Research, Validation and Commercialization of Technologies

Part A: Plausible Scientific Evidence of Supreme(AG)™ with Nutri-Mastic™ as a Mulch, Soil Amendment, Natural Fertilizer, and More

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"Man became distracted from the importance of organic compound cycling when it was discovered that soluble acidic based N P K "fertilizers" could stimulate plant growth. Large industrial concerns took advantage of the N P K discovery to market industrially processed "fertilizers" from mineral deposit. Continued use of these acidic fertilizers in the absence of adequate humic substances (in the soil) has caused many serious sociological and ecological problems. Man needs to reconsider his approach to fertilization techniques by giving higher priority to soil humus."

--"ORGANIC MATTER, HUMUS, HUMATE, HUMIC ACID, FULVIC ACID AND HUMIN: THEIR IMPORTANCE IN SOIL FERTILITY AND PLANT HEALTH," Dr. Robert E. Pettit, Emeritus Associate Professor Texas A&M University

As a note, as these mineral deposits depleted (as well as light/sweet crude oil), chemicals processed from complex "heavy/sour crude oil" filled the mineral void.

In formulating SGP+™, IFUS stored product away to determine its lifecycle. Furthermore, Hurricane Ida and the COVID Epidemic disrupted product sales, resulting in bales and bags of SGP+™ remaining in storage longer than its lifecycle for Bovine Ration Management Supplementation. It was determined that rather than disposing the product, it would be tested as mulch / soil amendment.

The nature of recalcitrant lignin, makes untreated Sugarcane Bagasse (SB) an undesirable mulch or soil amendment. However, pretreated SB was aged, then reformulated into a new product now called Supreme(AG) with Nutri-Mastic™.

Like SGP+™ with, SupremeAG™ is NOT simply Sugarcane Bagasse, BUT a proprietary formulation containing Nutri-Mastic™ (Mastic Gum, Ionic Minerals, Water), Carob, and Sugarcane Bagasse. The formulation is processed through IFUS's proprietary method, whereby Sugarcane Bagasse at 135-145°F shifts in less than 2-minutes to lowered temperatures of 92-94°F, and continued cooling to 84-86°F for several minutes within 2000-lb highly compresses bales. This transformation is immediately evident in the texture of the new proprietary

product, SupremeAG™ with Nutri-Mastic™.

Where the formulation of SupremeAG™ is similar to SGP+™ (as both contain Nutri-Mastic™ as a key part of the formulation), the aging and storing process is different so as to create accelerated degradation and depolymerization of the recalcitrant lignin. Furthermore, SB degrades into pools of water NOT considered favorable to applications to plants (as this waste water is very high in H2S and must be environmentally managed and treated). **HOWEVER, the water produced from stored bales of SupremeAG™ with Nutri-Mastic™ is very different. Where it remains black in color due to high concentrations of Iron, there is NO H2S smell to the water.** Furthermore, the storage facility initially smells similar to a coffee shop and with time generates a fresh earth, spicy smell.

A pictorial illustration of the formulation of SupremeAG™ follows:

1. Steam coming off the Sugarcane Bagasse before it is formulated, then processed into either SGP+™ or SupremeAG™.

2. It is said that a picture can be worth a thousand words. Below are pictures of structurally intact 2000-lb highly compressed bales of SGP+™ freshly produced in Pic 2-1 and 2-2:

Pic 2-1

Pic 2-2

3. Pictures of SGP+™ 6-months after production. Unlike untreated bagasse (or hay) compressed into bales, SGP+™ bales begin to collapse with darkened water produced (an indication of lignin depolymerization by microbes naturally occurring in the Sugarcane Bagasse). These bales become unusable for optimum supplementation of Bovine Ration Management. **However, when stored and aged in IFUS' Proprietary method, these once compressed bales begin to transform in SupremeAG™ as indicated by the bales collapsing (as shown in Pic 3-1 and 3-2):**

   Pic 3-1:

"Under anaerobic conditions, major bacterial decomposition occurs, leading to the formation of black or dark grey colored wastewater [30]," Abdoul Wahab Nouhou Moussa, et.al., "Critical State of the Art of Sugarcane Industry Wastewater Treatment Technologies and Perspectives for Sustainability," Membranes (Basel). 2023 Jul 31;13(8):709. doi: 10.3390/membranes13080709

Normally, this black-water from Sugarcane Bagasse results from pile maceration to prevent spontaneous combustion. This effluent would be filled with Iron Sulfides with a characteristic Sulfide smell. **Where the dark color is attributed to Iron, there is NO Sulfide smell in the IFUS facility from the black-water as well as NO water added to prevent combustion as the bales are cool. Hence, the toxic water produced from naturally degrading SB, is transformed into an Iron-rich water source favored by Iron- and acid-loving plants.**

Pic 3-2:

"A taxonomic classification of the bagasse metagenome reviews the predominance of Proteobacteria, which are also found in high abundance in other aerobic environments. **Based on the functional characterization of biomass-degrading enzymes, we have demonstrated that the bagasse microbial community benefits from a large repertoire of lignocellulolytic enzymes, which allows them to digest different components of lignocelluoses into single**

molecule sugars." Wuttichai Mhuantong, et.al., "Comparative analysis of sugarcane bagasse metagenome reveals unique and conserved biomass-degrading enzymes among lignocellulolytic microbial communities," Biotechnol Biofuels. 2015 Feb 8;8:16. doi: 10.1186/s13068-015-0200-8

From the science that has been performed to date on Sugarcane Bagasse (SB), IFUS can pictorially deduce that the transformation of lignocellulosic compounds into beneficial phytochemicals and other nutrients desired by plants evolves from the IFUS Proprietary and Formulation Processes. Hence, SupremeAG™ is born.

This reality is demonstrated in the transformation of SGP+™ after several years (2012). Unlike untreated Sugarcane Bagasse (of hay), SGP+™ disintegrates into dust as shown by Pic 4-1 and 4-2:

Pic 4-1:

Pic 4-2: Please note the coloration of the product as it has shifted from a light tan-brown with tinges of rust, to a much darker brown. Furthermore, please not the complete degradation of what one was long striated fibers (shown in Picture 5, which is located …again reflective of degredation of the ligninic stucture of the Sugarcane Bagasse.

Pic 4-2

IFUS has since modified its formulation method. Creation of the dust-like product is now occurring in an accelerated time frame.

4. Pictures of Untreated Sugarcane Bagasse in Pic 5:

   Pic 5:

Of note is that the Sugarcane Bagasse is VERY hot to the touch.

5. Contrasted to 4-month-old SGP+™ broken apart out of a 2000-lb bale in Pic 6 and in time and with reformulation is transformed into SupremeAG™:

The SGP+™ is cool to the touch.

6. What's happening? Accelerated lignin degradation and depolymerization!

Sugarcane Bagasse in unlike any grass on earth as it produces high levels of starch. When the Sugarcane Bagasse suspends its growth (typically due to cooler temperatures), the starch converts into sucrose. Once the sucrose is extracted from the Sugarcane, the residual sugars are quickly fermented in the remaining pulp (or Bagasse). **Over time, microbes in the Sugarcane Bagasse mat use the remaining nutrients and chemicals to degrade the cellulose, hemicellulose, and lignin. However, this can take years and is particularly exothermic.**

If Sugarcane Bagasse is compressed into a fiber board or bales, these products remain nondegradable for decades. For nearly a century, Sugarcane Bagasse was converted into brown paper, cardboard, and insulation board.

IFUS holds that is has discovered a commercially viable process by which lignin from Sugarcane Bagasse can be degraded and depolymerized *in vitro* by combining Sugarcane Bagasse with Mastic Gum, Carob, Ionic Minerals, and Water, through the IFUS Proprietary Formulation Technology.

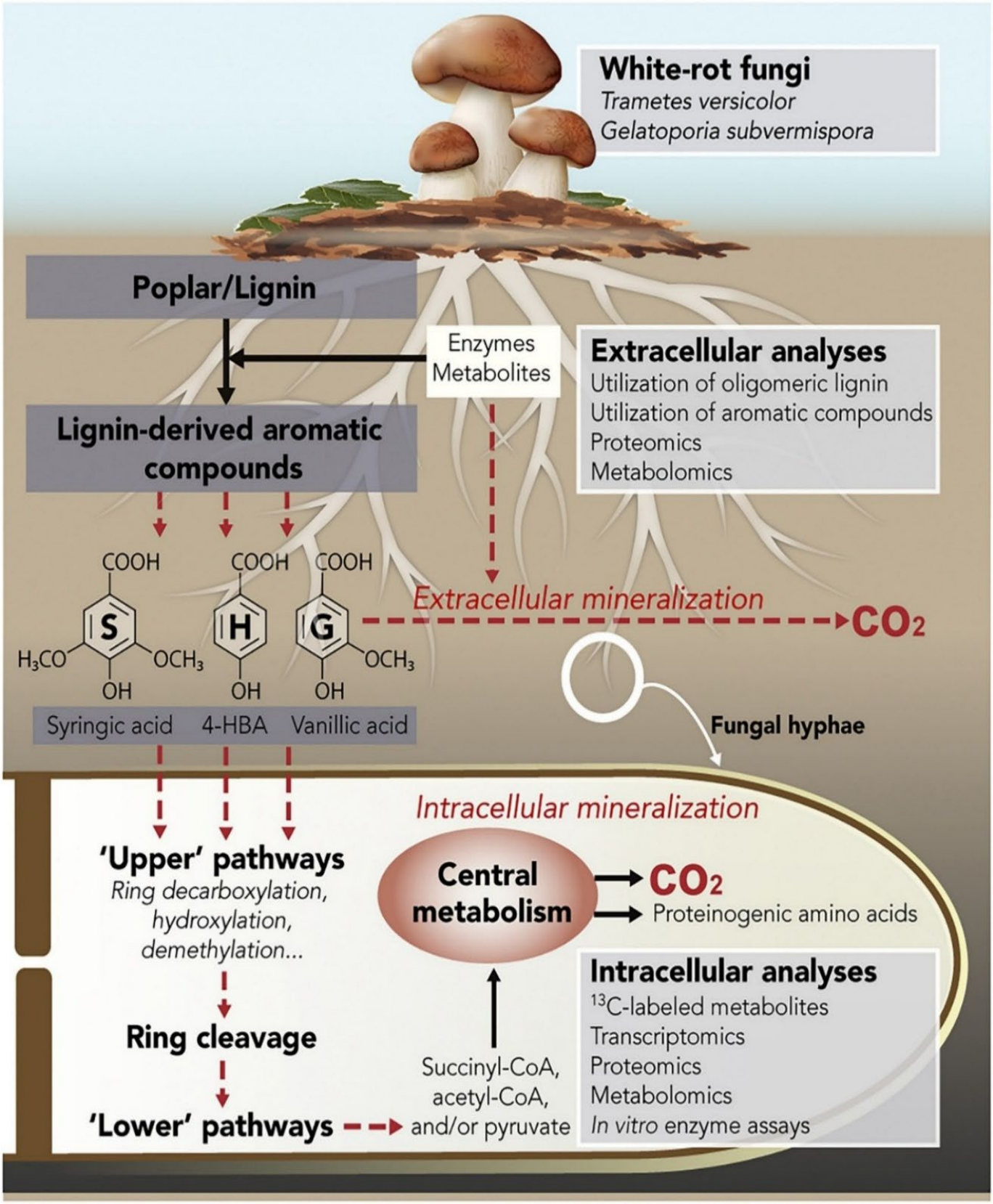
Furthermore, if one considers "Intracellular pathways for lignin catabolism in white-rot fungi" written by Carlos del Cerro, et.al in "The Proceedings of the National Academy of Sciences: Systems Biology/Biological Sciences," Feb. 23, 2021, one finds extraordinary evidence of the natural process of lignin degradation and depolymerization.

This is illustrated in the diagram below (Picture 7) on ground-breaking work done on Poplar Lignin. **The degradation and depolymerization pathways of S-, G-, and H-Lignin result in a plethora of beneficial phytochemicals, nutrients, water, and CO2 for plant nourishment.**

Picture 7 shows the natural eco-friendly process designed by Mother Nature to nourish plant life, while naturally cooling the soil with CO2…later absorbed by the plant in photosynthesis to create Oxygen.

Hence, IFUS's product lines made with Nutri-Mastic™ are believed to enable humans, animals, and plants to naturally become more "intact" with Nature. In other words, the IFUS product lines may well be creating a natural state of "homeostasis" beneficial to humans, animals, and plants.

Picture 7:


White-rot fungi
Trametes versicolor
Gelatoporia subvermispora
Poplar/Lignin
Enzymes
Metabolites
Extracellular analyses
Utilization of oligomeric lignin
Utilization of aromatic compounds
Proteomics
Metabolomics
Lignin-derived aromatic compounds
COOH
COOH
COOH
S
H
G
H3CO
OCH3
OCH3
OH
OH
OH
Syringic acid
4-HBA
Vanillic acid
Extracellular mineralization
CO2
Fungal hyphae
Intracellular mineralization
'Upper' pathways
Ring decarboxylation, hydroxylation, demethylation...
Central metabolism
CO2
Proteinogenic amino acids
Ring cleavage
'Lower' pathways
Succinyl-CoA, acetyl-CoA, and/or pyruvate
Intracellular analyses
13C-labeled metabolites
Transcriptomics
Proteomics
Metabolomics
In vitro enzyme assays

Why are iron- and acidic-loving plants thriving on SupremeAG™ with Nutri-Mastic™?

1. Iron
2. pH
3. Hydration
4. Phytochemicals
5. Soil Structure
6. Humic Substances
7. And, more.

Why are iron-loving and acid-loving plants mulched and/or soil amended with SupremeAG™ with Nutri-Mastic™ demonstrating a reduction and/or elimination of unwanted insects and/or bugs?

1. Plant and root health
2. Natural phytochemicals leached from the soil and/or the plant that attract beneficial insects and/or repel pests

Why are iron-loving and acid-loving plants mulched and/or soil amended with SupremeAG™ with Nutri-Mastic™ requiring less herbicides?

1. The matt suppressing weed growth
2. The healthier plant with healthier root system
3. The phytochemicals

Why are iron-loving and acid-loving plants mulched and/or soil amended with SupremeAG™ with Nutri-Mastic™ requiring less fertilizers?

1. Sugarcane Bagasse as well as SupremeAG™ have both been shown to be very high in natural iron (e.g., one analysis from Cumberland Valley Analytical Services showed a roughly 85% mixture of SGP+™ to contain 1625ppm Fe along with specific minerals tested to include: 0.17ppm Ca, 0.14ppm P, 0.20ppm Mg, 0.38ppm K, 0.02ppm Na, 74.00ppm Mn, 23.00ppm Zn, 8.00ppm Cu.

    a. SGP+™ is comparable to SupremeAG™ with a major exception, that being, the added degradation of the lignin fiber and what is believed to be an increased concentration of Humic Substances.

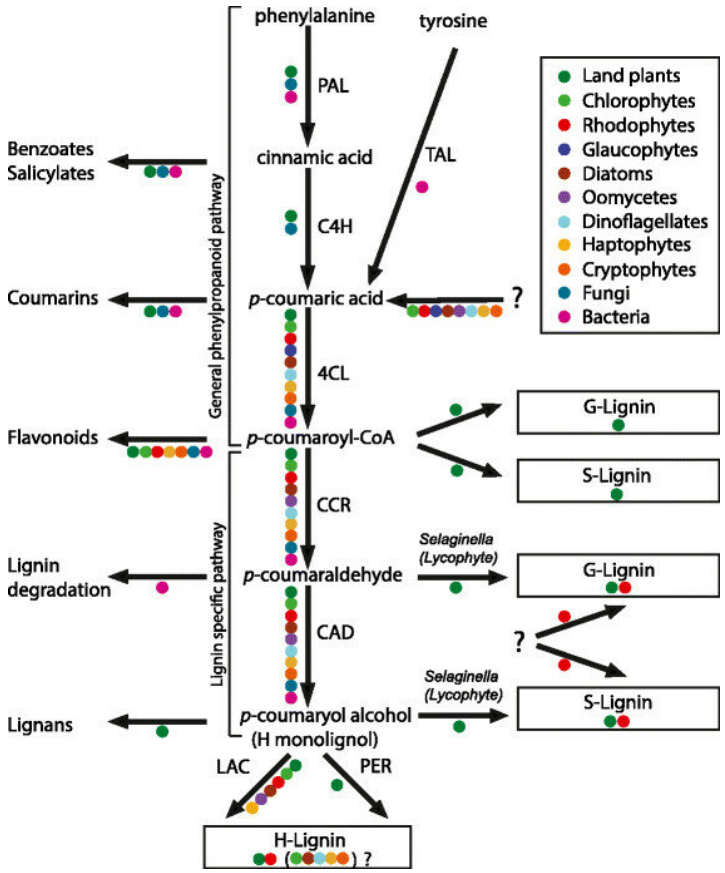
b. Additionally, the CVAS Analysis showed Crude Protein and Soluble Protein as a % of DM at 6.5ppm and 0.7ppm, respectively.

(i) You can view the CVAS reports at: https://www.impactfusionbrands.com/knowledge-base/cvas-standard-34710041-deer-run-ranch/

Additionally, published science shown above in Picture 7 supports the availability of any number of nutrients beneficial to animals and plants: "Intracellular pathways for lignin catabolism in white-rot fungi", Carlos del Cerro, et.al, The Proceedings of the National Academy of Sciences: Systems Biology/Biological Sciences, Feb. 23, 2021.

a. Any number of natural phytochemicals known to enhance soil quality, soil texture, and more have been shown to be produced as lignin degrades and depolymerizes.

b. Diagram 1 below illustrates a sample proposed pathway by which lignin can either be synthesized in nature, or degraded/depolymerized into natural phyto-chemicals found to be beneficial to root development, plant nourishment and more.



c. Subsequent actions, interactions, and relationships between these natural phytochemicals lead to a complex array of biochemistry producing:

(i) Polyphenols to include (a) Phenolic Acids (e.g., Gallic Acid, Hydroxybenzoic Acid, Hydroxycinnamic Acid, etc.)
(ii) Flavonoids (e.g. Anthocyanins, Flavanol, Flavonol, Flavonl, Isoflavone, etc.)
(iii) Non-Flavonoids (e.g., Lignans, Stilbene, etc.)
(iv) Terpenoids (e.g. Sesquiterpene like Beta-caryophyllene (BCP))
(v) etc.

This complex biochemistry is said to nourish the plant, enhance natural defense mechanisms against diseases, bugs/insects, stress-conditions, improve nutritional value / quality / yield / taste and more…without added synthetic fertilizers, pesticides, and more.

Why are iron-loving and acid-loving plants mulched and/or soil amended with SupremeAG™ with Nutri-Mastic requiring less water?

1. Bagasse is particularly hydrophilic.
2. **When lignin in bagasse degrades, and more so depolymerizes in the presence of White Rot Fungi and other beneficial microbes (found naturally in nature), water and CO2, along with a host of Proteogenic Amino Acids are produced.**
    a. Furthermore, published science as shown above in Picture 7 supports this: "Intracellular pathways for lignin catabolism in white-rot fungi", Carlos del Cerro, et.al, The Proceedings of the National Academy of Sciences: Systems Biology/Biological Sciences, Feb. 23, 2021.

In consideration of this information, IFUS can provide deeper and plausible scientific explanations in support of the efficacy of SupremeAG™ as an eco-friendly, cost-effective product and technology shown to improve the health, well-being, and yield of acid- and Iron-loving plants, trees, and shrubs.

We also remind you that these White Papers are considered Works-In-Progress. As new information is uncovered or new data reported, the White Paper is updated accordingly. Many of the areas are populated with information that requires more substantive information.

IFUS Table of Contents:

IFUS Point 1: Preface to Comments (PART A White Paper)

IFUS Point 2: Predation Prevention as a Natural Pesticide (In Progress)

IFUS Point 3: Mulching and/or Soil Amendment (In Progress)

IFUS Point 4: Soil Fertilization (In Progress)

IFUS Point 5: Soil Hydration (In Progress)

IFUS Point 6: Summary (In Progress)

IFUS Point 7: IFUS Conclusions (On-Going_

IFUS Point 8: Possible Next Steps

IFUS Point 9: Data: IFUS Trials and Reports

IFUS Point 10: Eco-centric Efficacy of SupremeAG™

IFUS Addendum 1: Application Guidance

IFUS Addendum 2: Two-Stage Application

IFUS Point 1: Preface to Comments

IFUS Point 1-A: Let us consider the content provided from and to the SUAREC (Southern University Agricultural Research and Extension Center) Scientific Team on an initial Statistical Trial conducted on "Greens." In a visit to the SUAREC Research Station (https://www.suagcenter.com/about/facilities), we discussed and observed the results of the initial trial. Of note was the impact of the insect infestation on the greens. Also of note, was the lack of impact on these particular plants where SupremeAG™ with Nutri-Mastic™ was applied as both a mulch and a soil amendment.

As we discussed the outcomes from the trial, we agreed to think through these. What has resulted are a series of "Working Theories." This is the best thinking we can bring to the table at this time. With more and better information, we will probably shift our perspective into a more informed set of contentions.

As discussed, it is our contention that the SupremeAG™ with Nutri-Mastic™ increased the phytochemical make-up of the "Greens". Additionally, the mineral content of the "Greens" may well have been improved. The interaction of improved phytochemical make-up, in combination with improved mineral make-up, provides a plausible explanation; that being, SupremeAG™ with Nutri-Mastic™ did improve the plants, but in a manner in which the specific concentration of phytochemicals increased, specifically those phytochemicals attract unwanted bugs/insects/pests.

Hence, the bugs/insects/unwanted pests devoured the plants. Any improvements to the plants would have been difficult at best to see.

For example:

"The chemicals that give off a cabbage smell primarily include:

(1) Methyl mercaptan (Methanethiol): A colorless, flammable gas with a distinct odor that smells like rotten eggs or cabbage.
(2) Sulfur compounds: Present in cabbage, especially when cut or cooked, leading to a pungent odor.
(3) Amines: Such as putrescine and cadaverine, which are produced when meat decomposes and contribute to a rotten meat smell.

These compounds contribute to the unpleasant aroma often associated with garbage and certain vegetables."

Ref. 1: (Lončarić A, Marček T, Šubarić D, Jozinović A, Babić J, Miličević B, Sinković K, Šubarić D, Ačkar Đ. Comparative Evaluation of Bioactive

Compounds and Volatile Profile of White Cabbages. Molecules. 2020 Aug 13;25(16):3696. Doi: 10.3390/molecules25163696. PMID: 32823667; PMCID: PMC7464038.)

"More importantly, cabbage contains indoles, specifically indole-3-carbinol, which is a phytochemical found in cruciferous vegetables. Indoles are derived from the breakdown of glucosinolates, which are sulfur-containing compounds found in cabbage and other vegetables. These compounds have been studied for their potential health benefits, including anti-cancer properties and antioxidant effects."

Ref. 2: (Linus Pauling Institute Micronutrient Information Center, https://lpi.oregonstate.edu/mic/food-beverages/cruciferous-vegetables)

Ref. 3: Katz E, Nisani S, Chamovitz DA. Indole-3-carbinol: a plant hormone combatting cancer. F1000Res. 2018 Jun 1;7:F1000 Faculty Rev-689. doi: 10.12688/f1000research.14127.1. PMID: 29904587; PMCID: PMC5989150.

Many "vegetable-eating" bugs/insects/pests are "thought to be attracted to indoles. Indoles are compounds that provide nectar and pollen to flowering plants, trees, and shrubs." This includes LadyBugs. Hence, if SupremeAG™ with Nutri-Mastic™ is increasing the phytochemicals that attract predatory bugs/insects/pests, who are already drawn to a particular plant because of its specific phytochemical make-up, then in fact for these particular plants the very unwanted predatory bugs/insects/pests will devour the plants. SupremeAG™ is actually producing enhanced attractants that (per the literature) specifically impact the olfactory receptors of these unwanted pests.

Ref. 4: Cna'ani A , Seifan M, Tzin V. Indole is an essential molecule for plant interactions with herbivores and pollinators. J Plant Biol Crop Res. 2018; 1(1): 1003.

This also portends that cabbage and related plants produce "Volatile organic compounds (VOCs)." We ask the question, "What Chemicals Attract Bugs to Eat Greens?" An answer is provided below:

"The attraction of bugs to eat greens is primarily due to the presence of certain volatile organic compounds (VOCs) and specific sugars, amino acids, and other nutrients in the plants. These compounds can be found in a variety of vegetables and are known to attract specific insects. For example, brassicas like cabbage and broccoli release glucosinolates, which are highly attractive to cabbage white butterflies and flea beetles. Similarly, cucurbits like squash and cucumbers produce cucurbitacins, which attract squash bugs and cucumber beetles. Understanding these specific attractions is crucial for gardeners to implement targeted pest control measures."

Ref. 5: Boncan DAT, Tsang SSK, Li C, Lee IHT, Lam HM, Chan TF, Hui

JHL. Terpenes and Terpenoids in Plants: Interactions with Environment and Insects. Int J Mol Sci. 2020 Oct 6;21(19):7382. doi: 10.3390/ijms21197382. PMID: 33036280; PMCID: PMC7583029.

Ref. 6: Shaoqun Zhou (周绍群), Georg Jander, Molecular ecology of plant volatiles in interactions with insect herbivores, Journal of Experimental Botany, Volume 73, Issue 2, 13 January 2022, Pages 449–462, https://doi.org/10.1093/jxb/erab413

Of note are the “glucosinolates.” We have not considered the “cucurbitacins” and other phytochemicals at this time as we have much to learn about the biochemistry of “glucosinolates” and the impact that these have on insect behavior.

Point 1-B: By contrast, Roses are part of the Rosacea family. These species are not noted for containing high concentrations of glucosinolates. Glucosinolates are primarily found in plants of the Brassicaceae family, such as broccoli, cabbage, and mustard, which are not related to roses. While roses are known for their fragrant flowers and ornamental value, they do not possess glucosinolates, which are sulfur-containing compounds typically found in cruciferous vegetables.

Additionally, like Roses, "Citrus fruits do not contain high concentrations of glucosinolates. Instead, they are rich in citrus bioflavonoids, which are a class of phytochemicals that provide various health benefits, including antioxidant properties. Glucosinolates are primarily found in cruciferous vegetables like broccoli and cabbage, and they require specific conditions to be transformed into bioactive compounds. Therefore, if you're looking for glucosinolates, citrus fruits are not a good source.”

Furthermore, Fruit trees as a rule do not contain high concentrations of glucosinolates. Glucosinolates are primarily found in plants of the Brassicaceae family, which includes vegetables like broccoli, cabbage, and cauliflower. While fruit trees are not part of this family, they do produce glucosinolates in their seeds and other parts, which are beneficial for human health. The literature is suggesting that “glucosinolates” are not found in the leaves of fruit trees. And, if “glucosinolates”, they exist at very low concentrations and our overpowered by other phytochemicals that would either mask or balance the odors produced.

Additionally, trials on Strawberries in the U.K. have become a focal point as to the application of SupremeAG™ with Nutri-Mastic™. The science provides answers to these questions:

1. Do strawberries like acidic soil? "Yes, strawberries like acidic soils, and there are many ways to increase your garden soil acidity for your strawberries to bloom well."
Source: https://gardeningbank.com/do-strawberries-like-acidic-soil/

2. Are strawberries Iron-loving plants? "Yes, strawberries are iron-loving plants. They require iron (Fe) for essential functions such as chlorophyll production and overall growth. Iron deficiency can lead to symptoms like yellowing of new growth, indicating a need for supplementation. Proper fertilization with iron is crucial for healthy strawberry production."
Source: https://flowergardennews.com/do-strawberry-plants-require-iron.html

3. Do strawberries contain glucosinolates? "Do not contain glucosinolates
Strawberries do not contain glucosinolates. Glucosinolates are primarily found in cruciferous vegetables, such as broccoli and cabbage, and strawberries are not classified as such. Instead, strawberries are rich in antioxidants like anthocyanins, which contribute to various health benefits."
Source: https://www.health.harvard.edu/diseases-and-conditions/blood-sugarfriendly-fruits-if-you-have-diabetes

4. Do ladybugs harm strawberry plants? "Ladybugs are not known to harm strawberry plants. They are beneficial insects that help control pests that can damage the plants. While ladybugs primarily feed on soft-bodied insects, they do not consume strawberries. In fact, having ladybugs in your garden can be beneficial as they help protect the health and productivity of strawberry plants. Ladybugs are sensitive to pesticides and other chemicals that harm beneficial insects, indicating that the plants have not been treated with harmful substances. They are important pollinators for strawberry plants, feeding on nectar and pollen to ensure the plants produce high-quality fruit.
Source: https://blog.entomologist.net/are-strawberry-plants-consumed-by-ladybugs.html

Hence, if one were to overlay the data and observations to date as to the efficacy of SupremeAG™ with Nutri-Mastic™ on improving strawberry production in the U.K., then one could entertain the plausible application of SupremeAG™ with Nutri-Mastic™ as a reasonable trial at minimum.

Point 1-C: Let's us consider another data point. Our research shows that for bovines consuming SGP+™, a significant reduction in flies on the hide and on the manure is found…along with the absence of fly larvae in the Manure Pats. It remains the IFUS contention that the reduction of flies on the hides of the cows is due to

phytochemicals that build and/or are released from the hide. These phytochemicals prove unappealing to the flies; i.e., the fly does not like the smell nor does it like the taste should it bite the cow. There are any number of previously conducted and published scientific studies that support this contention. We believe this is due to a reduction of the indoles (e.g., furfurals) and an increase in the flavonoids on and within the cow's hide (or something to this effect). This is further supported by reports of significant improvements in both taste and texture of the meat from those cows being fed SGP+™ that are butchered. It is further supported by reports from ranchers and dairymen applying SGP+™ as part of their Ration Management Strategy that hides of their respective herds are greatly improved with a sheen that is outstanding. The literature offered to date offers plausible explanations as to the source of this reported "sheen", which is attributed to phytochemicals related to the "flavonoid" family (of which, glucosinolates are not a part).

As for the fly larvae in the manure, fly larvae require undigested lignin to survive. The undigested lignin becomes the food source for the fly. Hence, the reduction in lignin pre- vs post digested in the cow's ration (as compared to manure) provides some level of quantitative measurement that the lignin is actually being degraded prior to feeding the cow, with lignin depolymerization occuring *in vivo* in the cow's digestive system. Again, any number of published studies support this contention.

Hence, the natural phytochemicals found in the ingredients in both SGP+™ and SupremeAG™ (Carob and Chios Mastic Gum, specifically), as well as similar phytochemicals produced by the degradation and depolymerization of lignin, offer tangible evidence of the efficacy of both SGP+™ and SupremeAG™ (when applied as appropriate technologies to respective plants, trees, and shrubs) in providing natural phytochemicals known to be attractants to beneficial bugs/insects/pests, while being repellants to unwanted bugs/insects/pests. This is notwithstanding the added micro- and macro-mineral content in both products, which is supplied by Nutri-Mastic™ as well as naturally found in Sugarcane Bagasse. Lastly, many of the phytochemicals found in the ingredients that are used to formulate SGP+™ and SupremeAG™ are also shown to have natural insecticidal effects. We have uncovered any number of scientific studies that support this. These are referenced on the IFUS Website at the following links:

(i) https://www.impactfusionbrands.com/knowledge-base/part-1-plausible-scientific-evidence-of-the-efficacy-of-sgptm-in-bovine-herd-performance-through-ration-management/

(ii) https://www.impactfusionbrands.com/knowledge-base/part-2-plausible-scientific-evidence-of-the-efficacy-of-sgptm-in-bovine-herd-performance-through-ration-management/

(iii) https://www.impactfusionbrands.com/knowledge-base/part-2a-carob-

plausible-scientific-evidence-of-the-efficacy-of-sgptm-in-bovine-herd-performance-through-ration-management/

Worthy of final note is that raw sugar from sugarcane, when stored in opened warehouses shows no sign of insects, bugs, and other unwanted pest…until dissolved in water.

Point 1-D: Now, in consideration of what has been offered to this point and by contrast, SupremeAG™ with Nutri-Mastic™ may increase phytochemicals that attract beneficial insects (like Ladybugs).

"Flavonoids in plants can have various effects on insects:

1. They may attract certain insects, acting as chemoattractants, particularly rhizobia.
2. However, they can also serve as insecticides, helping to deter other plant-feeding insects.
3. Additionally, flavonoids play a role in host-plant defense, potentially managing pests without harming beneficial insects.

In summary, while flavonoids can attract some insects, they also have significant roles in pest management and insecticide functions."

Ref. 7: Riddick EW. Evaluating the Effects of Flavonoids on Insects: Implications for Managing Pests Without Harming Beneficials. Insects. 2024 Dec 1;15(12):956. doi: 10.3390/insects15120956. PMID: 39769558; PMCID: PMC11678172.

Ref. 8: Himanshi Gautam, Ashish Sharma, Prabodh Kumar Trivedi, The role of flavonols in insect resistance and stress response, Current Opinion in Plant Biology, Volume 73, 2023, 102353, ISSN 1369-5266, https://doi.org/10.1016/j.pbi.2023.102353. (https://www.sciencedirect.com/science/article/pii/S1369526623000183)

At the IFUS Test Farm in Louisiana, the SUAREC team witnessed the effect of SupremeAG™ on fruit trees and rose bushes. Where the trees / plants were soil-amended and/or mulched with SupremeAG™, there was little or no evidence of the presence or the impact of predatory bugs/insects/pests. Furthermore, the quality of the fruit sampled both in form and tastes proved outstanding. This included the rose bushes, which had incredibly fragrant and plentiful blooms with no Rust-blight or other predation.

The literature suggests that these observations are supported by significantly higher

concentration of flavonoids (using compounds like the indoles), to enhance the olfactory senses of beneficial bugs/insects/worms/etc.

Point 1-E: IFUS acknowledges that “Flavanoids” can be found in plants like cabbage. However, the literature tells us that, “Flavanoids in cabbage are not identical to those found in fruit. While both cabbage and fruits contain flavonoids, they differ in their chemical structure and subclasses. Flavonoids are a broad category of compounds found in various plants, including fruits and vegetables, and they have distinct health benefits. For example, red cabbage is particularly rich in anthocyanins, a type of flavonoid, which may offer unique health benefits compared to other flavonoids found in fruits.”

We are presently exploring the differences and impacts of flavonoids vs indoles (and similar phytochemical families) so as (1) better understand how to successfully apply SupremeAG™ with Nutri-Mastic™ as a technology to specific groups of plants/trees/shrubs, and (2) which plants, trees, and shrubs might not thrive with SupremeAG™ with Nutri-Mastic™. We do have data to suggest a short list, which we offer later is this document.

Point 1-F: We have discussed the impact of Humic Substances at the beginning of this White Paper. We are continually investigating the impact of Humic Substances on phytochemical production along with critical mineral interaction.As suggested in the beginning of the document, and per the photos below, it becomes visibly obvious that Aged SGP+™ with Nutri-Mastic™, when reformulated into SupremeAG™ with Nutri-Mastic™ become a source of Humic Substance. The shift in coloration from basic Sugarcane Bagasse into SGP+™, then into SupremeAG™ when overlayed to color charts of Humic Acid provide this guidance. Additionally, the performance of plants, trees, and/or shrubs mulched, soil-amended, and/or both further supports this contention.

As a reminder, Dr. Robert E. Pettit, Emeritus Associate Professor Texas A&M University, published a treatise: "ORGANIC MATTER, HUMUS, HUMATE, HUMIC ACID, FULVIC ACID AND HUMIN: THEIR IMPORTANCE IN SOIL FERTILITY AND PLANT HEALTH."

The picture below provides a perspective on the importance to Humic Substances to the well-being of plants, trees, and shrubs.

https://www.humicacid.org/wp-content/uploads/2018/07/humic-substances-e1587220456345.jpg

The Global Healing Center agrees with Dr. Pettit's contention by stating, "In summary, humic substances play a crucial role in enhancing soil quality, promoting plant growth, and supporting sustainable agricultural practices, making them invaluable for effective soil management."

Furthermore, Cornell University scientists write about "Returning essential nutrients to the soil." Their team suggests that, **"Degraded lignin nourishes plants by returning essential nutrients to the soil, which is crucial for nutrient cycling and maintaining the balance of ecosystems.** The breakdown of lignin by microorganisms like white-rot fungi and brown-rot fungi releases nutrients such as carbon, nitrogen, and phosphorus, which are vital for plant growth and health. These nutrients are then utilized by plants to grow, develop, and reproduce, contributing to the overall health and sustainability of the ecosystem." ("The Effect of Lignin on Biodegradability, Tom Richard, Cornell Composting, Science & Engineering, https://www.compost.css.cornell.edu/calc/lignin.html)

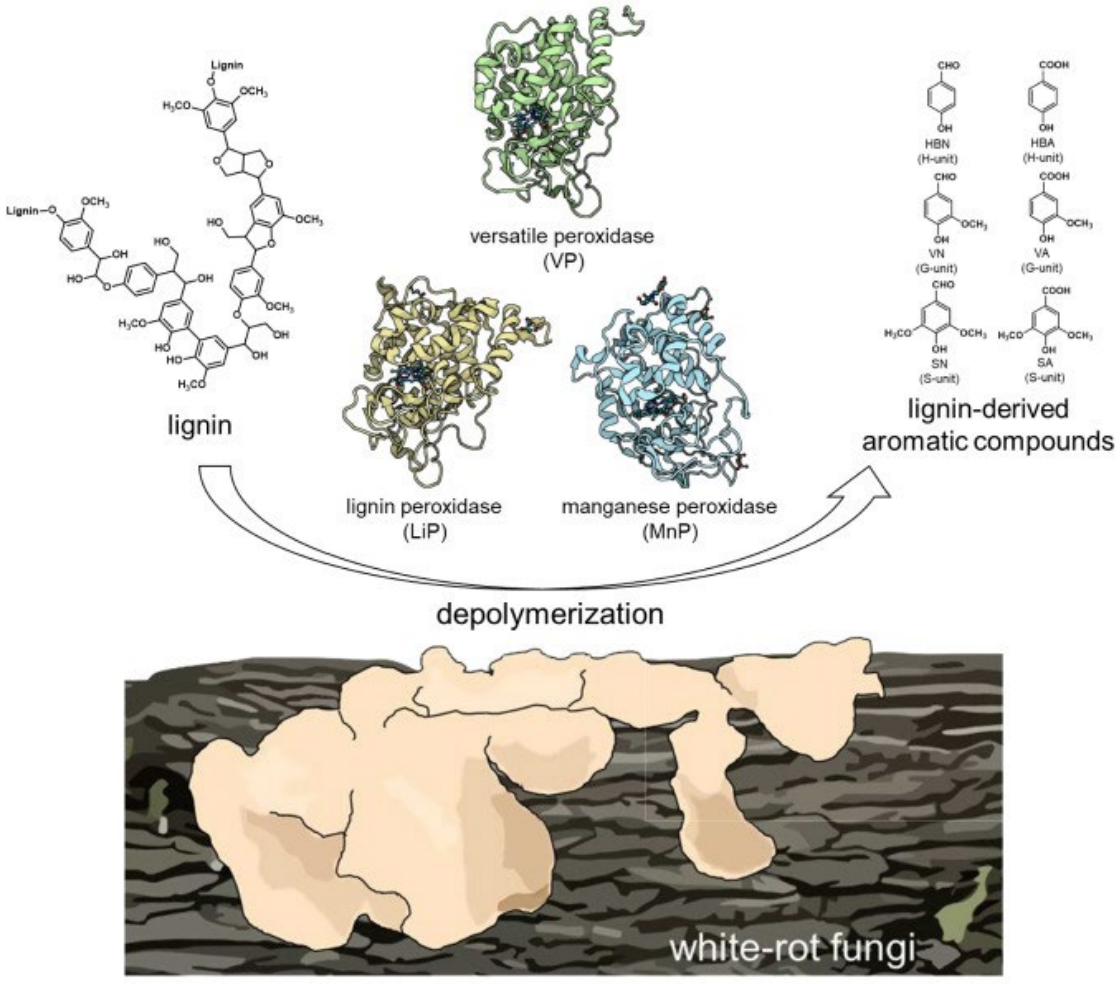
Researchers at NC State BioResources write of providing plants "with essential nutrients". They tell us that, **"The degradation of lignin by white rot fungi nourishes plants by providing them with essential nutrients.** White rot fungi are capable of breaking down lignin, which is a major component of wood, into simpler organic compounds that plants can utilize.

This process involves the use of enzymes such as lignin peroxidases and laccases, which are secreted by the fungi and play a crucial role in the breakdown of lignin. The resulting organic compounds are then absorbed by the plants, providing them with carbon, which is a vital energy source for growth and development.

Additionally, the fungi also incorporate carbon from lignin-derived compounds, using both cellulose and lignin as food and building material. This dual role of white rot fungi in the decomposition process and their contribution to plant nutrition highlights their importance in the ecosystem and their potential for biotechnological applications."

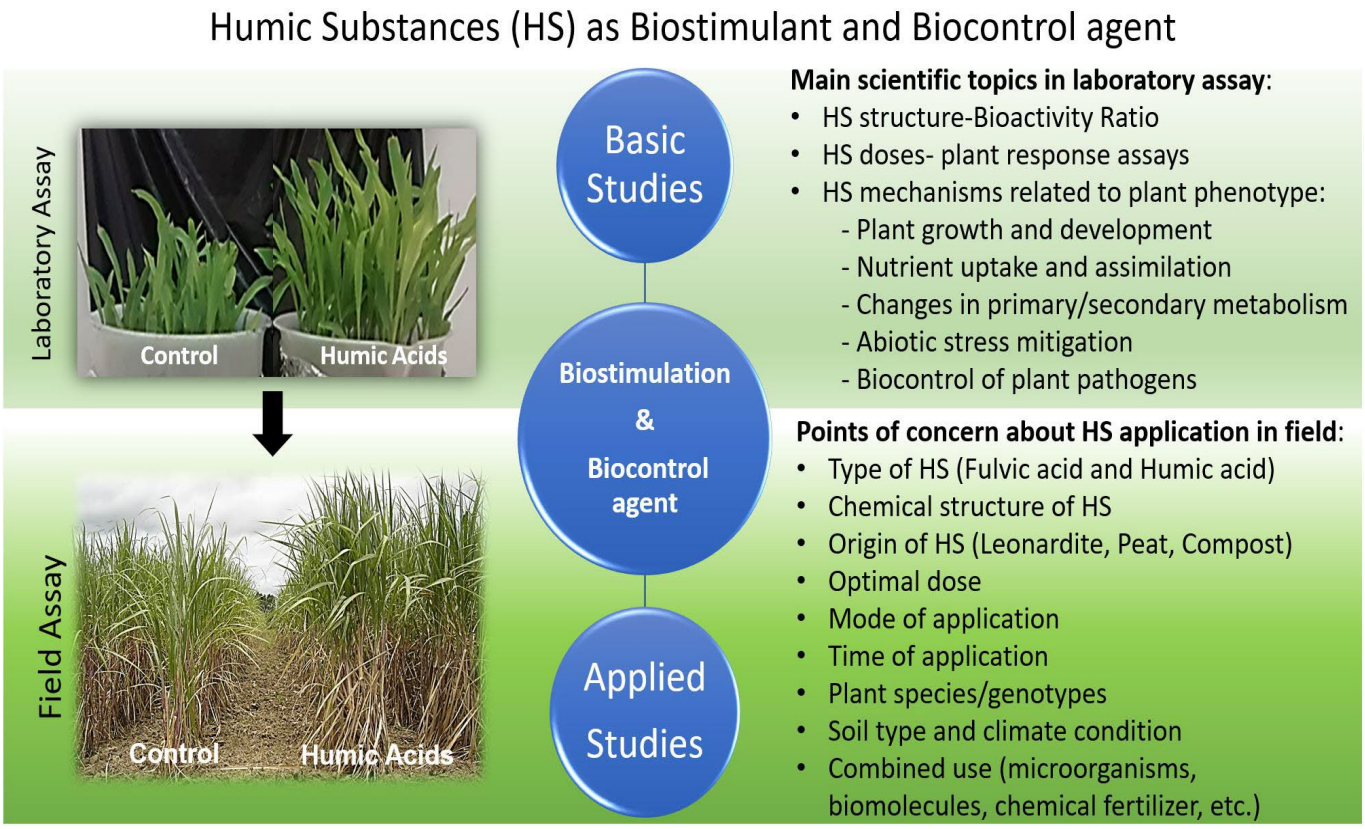
> Source: (Jin, L., Zeng, G., Chen, H., Wang, L., Ji, H., Lin, S., Peng, R., and Sun, D. (2021). "Mechanism of lignin degradation via white rot fungi explored using spectral analysis and gas chromatography-mass spectrometry," BioResources 16(3), 5494-5507)

These concepts are illustrated in the diagram below, whereby we find degradation, but more importantly the depolymerization of lignin by White Rot Fungi.



It would seem that the degradation and depolymerization of lignin by White Rot Fungi seems to be "supercharged" (in a manner of speaking) when Sugarcane Bagasse is transformed into SupremeAG™. The result of this is believed to produce (beside water and Carbon Dioxide) a cascade of beneficial nutrients and phytochemicals necessary for the production of healthy plants. When these plants are consumed by humans or animals, they too receive the benefits of nutrients and phytochemicals enhanced by Humic Substances, macro- and micro-minerals, and the synergetic effects created by and found in natural substances.

This contention is supported by research performed on Sugarcane Bagasse and the impact of Humic Substances on the growth and performance of the Sugarcane plant itself.



Source: fpls-11-00426-g001.jpg (2005×1093)
https://www.frontiersin.org/files/Articles/530151/fpls-11-00426-HTML-r2/image_m/fpls-11-00426-g001.jpg

Additionally, "…sugarcane bagasse can degrade into humic substances. Humic and

fulvic acids are produced from sugarcane bagasse through processes like Solid-State Fermentation (SSF) and Submerged Fermentation (SmF). The decomposition of sugarcane bagasse can lead to the extraction of humic acid, which is beneficial for soil health and plant growth."

H.Ghanavatia, et.al, Sharif University of Technology, Scientia Iranica Transactions F:Nanotechnology, http://scientiairanica.sharif.edu, ScientiaIranicaF(2022)29(6),3554{3569

"The process of fermentation enhances the production of humic substances, making sugarcane bagasse a valuable resource for organic farming and soil improvement."

Mwita S C, Banyikwa A, Maheswara R V. Soil Amendments with Sugarcane Bagasse and its Effect on Soil Humic Acid Contents and Chinese Cabbage Growth Components. Agri Res& Tech: Open Access J. 2019; 21(3): 556166. DOI: 10.19080/ARTOAJ.2019.21.556166

In Picture 1& 2 below, we see SupremeAG™ with Nutri-Mastic™ in a SuperSak. The product was formulated then placed into the sack for about 6 months.

SupremeAG™ with Nutri-Mastic™ in SuperSak (Picture 2):

Supreme(AG) with Nutri-Mastic™ transferred into a cart and allowed to sit in sunlight for an hour (Picture 3):

Stock Photo of Humic Substance Rich Soil (Picture 4):

The literature suggests that, “Humic substances significantly enhance soil health by improving structure, increasing nutrient availability, promoting microbial activity, and supporting sustainable agricultural practices:

1. Improves Soil Structure: Humic substances, particularly humic acid, act as a natural binder for soil particles, creating stable aggregates. This improves soil aeration, drainage, and root penetration, which is especially beneficial in compacted or heavy clay soils. The enhanced structure allows for better water movement and reduces erosion risks.

2. Increases Nutrient Availability: Humic substances have strong chelating properties, allowing them to bind essential micronutrients like iron, zinc, and manganese. This prevents these nutrients from forming insoluble compounds, making them more accessible to plant roots. Additionally, humic substances enhance cation exchange capacity (CEC), which helps retain positively charged nutrient ions such as calcium, magnesium, and potassium, reducing nutrient leaching.

3. Stimulates Plant Growth: Humic substances boost plant metabolism by stimulating enzyme production and increasing photosynthesis. This leads to more vigorous plant growth, stronger stems, and larger leaves, which are critical for healthy crop development. (Remember Picture 7 above…"Fungal hyphae)

4. Enhances Microbial Activity: Healthy soil is rich in microbial life, and humic substances provide a source of carbon and nutrients for beneficial microorganisms. This promotes the proliferation of these microbes, which play a vital role in decomposing organic matter and cycling nutrients back into forms that plants can readily use.

5. Increases Water Retention: Humic substances improve the soil's ability to retain moisture by enhancing its sponge-like structure. This is particularly beneficial for sandy or arid soils, helping to reduce irrigation frequency and making crops more resilient during dry spells.

6. Reduces Soil Erosion: By stabilizing soil structure and increasing organic matter content, humic substances help reduce the risk of soil erosion caused by wind and water. This is especially important for sloped agricultural land where topsoil loss is a concern.

7. Supports Sustainable Agriculture: Incorporating humic substances into agricultural practices contributes to sustainable soil management by improving soil health, enhancing crop yields, and reducing the need for chemical fertilizers. This aligns with modern agricultural practices aimed at sustainability and environmental stewardship."

Ref. 9: Trevisan S, Francioso O, Quaggiotti S, Nardi S. Humic substances biological activity at the plant-soil interface: from environmental aspects to molecular factors. Plant Signal Behav. 2010 Jun;5(6):635-43. doi: 10.4161/psb.5.6.11211. Epub 2010 Jun 1. PMID: 20495384; PMCID: PMC3001551.

Ref. 10: Jaya TIWARI, AL RAMANATHAN, Kuldeep BAUDDH, John KORSTAD, Humic substances: Structure, function and benefits for agroecosystems—a review, Pedosphere, Volume 33, Issue 2, 2023, Pages 237-249, ISSN 1002-0160, https://doi.org/10.1016/j.pedsph.2022.07.008. (https://www.sciencedirect.com/science/article/pii/S1002016022000765)
Ref. 11: https://www.nature.com/research-intelligence/nri-topic-

summaries/humic-substances-and-their-role-in-plant-growth-and-soil-health-micro-30601

Ref. 12: Piccolo, A., Drosos, M. The essential role of humified organic matter in preserving soil health. Chem. Biol. Technol. Agric. 12, 21 (2025). https://doi.org/10.1186/s40538-025-00730-0
Ref. 13: Yutong Sun, et.al., Advances in the Application of Humic Acid in Agriculture: Impacts on Soil Fertility, Crop Growth, and Carbon Emissions November 2024 International Journal of Public Health and Medical Research 2(3):27-30. DOI:10.62051/ijphmr.v2n3.05

In summary, "Humic Substances" play a crucial role in enhancing soil quality, promoting plant growth, and supporting sustainable agricultural practices, making these "Substances" invaluable for effective soil management.

IFUS contends that data and observations collected to data strongly suggest the presence of natural "Humic Substances" in its SupremeAG™ product formulated with Nutri-Mastic™. Lignin degradation and depolymerization further contribute to a laundry list of key phytochemicals. Additionally, naturally sourced ionic minerals, which are part of the Nutri-Mastic™ formulation, add a critical dynamic to SupremeAG™.

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