



Medical Sciences Group

Study of the Benefits of PureBiotics® Probiotic Environmental Control (StaBiotics) for Plant Care in the Growing Of Cannabis & Other Plants

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ABSTRACT

For centuries probiotics have been used in a wide range of applications for human food and animal feed to medicines and cosmetics. In the past decades it has been discovered how much more beneficial bacteria are essential to not only animal life than has in the past been realized, but also how essential these probiotics are essential to plant and their root systems.

It has now been proven over the past decade that the StaBiotics™ (Stabilized Blended Proprietary Probiotics) from PureBiotics® are also the key solution to the growing problem of resistant infections and provide the ability to greatly reduce the use of antibiotics. However, the subject of this study was the use of PureBiotics® for plants and as a solution to significantly reducing the need for chemicals in the growth of plants (see the section on these problems), specifically in this case, for Cannabis Plants for the medical and recreational applications now legal in a number of areas.

StaBiotics have proven to be the totally safe, chemical-free, natural solution to providing healthier plants and faster growth times, while also providing protection against molds and other problems via direct, safe and natural biological action, instead of using chemicals. In a sense, it is the same concept of using lady bugs to protect against aphids and other pests without ever harming your plants.



Introduction to:



The data for this study in this field was prepared from a number of years of use in three geographical areas of Green Care usage in the USA, Canada and Europe. The need was for a natural replacement for range of questionable chemicals used on or for foods for both plants and for the full range of livestock.

Over the past decade, the PureBiotics' StaBiotic™ (for a blend of Stabilized Proprietary Probiotics) products have been used for a wide range of agricultural applications from plants (including vegetables and flowers) to the growth of millions of animals (primarily swine, cows and horses) and for poultry (primarily chickens, turkeys, quail, raptors and racing pigeons), as well as for Koi and other type fish farms and for exotics such in zoos and pets. In addition, other major applications are for hospitals & medical centers, restaurants, homes, hotels, industrial use, HVAC systems and for use in skin and personal care products.

The first consideration for any of these uses was that the products were completely safe. To this end a large number of university and hospital studies as well as field trials and user reports have been done over the years (copies of all are readily available in the documentation library link).

The key is that these StaBiotics are safe, stabilized probiotics in spore form in purified water and that the probiotics are classified as both a food for both humans and animals and as safe for human and animal use and consumption by a number of regulatory and certification agencies.

Product characteristics

When these probiotics-based products are sprayed on plants, they act as a foliar feed and a growth promoter, while also consuming organic dirt & pollution, which provide cleaning function as the probiotics consume matter from the plants surfaces and convert it to CO₂. Among other benefits, this provides organically cleaner leaves to receive more sunlight and the benefits of additional CO₂ directly to the leave surfaces for better absorption and exchanges of gasses.

As to safety, all of PureBiotics' StaBiotic bacteria are certified as "Class-1" category, according to all International classification schemes (none pathogenic nor 'hazardous), according to Council Directive 2000/54/EC and they are approved by Association of American Feed Control Officials for ingestion.

The products are also 100 % Non-GMO and biodegradable as per OECD standards.

Further, they have also now been authorized by the European Food Safety Agency as safe for both food for humans and for feed for animals. The CTGB Board for the authorization of plant protection products and biocides authorized and recognized the PureBiotics StaBiotic/Probiotic products to go to the market as Biostimulants.

The PureBiotics StaBiotic™ (Aqua Clear Green Care) products are based on probiotics as sole active substance for the primary product and the second product is based on probiotics and enzymes as sole active substances. The probiotics consist of strains of *Bacillus licheniformis*, *Bacillus megaterium* and *Bacillus coagulans*; whereas in the enzyme product, the enzymes consist of lipase and amylase.



The intended use of the products is to stimulate plant growth when sprayed on its leaves and to provide healthier and safer water systems when also used in hydroponic systems. The mode of application, as well as its effect on the plants can be described in the following way. After spraying, the StaBiotics™ remain present on the leaf surface; where this new generation product exerts the following sequential effects:

- In the PRO product that also has enzymes, the enzymes immediately **degrade** their relevant **organic substrate** when present on the leaves (as organic dirt/pollution). This action remains active for about 2 hours before dissipating.
- The **Bacillus** spores germinate within one to two hours and start to **degrade any organic dirt** on the leaves. This action will continue normally for at least 5 days.
- The active **Bacillus** cells also end up in the stomata of plant leaves, where they **produce CO₂** as a BioStimulant for the plant. This action will also continue normally for at least 5 days.

The eventual biostimulation obtained by this mode of action is twofold:

- The reduction of the accumulation of organic dirt on the plant leaf surface allows **sunlight to better penetrate the leaf**. In general, dirt prevents sunlight from reaching the chloroplasts in the plant leaf cells that are responsible for photosynthesis, which makes the plant grow
- The **Bacillus** bacteria **produce carbon dioxide** ('CO₂') as a 'waste' gas directly against the plant surface at the microscopic level. This gas is an absolute requirement for the plant metabolism (photosynthesis), and is absorbed by the plant through the openings on the leaf surface (stomata). Because the Bacillus bacteria (after spraying) also settle on the stomata, they can feed the plant CO₂ directly into the leaf.

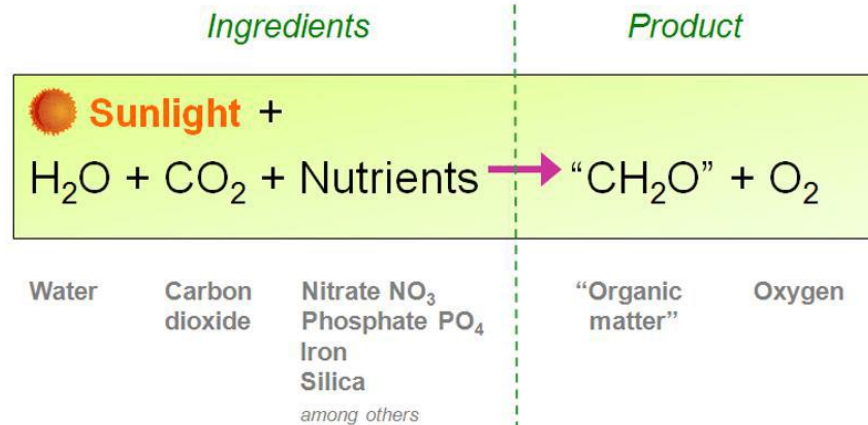
The indirect growth promotion by improving sunlight passage and direct growth promotion by supplying CO₂ to the leaves, makes the PureBiotics StaBiotic products for plant care (i.e. AquaClear Care) a good leaf amplifier, based on the revolutionary technology of StaBiotics™.

Reduction of organic dirt – improving sunlight penetration

Plant leaves tend to accumulate organic dirt originating from decaying organic matter such as old plant material and dead microorganisms. This accumulation of dirt blocks the passage of sunlight into the plant leaf. Any removal or reduction of organic dirt accumulation, which is a function of the StaBiotics™ therefore improves sunlight penetration into the leaf.



Photosynthesis



Many years of scientific literature have demonstrated that *Bacillus* species are very potent in their capability to clean organic matter from surfaces under a wide variety of environmental conditions (Priest, 1977: *Extracellular Enzyme Synthesis in the Genus Bacillus. Bacteriological Review, vol-41*).

The PureBiotics StaBiotic products are comprised of a blend of a number of different *Bacillus* species, selected for their combined broad spectrum enzyme production under fluctuating temperature, pH and humidity conditions.

Because the *StaBiotic*[™] spores require up to several hours to fully germinate and start producing enzymes, free enzymes were added to the one of the two PureBiotics StaBiotic AquaClear & Green Care Products (the PRO) so that right after application they can immediately exert a first effect. The enzymes are lipases and amylase, to reduce the main lipid and sugar organic compounds found in the organic dirt on leaves.

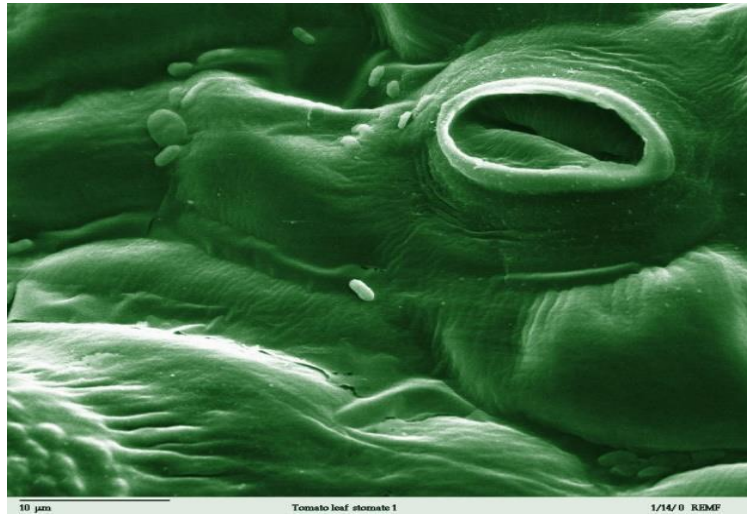
Production of CO₂ in the stomata – CO₂ feeding to the plant

As mentioned in the previous photosynthesis scheme; CO₂ is the most important element needed for plant growth, besides water. CO₂ is taken up by the plant leaves through certain openings called stomata.

The CO₂ can then enter the inside of the plant cells and be processed in the chloroplasts to form plant organic matter for growth. Oxygen is released in the environment again as a “waste” product.

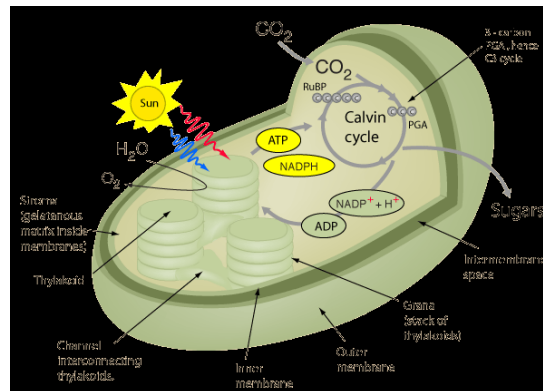


The below electron microscopic picture shows a leaf surface with a stoma, and the much smaller bacterial cell on the plant surface. This shows that the Bacillus bacteria in the PureBiotics' StaBiotic™ Green Care products easily provide CO₂ directly to the leaf surface as well, as they clean down to the microscopic level.



Once on the plant leaf, the StaBiotic™ strains will produce CO₂, which will enter the chloroplast to contribute to the photosynthesis. Production of CO₂ by Bacillus species is known from scientific literature (T. Gibson and Y. Abdel-Malek. 1945. Journal of Dairy Science. The formation of carbon dioxide by lactic acid bacteria and Bacillus licheniformis and a cultural method of detecting the process).

In the below chart is the scheme of a chloroplast, indicating the CO₂ position:



The combination of improved sunlight penetration, and feeding CO₂ to the chloroplasts, results in a biostimulation of the plant. Water and nutrients are sourced from the ground (or by means of hydroponics and fertilizers).

IMPORTANT NOTE ABOUT THE PROBLEM WITH PESTICIDES & DISINFECTANTS

In addition to the obvious problems of using chemicals on plants such as Cannabis that will be extracted for a number of delivery systems for human use, is the growing problems of creating resistant organisms, which is now becoming a crisis in our medical facilities.



THE ADDITIONAL PROBLEM WITH UNEXPECTED CONTAMINANTS



See WebMD Health News for the full article, but the key “highlighted” notes of interest are:

METALS, FUNGUS FOUND IN COLORADO'S MARIJUANA

March 24, 2015 -- Legal marijuana grown in Colorado is two to three times as potent as what was sold on the black market 30 years ago, according to test results released this week at a scientific meeting in Denver.

But it's the unexpected contents of Colorado's recreational marijuana that surprised researchers. Scientists found **butane, heavy metals, and fungus** in some samples.

“It's pretty startling just how dirty a lot of this stuff is,” said Andy LaFrate, president and director of research at Charas Scientific, in a news release. **“You'll see a marijuana bud that looks beautiful. And then we run it through a biological assay and we see that it's covered in fungi.”** LaFrate shared the findings at a meeting of the American Chemical Society.

What's in Colorado's Recreational Pot?

...But the findings have raised questions about what should be tolerated in marijuana sold to the public and if such contaminants could be harmful. **“It's a natural product. There's going to be microbial growth on it no matter what you do,”** LaFrate said in the news release. “So the questions become, ‘What's a safe threshold? And which contaminants do we need to be concerned about?’”

When contaminant testing becomes mandatory soon, pot stores will be required **to test for molds, mildew, and filth; germs; and herbicides, pesticides, fungicides, and other harmful chemicals.** They will also be required to include this information on labels, along with potency and the number of servings. (2015 WebMD)

THE SCIENCE OF CLEAN...

It is interesting to note that soap is not a disinfectant, but its effect to clean surfaces provide a major benefit in the fight against contaminants, and so benefit health. In the same way, PureBiotics' StaBiotics™ provide an extremely effective, but simple in concept, biological cleaning action that basically converts dirt and other contaminants to CO₂, which rids the plants of surface organic matter that not only decrease the plant's ability to function, but also serves as materials for the growth of foreign matter and other organisms that impact the plant negatively.

The further benefit is that the very action of the StaBiotics/Probiotics produce CO₂ right on the leave's surfaces provides the additional growth benefit.

Plant BioStimulants

Plant biostimulants are a new generation of products on the EU market. Over the last few years the European Commission has been working on collecting scientific data with the aim define biostimulants and there are now two EU-wide accepted definitions of biostimulants and which are now widely understood and accepted around the world.



The first one defines them as:

"Substances and materials, with the exception of nutrients and pesticides, which, when applied to plants, seeds or growing substrates in specific formulations, have the capacity to modify physiological processes of plants in a way that provides potential benefits to growth, development and/or stress response."

The second definition states that a biostimulant is:








"Any substance or microorganism, in the form in which it is supplied to the user, applied to plants, seeds or the root environment with the intention to stimulate natural process of plants to benefit their nutrient use efficiency and/or their tolerance to abiotic stress, regardless of its nutrients content, or any combination of such substances and/or microorganisms intended for this use."

EXAMPLES OF APPROVALS AND REGISTRATIONS FOR STABIOTICS™



PUREBIOTICS COLORADO DOA LICENSE REGISTRATION

With the new understanding of the importance of BioStimulants and the growth factor added by the use of PureBiotics' StaBiotics™, PureBiotics and its StaBiotic™ products has now been registered for use on plants by the Colorado Department of Agriculture. The Colorado AgLicense ID for StaBiotics is 001K6D and the License ID is 90164. The product ID is 96151 for StaBiotic™ Mist – Probiotic Environmental Control (PEC).

It should also be noted that PureBiotics' range of StaBiotic Products have been certified, qualified, meet and/or produced under the following variety of agencies and ruling bodies:  Green Seal,  NSF,  ISO Certified,  EcoLabel, are all  GMO-FREE, and it is important to note that all of PureBiotics' StaBiotic/Probiotic organisms that are the base of all of PureBiotics' probiotic products, are all listed in the  **European Food Safety Authority's (EFSA)** published list of microorganisms **consider safe to use in food for both humans** and animals and the same for  **AAFCO LISTING** where all PureBiotics StaBiotic™ (Probiotic) products contains only bacterial strains which appear on the **Association of American Feed Control Officials (AAFCO) list**. This is a list of the species of Microorganisms that are allowed as Direct-Fed Microbials in the United States. This list is found in the 2009 **AAFCO Official Publication, Chapter 5 (Official Feed Definitions), Part 36 (Fermentation Products), and sub part 14 (Direct-Fed Microorganisms) - FDA-AAFCO ALLOWABLE ADDITIVES FOR FEED AGREEMENT**: Through an agreement signed in November of 2007, **the US Food and Drug Administration (FDA)** gave the Association of American Feed Control Officials (**AAFCO**) the authority to publish a list of allowable **additives** in Agricultural Feed products in the USA. These StaBiotic™ products have also been certified to be used on organic animals by several organic certifying organizations, along with other certs and registrations.

EXAMPLES OF FIELD USE OF PUREBIOTICS' STABIOTICS®

PureBiotics Fungus Test with Pineapples

The real-life test of PureBiotics' StaBiotics™ was done as part of a simple and practical actual shipment experiment for fungus control with four (4) crates of pineapples during the same shipment:

- (a) Two (2) of the crates were used as controls and not sprayed with PureBiotics' StaBiotics™ and another random two (2) of the crates were sprayed with Green Care Plus (*under a GC Plus private label*) diluted at 0.25%.
- (b) All the boxes were placed in a storage cell.
- (c) After two (2) weeks - the pineapples were removed from the storage cell. The results are documented in the following slides.

PT Test Report Photos-1 + 2:

Pineapples not sprayed with PureBiotics' StaBiotics™ (for Plant Care)



A great deal of fungi was present

PT Test Report Photo-3:

Pineapples sprayed with PureBiotics' StaBiotics After 2 weeks





No visual presence in any layers of the Pineapples of any fungi PureBiotics StaBiotics^(tm) Fungus Test with Pineapples Comparison Photos



Side by side comparison of pineapples from four crates selected from a shipment (after two weeks in a shipping container) with pineapples on the left photo from the two (2) crates not sprayed with PureBiotics as controls that developed fungi –

- and the photo of the pineapples on the right side from the two (2) crates sprayed with PureBiotics showed no visual presence of Fungi in any layers of the shipped pineapples.

OTHER EXAMPLES OF FIELD USE OF PUREBIOTICS STABIOTICS™

- ❑ From HortiCare: “By using PureBiotics’ (StaBiotics™) for Green Care, we have created stronger and healthier plants and the results showed us a reduction of mold spores and also a decrease in unwanted bacteria.
- ❑ In experiences with cucumbers, peppers, gerberas, lettuce, tomatoes and other crops, resulted in much less fruit with rot on the inside (fusarium). There is better growth and less problems. We also do see a reduction in the use of chemicals. This saves money. Each spraying with a chemical product gives a growth inhibition. Note: We see in cucumber production, a saving from 10% to 60% on the use of chemicals. We are doing testing on spoilage reduction and extending the shelf life of products.
- ❑ B. Beasley: Note that starting some years ago with Beasley Flowers, there has been excellent results in providing longer shelf life for Flowers plus in some cases providing hospitals with safer flowers for patient rooms.
- ❑ PureBiotics’ Farm Sciences product’s benefits for agriculture starts with the production facilities like green houses. In one recent test the non-sprayed test greenhouses averaged 87% and our sprayed greenhouses had a 50% reduction down to 42.5% in powdery mildew.
- ❑ J. Edwards Report: In Alberta we have one large greenhouse that cut the cleaning time in their propagation rooms by 50% and found that at the same time all of their water lines became clear of algae.
- ❑ We have 2 other locations in Alberta where PureBiotics is in use in greenhouses. They were having problems with algae and slime building up in their tanks and water lines shortly after start-up in the spring. With the use of PureBiotics this has not appeared.

**When this study is expanded and a number of reports are added as references in an addendum, it will be resent out to the listed mailing list.*



Notes on usage:

There is a wide range of dilution and spraying instructions depending on a number of conditions that is being prepared with details of each type of use. However, since one of the current key uses of the PureBiotics StaBiotics™ of current interest is for the legal production cannabis, the dilution factors and range of spraying is as follows:

For where the driest possible conditions are wanted, use the StaBiotic™ Concentrate diluted with 20% water. For other cases, up to 10 to 1 dilutions can be use. Only mix as much as you are planning to use over the next five days. Also always keep both the concentrate and the mixed solution out of direct sunlight and keep from freezing.

Then mist the plants not less than three (3) times per week, though more often should be used for problem situations. Both the plant leaves, branches and stem - and the entire area (including walls) should be misted for best control – though not the roots.

Use a very light mist as the product is extremely effective.

Depending on the situation, experimentation is recommended with dilutions down to 25% product and 75% water or as low as ten to one.

Note that for common and less expensive crops, like vegetables and flowers, where more moisture is not a factor, a far greater dilution has been effective even down to 3% to 5%.

CONCLUSION

As can be seen, the PureBiotics StaBiotic™ Plant Care Products, which have a number of certification, are considered both as an excellent organic cleanser for plant surfaces as well as are considered as biostimulants for plants. These StaBiotics™ are not intended as biocides; and no pesticide claims are being made. The natural effect of their use do provide a great deal of health benefits to plants and provide faster and healthier growth rates.

The PureBiotics StaBiotic™ green care products offer a sustainable technology to both protect and stimulate plants in a 100% natural way!

A major benefit of the StaBiotic™ Green Care products is that the active substances are all biosafety level 1 and these PureBiotics StaBiotics™ are food grade microorganisms and have been classified as a food for both humans and animals.

To answer another common question as to why these StaBiotic™ products are so effective at removing most odors from kitchen and gym scents to feces and smoke is that they eliminate all the odor sources down to the microscopic level and covert them to common CO2.

This paper was intended to provide information about the nature of the innovative PureBiotics StaBiotic™ and AquaClear StaBiotic™ Green Care and High Therapy Products.

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