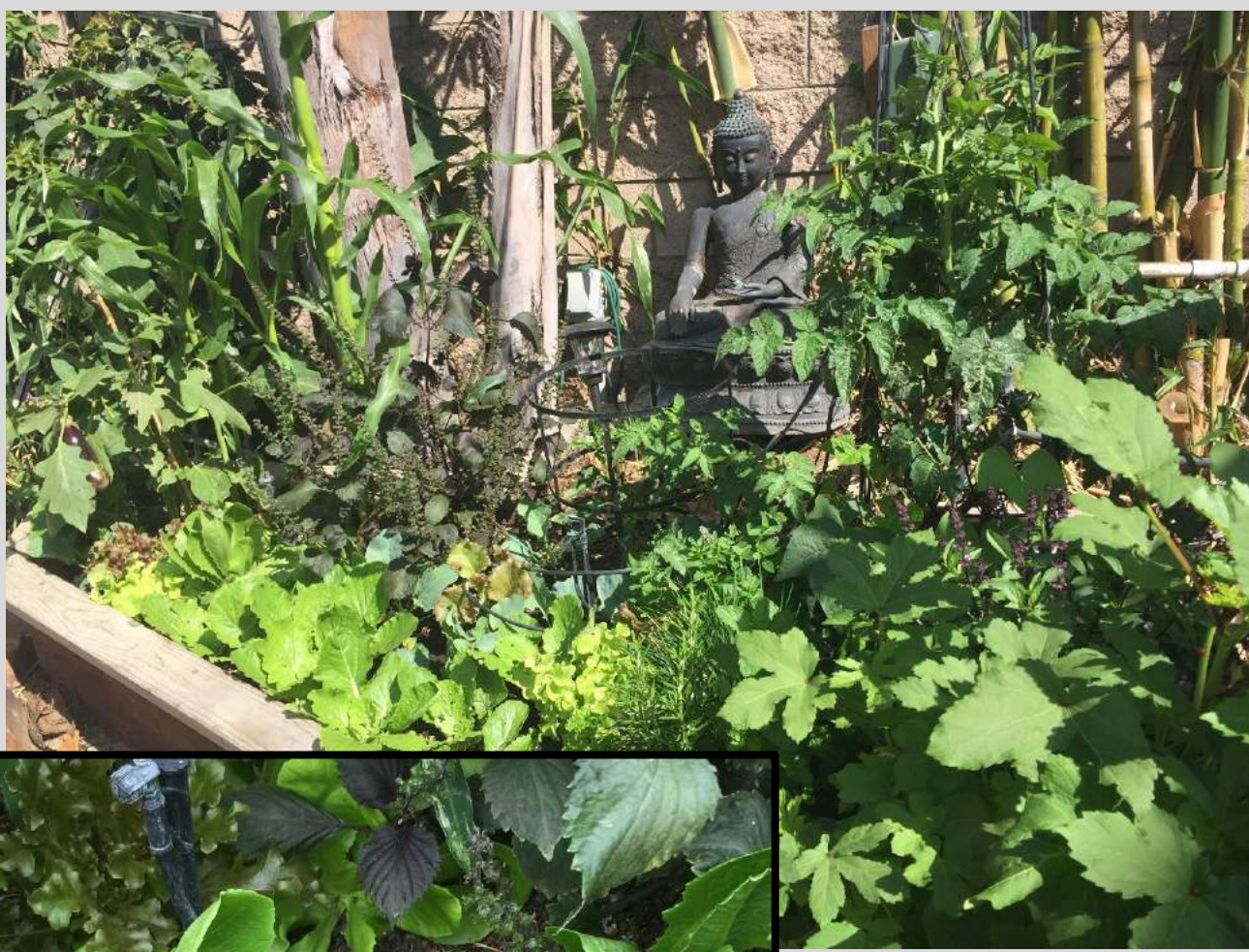
USA – CALIFORNIA – HOME GARDEN

2017



USA – CALIFORNIA – HOME GARDEN

2017



A pair of hands is shown from the wrists down, cupping a small green seedling with three leaves and a mound of dark soil. The background is a soft-focus green field. The text is overlaid on the center of the image.

MICROBEBIO®

IN FIELDS
SPRING 2018

RICE FIELD IN VIETNAM

Spring: RICE 2018 (GIONG RIENG – TAN CHAU – PRIVATE TESTS)



RICE FIELD IN VIETNAM

Spring: RICE 2018 (GIONG RIENG – TAN CHAU – PRIVATE TESTS)



RICE FIELD IN VIETNAM

Spring: RICE 2018 (GIONG RIENG – TAN CHAU – PRIVATE TESTS)



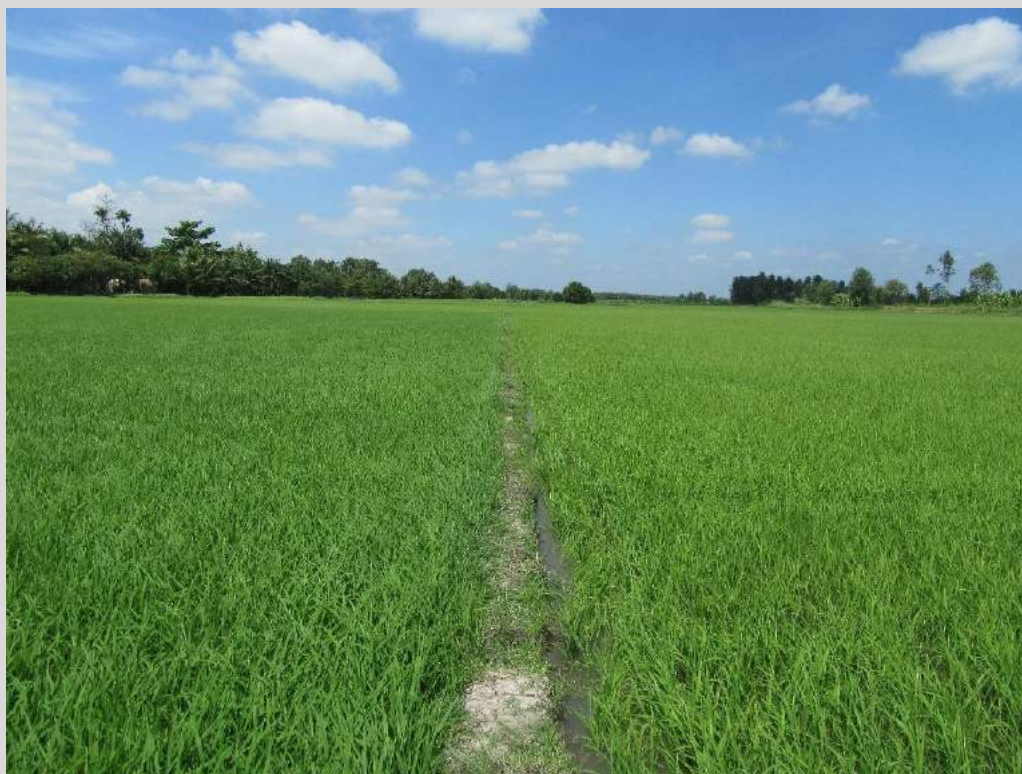
RICE FIELD IN VIETNAM

Spring: RICE 2018 (VUNG LIEM- PRIVATE TESTS) – 02/07/18 – 02/22/18



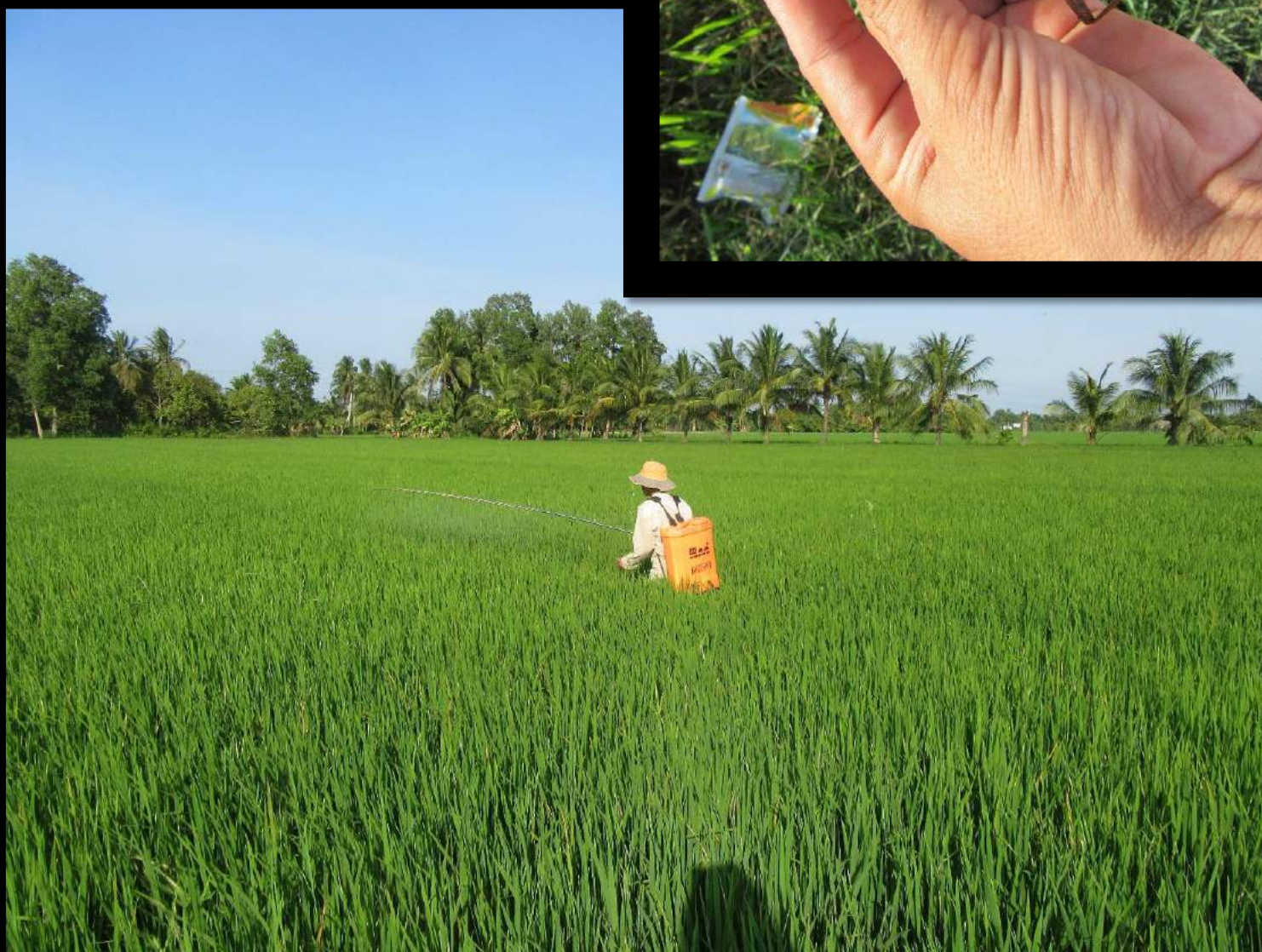
RICE FIELD IN VIETNAM

Spring: RICE 2018 (VUNG LIEM- PRIVATE TESTS) – 02/07/18 – 02/22/18



RICE FIELD IN VIETNAM

Spring: RICE 2018 (VUNG LIEM- PRIVATE TESTS) – 03/18/2018



BELL PEPPER TRIAL TEST IN VIETNAM

Spring 2018: Lam Dong

Products:

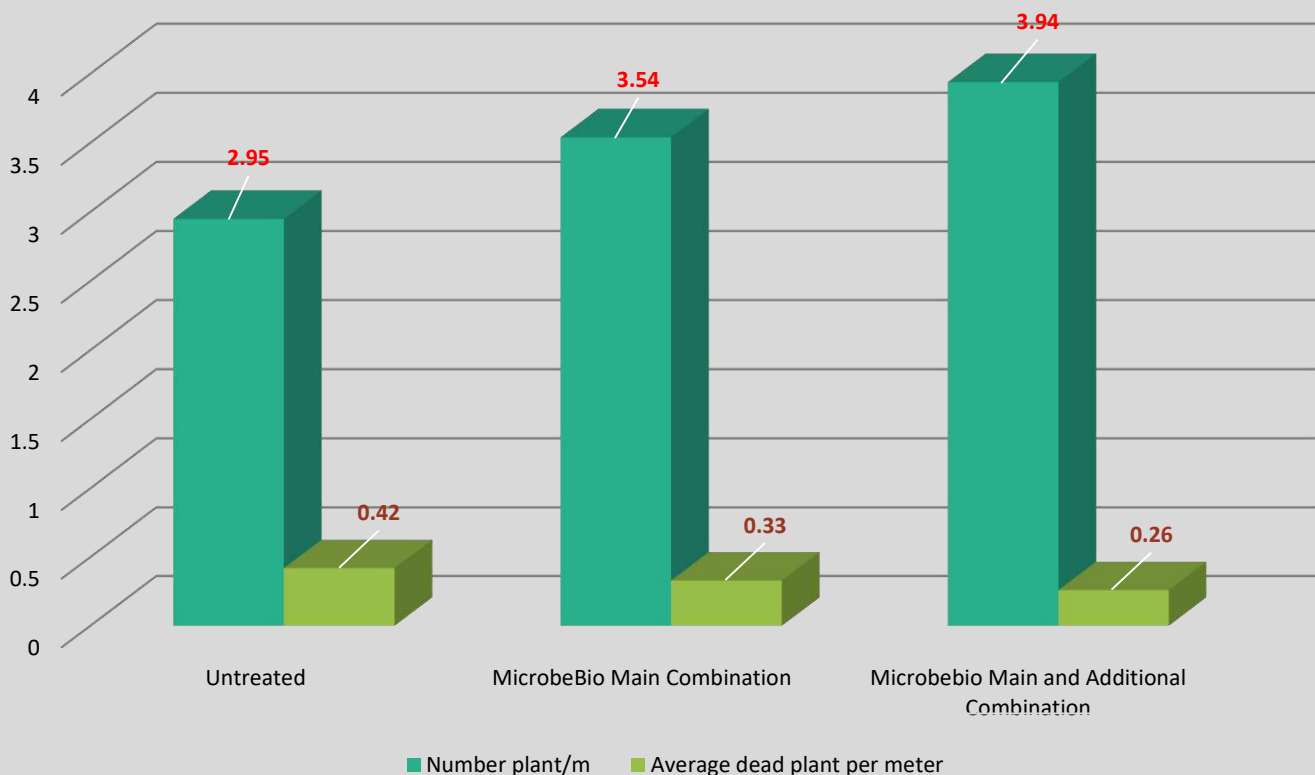
- **MicrobeBio Main Combination:** MicrobeBio® Vigor Boost and MicrobeBio® Nature Foliar
- **MicrobeBio Main and Additional Combination:** MicrobeBio Main Combination: MicrobeBio® Vigor Boost, MicrobeBio® Nature Foliar, and MicrobeBio Nature Activator.

Country: Vietnam

Province: Lam Dong

Yield Increase: 20%

The test results: Using the general application, the yield of MicrobeBio Main Combination increased marketable over untreated. Furthermore, the yield of MicrobeBio Main and Additional Combination significantly increased marketable over untreated.



COTTON TRIAL TEST IN VIETNAM

Gia Lai - 2016

In 2016, MicrobeBio had done a privacy Cotton trial test result in Gia Lai, Vietnam. Production Strategy was to apply MicrobeBio® Vigor Boost, MicrobeBio® Hydro Activator, and MicrobeBio® Nature Foliar. The trial produced 23.5% Yield Increase.

Products:

Our field:

- MICROBEBIO® VIGOR BOOST
- MICROBEBIO® HYDRO ACTIVATOR
- MICORBEBIO® NATURE FOLIAR

Other field

- NITROGEN BASED FERTILIZER

Area:

- Country: Vietnam
- Province: Gia Lai

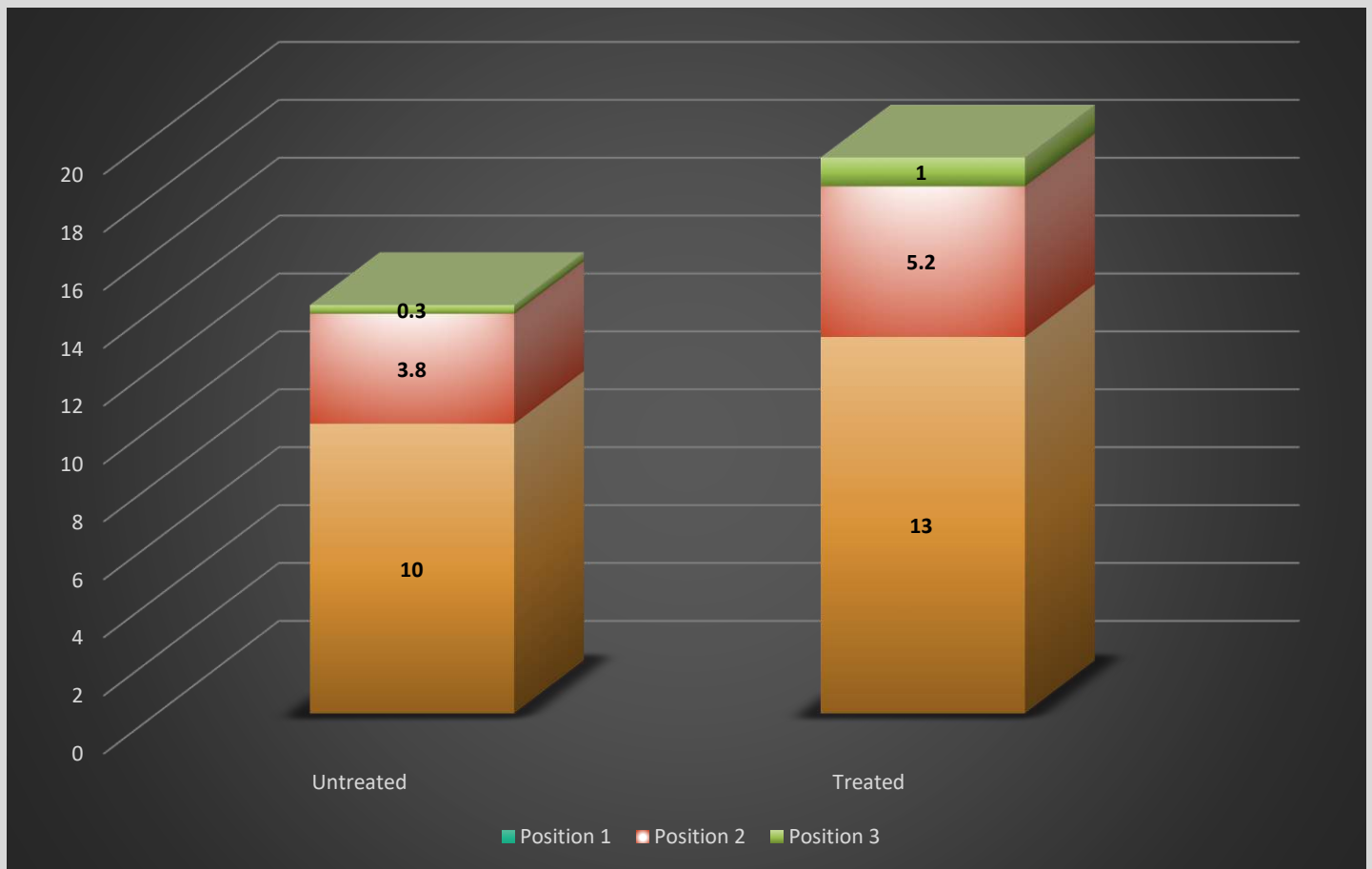
Trial Test Result:

Average total bolls per plant by position and the average percentage of the treated plants when compared to the untreated plants by position:

- Position 1: Bolls make up the highest percentage of the total yield. This position cracked boll on the plant, count the main-stem nodes above it to the uppermost harvestable 1 position boll. In the mature 1st position boll, it takes about 60 additional HU to mature a 1st position boll one main-stem node up the plant.
- Position 2: Bolls rank second in contributing to the total yield. In any given mature, boll on a fruiting branch, it takes about 120 HU to mature an additional position when moving out on a fruiting branch.

COTTON TRIAL TEST IN VIETNAM

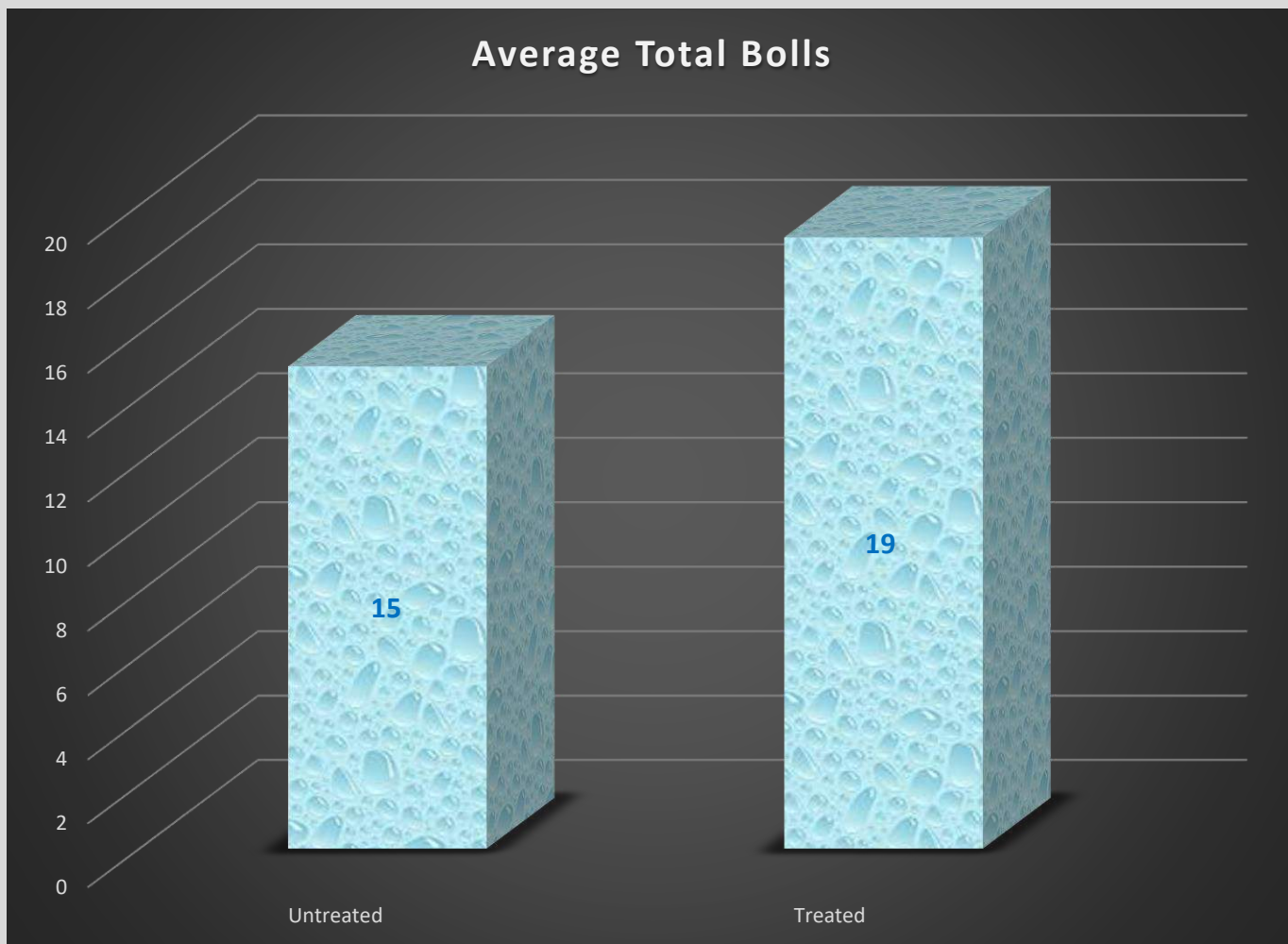
Gia Lai - 2016



The first four positions contribute most to total yield.
These are considered the most important positions.

COTTON TRIAL TEST IN VIETNAM

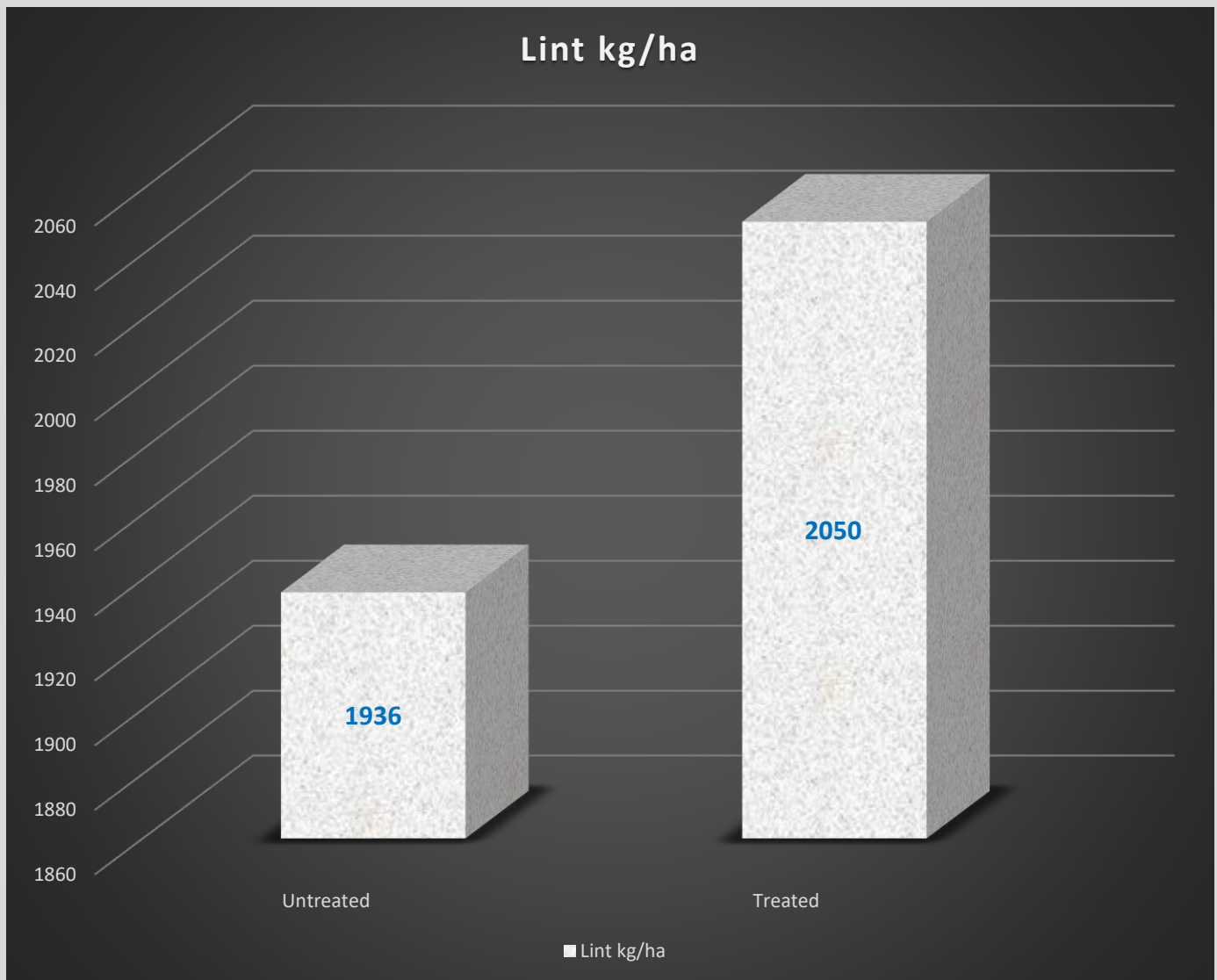
Gia Lai - 2016



Average total bolls per plant by treatment and the average percentage of the treated plants when compared to the untreated plants.

COTTON TRIAL TEST IN VIETNAM

Gia Lai - 2016



The untreated Field produced an average weight of 1936 kg/hectare. On the other hand, the treated Field with 3 times' application produced 5.9% more kg/hectare.

COTTON TRIAL TEST IN VIETNAM

Gia Lai - 2016



TOBACCO TRIAL TEST IN VIETNAM

Cao Bang – Lang Son



Products:

- MicrobeBio® Vigor Boost
- MicrobeBio® Hydro Activator
- MicrobeBio® Nature Foliar

Area:

- Country: Vietnam
- Province: Cao Bang, Lang Son

Trial Test Results:

TOBACCO TRIAL TEST IN VIETNAM

Cao Bang – Lang Son



UNTREATED	TREATED
There are Tobacco Mosaic Virus and Rastonia Solanacearum	Present Tobacco Mosaic Virus and Rastonia Solanacearum
Leaves per plant maximum is 19.	Lease per plant is 24
Yield: 226.8kg per hectare	Yield: 360 kg per hectare. The yield significant increased marketable over the untreated (approx: > 30%).
Leaf quality: in average	Leaf quality: at rate of 1 + 2 grade leaves over 50% in the plating area such as: <ul style="list-style-type: none"> • Nicotine content • Inverted sugar solution meets the cigarette factories' requirement. • The sensory score is always evaluated at the level of attractiveness from good to excellent.

TOMATO TRIAL TEST IN VIETNAM

Lam Dong

Products: MicrobeBio® Vigor Boost, MicrobeBio® Nature Foliar, and MicrobeBio® Nature Activator.

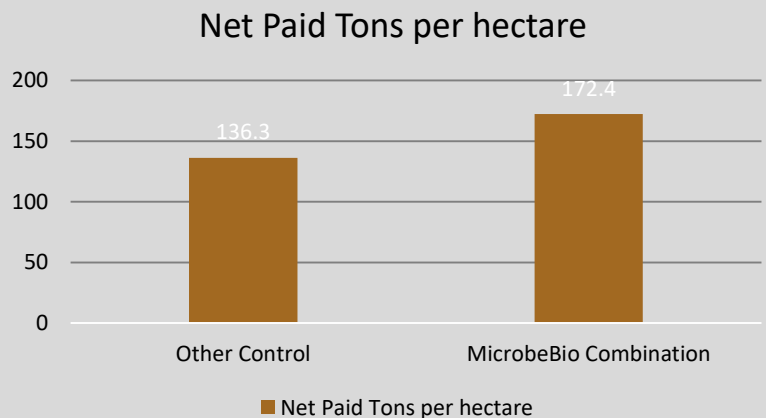
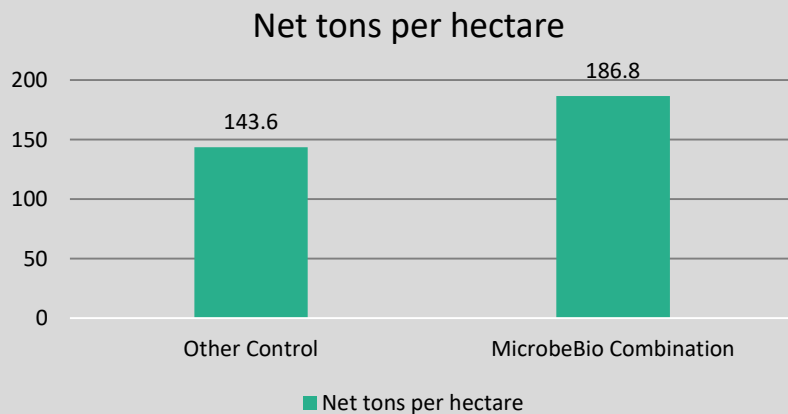
Country: Vietnam

Province: Lam Dong

Yield increase: 22.6%

The test result:

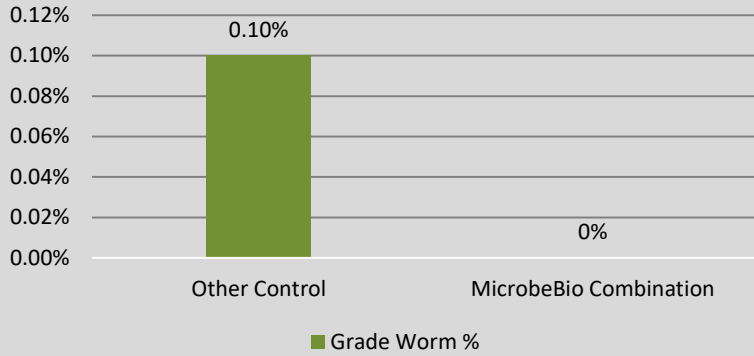
Densities	Net tons per hectare	Net Paid tons per hectare	Grade Worm %	Grade Green %	Grade Color	Grade Brix	Grade pH
Other Control	143.6	136.3	0.01%	0.69%	21.65	4.85	4.02
MicrobeBio® Combination	186.8	172.4	0%	2.15%	23.82	4.85	5



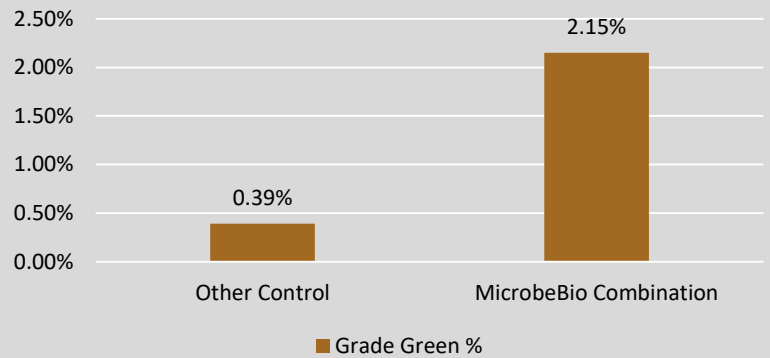
TOMATO TRIAL TEST IN VIETNAM

Lam Dong

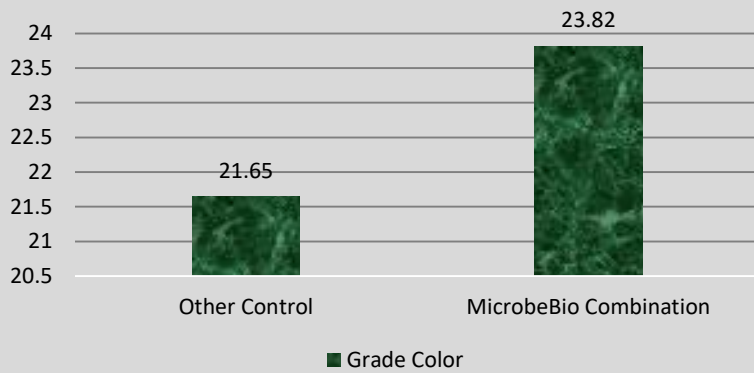
Grade Worm %



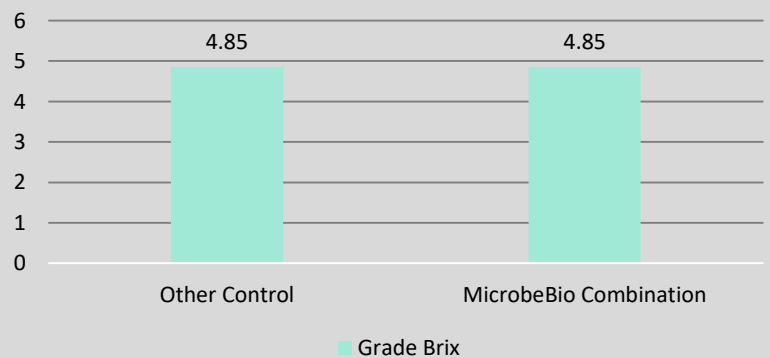
Grade Green %



Grade Color

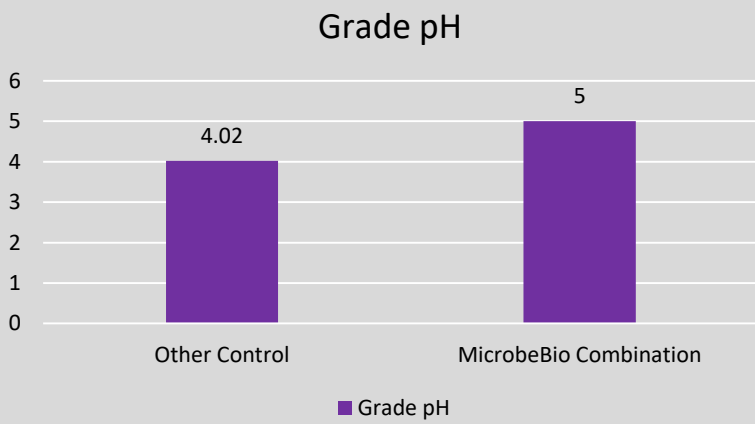


Grade Brix



TOMATO TRIAL TEST IN VIETNAM

Lam Dong



CABBAGE TRIAL TEST IN VIETNAM

Don Duong

Country: Don Duong, Vietnam

Time: January 2018 – February 2018

Area: 10,000 m² (1 hectare)

Products: MicrobeBio® Nature Vigor; MicrobeBio® Hydro Activator; MicrobeBio® Nematicides X1; MicrobeBio® Fungicides X4; and MicrobeBio® BioRational X6.

Results



Image 1: Cabbages after 15 days



Image 2: Cabbages after 50 days

CABBAGE TRIAL TEST IN VIETNAM

Don Duong

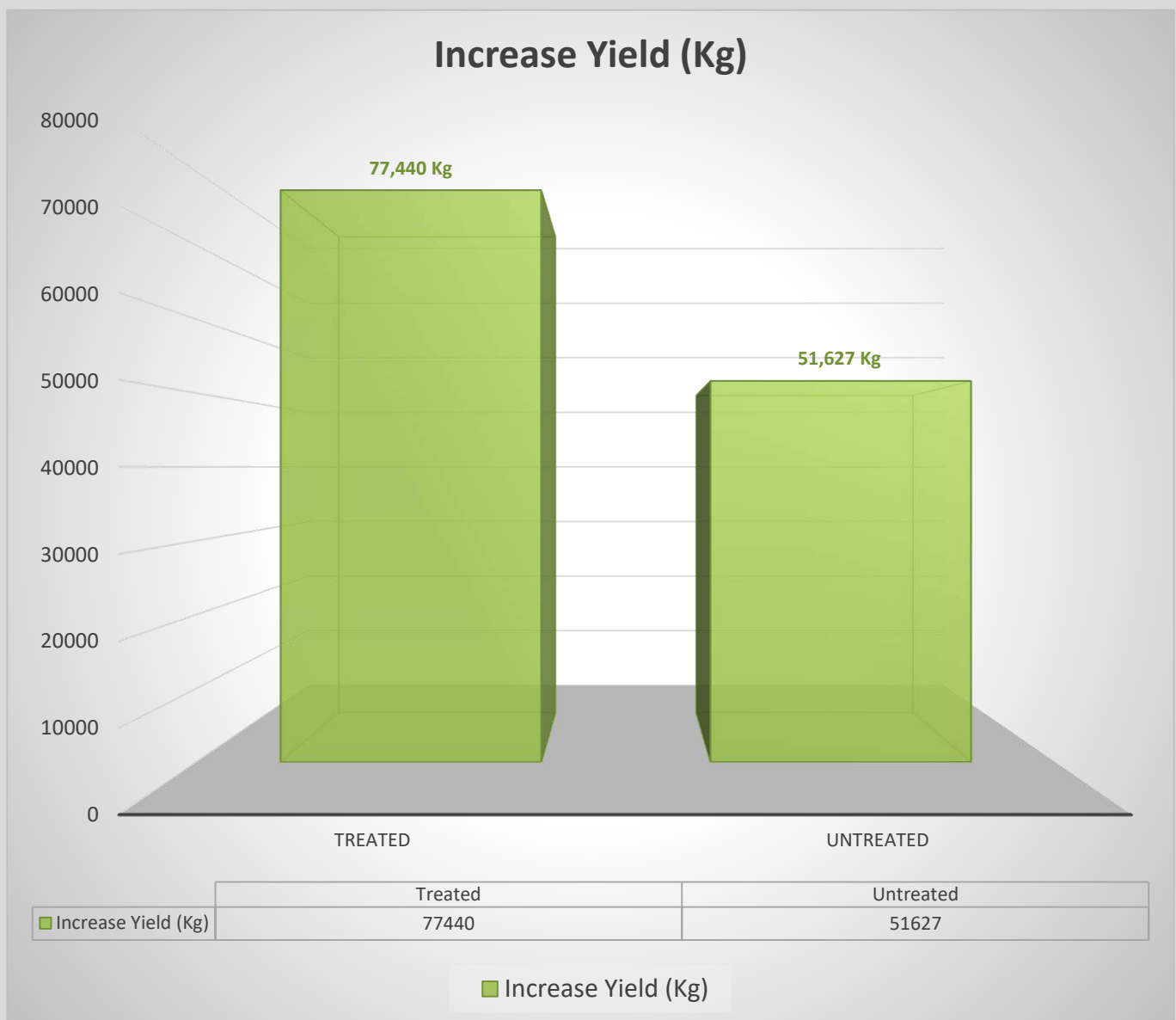


Image 3: Cabbages at first harvest

CABBAGE TRIAL TEST IN VIETNAM

Don Duong

Although this is an unseasonal cabbage growth,
we received the summary of results.



WHAT CAN BE EXPECTED FROM MICROBEBIO® PRODUCTS

MicrobeBio® products not only increase production yields up to 50%, but also serve to reduce nitrogen-based fertilizer inputs to as much as 100%. Furthermore, **MicrobeBio®** products aid in the reduction in insecticides and fungicides, as well as irrigation, which leads to improved input savings. Our products help enrich the nutritional value and shelf life in the produce after harvests. **MicrobeBio®** products also work to restore the soil's fertility, structural strength, and infiltration resulting in superior soil sustainability for future generations. Most importantly, **MicrobeBio®** empowers farmers to maximize both profit and productivity, all while tending to the land in a sensible and mindful manner.







What are soil microbes?

Microbes are single celled organisms found in the soil. They are diverse at metabolizing a variety of organic food sources and converting them into useable by-products for plant use.

What do soil microbes do to the soil?

Bacteria work to accelerate the breakdown of organic matter into inorganic material. This process is called nutrient recycling. Microorganisms are excellent recyclers of soil nutrients and minerals for improved plant uptake. A majority of nutrients are present in the soil in an insoluble form, unavailable for plant use. Microbes are the only organisms on earth that are able to convert them into plant useable forms for improved crop yield and soil health.

Do the microbes damage the soil?

No, microbes do not damage the soil, even in very high doses. In agriculture, the 'salt index' of a product determines how much damage to crop fertility will be done if a product is overapplied. For example, Urea has a salt index of 74.4, DAP has a salt index of 29.2 whereas beneficial microbes have a salt index of 0. As a result, beneficial Ag microbes has no potential to damage soils or crops, even at higher than recommended dosages.

Are there any risks involved with MicrobeBio® organic fertilizers?

No risks exist by using organic fertilizers produced by MicrobeBio®. All fertilizer inputs and beneficial microbes are naturally derived, non-GMO and beneficial to the environment and ecosystem.

Can MicrobeBio® work with any soil?

Yes, MicrobeBio® has a proprietary testing and formulation platform that enables it to produce and customize product formulations specific to the changing climates and soil types.

What are the benefits of organic fertilizers? Soil, plant, and human benefits?

Organic fertilizers are superior to conventional fertilizers in the marketplace because of their low risk profile and use. Organic fertilizers improve soil structure, water and air channeling in the soil that directly improve soil and plant health. Also, organic fertilizers are stable, do not leach into the water table or rivers and are considered slow release. Their slow release characteristics allow them to be a reliable food source for crops and plants all season long.

Due to the application of organic fertilizers and beneficial microbes, the mineral and nutrient content that has long been “locked” in the soil will be released into the plant. As a result, mineral, vitamin and nutrient content in crops, vegetables and fruits will be increased over time. This will directly and positively affect human health and the overall health of the population.

What differences are there between chemical and organic fertilizers?

Chemical/conventional fertilizers are typically derived from petroleum and oil sources. These are synthetic, manmade chemicals that convert petroleum hydrocarbons into a nutrient-salt complex. Once applied to the soil, these salt complexes break up and a portion of them are quickly locked into the soil, becoming insoluble and unusable, whereas the remaining percentage leach into rivers, ponds and other bodies of water causing pollution and eutrophication (algae overgrowth).

Organic fertilizers do not contain nutrient-salt complexes but are loaded with organic material that slowly releases for season long nutrient absorption by crops. The conversion of the organic fertilizer into plant usable nutrients is facilitated by microorganisms. Microbes are the only species on earth that can convert nutrients in the soil into forms that plants can use. No other chemicals or mechanisms are able to perform the functions of beneficial bacteria. This is the reason why organic fertilizers and beneficial bacteria are essential to soil health and crop production.

What bacteria are involved in these microbes and their functions?

The MicrobeBio® microbial line is diverse and takes into consideration the soil and climate requirements. The microorganisms comprised in our products are carefully and scientifically selected to metabolize a wide scope of simple and complex polymers commonly found in different soil types, taking into consideration salinity and pH. Our bacteria are within the groups of Bacillus, Paenibacillus, Diazotrophs (Nitrogen fixers), Streptomyces, Phosphaticum (Phosphorus releasers), Trichoderma, Saccharomyces and many other organisms that work to complete the soil food web cycle in the soil and to optimize plant nutrient uptake and utilization. These microbes are superior at recycling nutrients in the soil all year long, providing timely nutrients to plants when they need it the most. Additionally, a subset of microbes work in

synergy to form a competitive exclusion perimeter surrounding the rootzone (rhizosphere) to protect the plant from disease and invaders.

What products can you grow using organic fertilizer? Ex: wheat, corn (maize), soya beans, vegetables, tomatoes, etc.

There are no limits to the types of crops available for treatment with organic biofertilizers. All crops and soil types are accessible and can be improved through microbial action in the soil. The end result will be enhanced soil tilth, and improved microbial biodiversity throughout the rootzone.

How does the climate and weather patterns affect the microbes or soil?

Climates and soil types have a varying effect on soil biodiversity. MicrobeBio® is the first company to be able to answer this challenge through the use of its novel biochemical screening platform that identifies, characterizes and selects specific microbes in a soil profile for optimal use and application in specific climate regions. Through our identification platform, we are able to rapidly isolate and optimize specific microbial biofertilizers for selective and optimal use. Thus, what was previously a barrier is no longer a limitation to our microbial technology.

What are the application requirements for microbes based organic fertilizer?

MicrobeBio® Vigor Boost™

1 kg to treat 1 ha (3 applications: 500g – 250g – 250g)

Brew the product for at least 24 hours into at least 5 liters of non-chlorine water to activate the microbes.

Dilute the brewed mixture into at least 250 liters of non-chlorine water to treat 1 hectare

MicrobeBio® Nature Foliar™

1 liter to treat 1 ha (2 applications: 500ml - 500ml)

Dilute 1 liter of Nature Foliar into 250 liters non – chlorine water to treat 1 hectare.

MicrobeBio® Hydro Activator™

8 liters to treat 1 ha (3 applications: 4L – 2L – 2L)

Dilute every 1 liter of Hydro Activator into 100 liters non – chlorine water

MicrobeBio® Nature Activator™

25 kg to treat 1 ha

Broadcast the product evenly to the soil around each plant/along planting rows. Water well after each application

How do microbes help improve the soil on a long-term basis?

Improves soil tilth, lessens soil compaction, and improves water channeling and aeration. Additionally, the microbes are excellent nutrient recyclers and decomposers, resulting in an abundance of nutrients and minerals in the soil over a long-term period. As a result, most, if not all the major and minor nutrients will increase in the soil horizon profile and will be available for new plant growth as well as carryover into the next planting season.

Can MicrobeBio® provide solutions to challenges such as army worms or persistent pests?

Yes MicrobeBio® has identified and is able to supply biological solutions for common insect pests, including most piercing and sucking insects and the army worm.

How does too much chemical fertilization affect the contents of the soil over time?

Chemical/conventional fertilizers have an extremely high salinity associated with them. As a result, over salting of the soil is common in conventional fertilizer applications. The NPK nutrients in chemical fertilizers are highly available once put down in soils, however there has been much research that has proven only 30% of all nutrients in synthetic fertilizers are used by plants. The remainder of the NPK and micronutrients are either leached into water tables or volatilize into the atmosphere. This is not a desirable outcome and has proven time after time to cause environmental pollution in water, soil and air.

How do these soil bacteria survive undesirable conditions such as salinity, drought, abiotic and biotic factors and PH?

The microbes that MicrobeBio® provides are stable and spore formers. These unique characteristics of our bacteria enable them to survive extreme environments like abiotic and biotic factors until better conditions present themselves.

What is the shelf life of these soil bacteria?

Liquid (minimum 2 years) and powder (minimum 5 years)

What is the impact of humic acids, molasses and sugar added directly to the soil, rather than adding bacteria?

The addition of sugars directly to soil is usually a mistake. The reason is that soil imbalances commonly occur as a result of numerous biotic and abiotic factors in the environment. Also, after crop harvest an imbalance and deficiency in nutrients is commonly seen in the soil due to crop uptake throughout the season. These deficiencies reduce the number of beneficial bacteria living in the rootzone. As a result, much research has proven that opportunistic pathogenic fungi like Pythium, Rhizoctonia, Phytophthora, and Fusarium take over the field and are present in high numbers prior to next season's planting. Since fungi are microscopic, the grower is unable to determine that his soil is infected with crop pathogens and plants new seedlings into infected soils. Adding molasses and sugars to imbalanced soils is a very bad idea because the sugars will work to proliferate the pathogens in the soil prior to seed planting and germination. Therefore, MicrobeBio® always recommends treating soils with our beneficial and highly scientific bacteria first to control soil pathogens and to protect the sensitive seedling as it begins to germinate.

How can these bacteria help soil in the off-farming season or during winter?

The beneficial bacteria colonize the soil and reside in the small rock pores and structures within the soil. Once the microbes form colonies, then they will become part of the overall microbiology profile in the soil. Since the microbes excel at mineralizing nutrients from rock forms into plant usable forms, then a greater concentration of nutrients will be made available over the winter and will be available for rapid use by the Spring planting season.

What are the yield difference in farms using chemical fertilizer and organic fertilizer per hectare?

Crop yield improvements increase annually as the soil health is restored to a greater balance and microbial colonization in the soil is increased. Typical yields can range from 20-75% over conventional fertilizers.

What treatment is there for soils that are acidic to make the microbes work effectively?

Organic fertilizers are optimal food sources for beneficial microbes to help them work more efficiently and effectively. The organic fertilizers have a slow release characteristic to them that allow for season long feeding of the microbes. Once the microbes begin to grow then they will reduce the pH of the soil as a natural byproduct of growth. These pH reducers produced by bacteria help plants interact with their environment in a more effective and better way since plant roots prefer a pH soil environment.

MICROBEBIO® GROW SOIL

You might say **MicrobeBio®** has taken the best of Mother Nature and put it into a concentrated form and, like all-natural products should be, we never use growth hormones or GMOs, never irradiate and never use chemicals that are harmful to humans, livestock or the planet.

In closing, think of **MicrobeBio®** products like this; we're the health food of plant food, here to put a stop to all the horticultural junk-food that's been shoved down Mother Nature's gullet for far too long.

JOIN US IN CREATING A LIFESTYLE OF HEALTH AND SUSTAINABILITY, A BILLION MICROBES AT A TIME.

www.MicrobeBio.com . info@microbebio.com