Stimul-8

Agricultural Crop Biostimulant / Growth Supplement

Stimul-8 is registered for use in Canada under CFIA #2025157S

Manufactured by

The Pioneer in Agricultural Chitosan Technology

Organisan corporation

Made in U.S.A.

Mark Nichols
678-935-8120
markn@organisancorp.com

organisancorp.com

Tom Wood
208-317-4580
tomw@organisancorp.com

What is Stimul-8?
Stimul-8 is a specifically formulated biostimulant and growth supplement product. Stimul-8 is a unique synergistic blend featuring chitosan and yucca extract along with proprietary inert ingredients. Taken together, Stimul-8 is designed to give you the maximum biostimulant action available from chitosan. Stimul-8 is ideally suited for a wide variety of agricultural crop applications. When applied according to label directions, Stimul-8 exerts its biostimulant effects, in some cases, almost immediately. These principal functioning agents combine the properties of a superior biostimulant and growth supplement (chitosan) plus an agricultural and soil wetting agent (yucca). Together, these actives benefit the growth and development of all plants. The main active ingredient, chitosan is a natural cationic polymer primarily derived from shellfish. Chitosan's cationic feature brings excellent biostimulant qualities to this formulation giving you more healthy plants with increased vitality, vigor and yield.

Yucca is a staple ingredient in the food industry and is also used to prepare natural shampoos, cosmetics and liquid soaps. The same properties that make it safe and effective for these products, combined with its excellent wetting characteristics, make yucca a superior agricultural surfactant. Its biosustainabilty supports Organisan Corporation's mission to provide green and environmentally friendly products to the industry. The use of *Yucca schidigera* has been long recognized as a superior natural wetting agent and surfactant via flood or drip irrigation, and as a foliar spray to increase water and fertilizer penetration, reduce surface tension of agricultural sprays, and soften hard compacted soils. Yucca extract has the ability to interact with cells on the leaf surface and reduce surface tension. This has two consequences. It increases rainfastness and facilitates chitosan entry into leaf tissues. With plant roots yucca increases water and nutrient absorption and also create a more favorable rhizosphere for the plants. This is the reason *Y. schidigera* products have been used in agriculture for years, as soil improvers, foliar sprays, wetting agents, stress control agents, and plant growth promoters.

Stimul-8 as a Biostimulant
Biostimulants is a term used to describe substances or microorganisms that contribute to improving plant nutrition and growth. Biostimulants are either synthetic or natural materials. They are applied to soils, plants and seeds. Overall, biostimulants improve a plant's tolerance to abiotic stresses and also promote increases seed, grain yield and quality. Elicitors are another class of substances that positively act on plants. Elicitors can also act as biostimulants, and conversely many biostimulants have elicitor effects. Whether it is an elicitor or biostimulant, both promote positive plant responses.

Numerous biostimulant activities are attributed to Chitosan. Stimul-8 chitosan increases photosynthetic activity, tolerance to drought, salinity, temperatures stress (elevated heat and chilling/ freezing), increased activity of antioxidant enzymes, defense genes (particularly related to fungi and bacterial infections), enhancing plant growth under abiotic stress, improving germination rates and efficiency, increasing seedling survival, and consequently, improving plant resistance to pathogen infection thereby improving plant growth and productivity.

Chitosan's benefits in various agricultural applications and is extensively well documented in the literature. Row crops, cereals, pulses, root crops, produce, nut crops, pome fruit, horticultural crops, turf, hemp, forage have all benefitted from chitosan application. Chitosan has been shown to positively affect a number of aspects of plant health, vigor, productivity, germination and including but not limited to:

- Influencing transpiration control
- Increasing chlorophyll content
- Increasing photosynthetic output
- Increasing root mass
- Increasing yield
- Improving Brix ratios
- Stimulating production of plant secondary metabolites which protect against abiotic stresses
- Priming seeds to improve germination rate and make seedlings more resistant to abiotic stresses

Plants can recognize chitosan on their cell surfaces via a pattern recognition receptors which recognize microbial compounds, such as bacterial flagella or fungal chitin. It is the particular pattern within each compound that triggers a response with the plant. These various compounds fall into three main categories; pathogen associated molecular patterns (PAMPs), microbe-associated molecular patterns (MAMPs), or damage-associated molecular patterns (DAMPs). Chitosan falls into the PAMP category. Upon recognition by the cell, chitosan behaves as a general elicitor, inducing resistance by pattern recognition. The recognition and binding of these molecular patterns transmit signals to the interior of the cell resulting in responses to that particular molecular pattern. In the case of chitosan, a number of varied responses have been described.

Chitosan application promotes an increase of Ca^{2+} concentrations in plant cells and induces callose deposition in plants. Callose deposition is a plant reaction to biotic and abiotic stress, such as lesions and infection caused by phytopathogens. Plants produce callose to isolate stress impact in the tissue locally by depositing a physical barrier.

Chitosan can induce resistance to abiotic stresses, including salt, drought and temperature stress. Chitosan has been found to act as a stimulator of plant defense responses to both wounding and pathogen infections. Exposure to chitosan leads to production of reactive oxygen species (ROS) and pathogenesis-related proteins (PRP's). ROS include Nitric Oxide (NO) and Hydrogen Peroxide (H_2O_2). These compounds are produced in response to chitosan foliar application and act as signaling molecules leading to production of PRP's. These PRP's protect plant tissues against infection. It appears that different molecular weights of chitosan lead to different levels of PRP induction, suggesting that different types of chitosan molecules trigger different perception in plants. PRP's of note are chitinases and other fungal cell degrading enzymes. Phenyl ammonia-lyase (PAL) is another. PAL is found in plants, algae, ferns, and microorganisms. It plays a key role in plant development and stress response, and is involved in the synthesis of many secondary plant products, including Flavonoids, Lignins (helps prevent lodging), Plant Hormones, Alkaloids, Salicylic acid, Phenolics, and Phytoalexins. Phytoalexins are antimicrobial compounds that plants produce in response to infection or other stresses. They are part of a plant's defense system that helps control invading microorganisms. Phytoalexins are low-molecular-weight, toxic substances that plants produce to protect themselves from fungi, bacteria, nematodes, and other organisms.

In addition, foliar application of chitosan increases the levels of abscisic acid (ABA) and H_2O_2. Both of these substances are believed to be signals for stomatal closure (along with elevated Ca^{2+} in the stomatal cells) controlling water loss via transpiration through the leaves.

The chloroplast appears to be the primary organelle for chitosan action. Chitosan is also known to increase chlorophyll content which correlates to an enhanced growth or increased net photosynthesis rate. Chitosan sensing at the cell surface sends signal(s) to the chloroplast where several responses are generated. One is the octodecanoid pathway which generates H_2O_2 and Jasmonic Acid (JA).

JA is an important plant hormone involved in the regulation of plant development, growth, flower development and senescence. Additionally, JA plays a role in plants' response to biotic and abiotic challenges. The role JA plays with plant defense responses is that of a signaling molecule. Its levels increase when the plant is wounded or under pathogen attack. The increased presence of JA activates plant defense related genes which result in elevated levels of metabolites involved in plant defense. With beneficials, JA is involved with symbiotic relationships as well as other plant microbe interactions. JA helps mitigate the plant's response to effects from abiotic stresses like temperature, drought and salinity.

Seed priming with chitosan has demonstrated numerous benefits to the seed and seedling. Soaking seeds with chitosan allows the chitosan to penetrate the seed coat enter the seed interior. Upon germination, the seed, and by extension seedling, are already primed with chitosan and benefit from the very start.

Chitosan is also influences flowering. Foliar applications have led to early budding, increased number of inflorescences and elevated pigments such as anthocyanins.

Stimul-8 as a Bridge to Regenerative Agriculture

Regenerative agriculture is a set of practices that together promote and encourage a conservation mindset and rehabilitative approach to food and farming husbandry. Regenerative agriculture focuses principally on topsoil regeneration, increasing biodiversity in the soil biome by strengthening the health and vitality of farm soil, phyllosphere and the field in general, improving water cycling and usage, enhancing and revitalizing the agricultural ecosystem and supporting biosequestration.

Regenerative agriculture is not a specific practice. It combines a variety of sustainable agriculture techniques. These include but not limited to maximal recycling of farm waste and adding composted material from non-farm sources, restoration ecology, and holistic management. Large farms practicing or converting to regenerative methods like "no-till" and/or "reduced till" practices.

Within this regenerative framework, Stimul-8 chitosan is a natural fit and an excellent additive to the farmer's arsenal. Chitosan as an input has many attractive features that support its use as a bridge to regenerative agricultural practices. Chitosan is non-toxic and eco-friendly. It is a natural material produced by some living organisms (chitin is far more common). Chitosan in agricultural products is derived from industrial sources of chitin be it shellfish or fungal. Either way, the chitosan from these sources is the same. Chitosan is biodegradeable in the soil. There are many microbes that can sense and digest chitosan as a food source. This is an important facet of carbon cycling not just from added Chitosan but nematode eggshells, insect and fungal carcasses are a chitin source. Chitosan promotes the presence of beneficial microbes in the soil. This feature greatly enhances the synergy between crop plants and soil microbes. The promotion of beneficials leads to greater synergy with plants and supports not only a healthy rhizosphere but contributes to building a healthy soil. Chitosan being cationic can also help with building and stabilizing soils by forming linkages with soil and clay particles. Chitosan is also antagonistic to a wide range and class of phytopathogenic biotic stress agents (fungi, bacteria, viruses, nematodes) further contributing to healthy crop plants. From our own extensive experience with growers routinely employing our products, we have seen soils improve from a general composition standpoint to promoting more beneficials and inhibiting pathogens. In short, chitosan helps redressing the balance of the soil microbiome in favor of beneficials and symbionts.

Aside from what's going on in the soil, chitosan also has biostimulatory and eliciting functions all of which contribute to a healthier crop more capable of withstanding and surviving the seasonal biotic and abiotic stresses. Healthier plants lead to more productive crops!

The importance of pH

pH is a numerical scale describing acidity (or alkalinity) in aqueous solutions. pH is a term utilized by many and perhaps not understood what the term or values mean. pH is an indication of the concentration of hydrogen ions (H^+) generally in an aqueous solution. The pH scale runs from 0 (most acidic) to 14 (most alkaline). The smaller the pH value the more acidic a solution is, so the pH scale is an inverse relationship with H^+ concentration. pH values are determined from a logarithmic scale where a pH change in one whole value is a 10 fold increase (or decrease) in H^+ concentration and vice versa. This relationship is expressed as follows:

$pH = -\log10[H^+]$ *square brackets indicate concentration and the negative sign indicates the inverse relationship between pH and H^+*

So, a solution of pH 4 has 10 times more H^+ than a solution at pH 5. Conversely it can be stated that a solution of pH 5 has 10 times less H^+ than a solution at pH 4. Likewise, a pH of 2 has 10^3 (thousandfold) greater concentration of H^+ than a pH 5 solution. pH is an important consideration for agriculturalists with regards soil and spray tank mixtures. No need to expound on that.

From a chitosan perspective, pH is very important consideration to a spray tank mixture. Chitosan is a polycation. This means it carries multiple positive charges along the length of the polymer chains. The degree of this cationic nature is dependent on pH. Basically, the more acidic, the more cationic the chitosan becomes. It is the cationic nature of chitosan that is at the heart of its amazing variable functionality.

Obviously, there has to be a balance between practicality, applicability and potential harm to target crop (very low pH). With chitosan, increasing pH (becoming more alkaline) the positive charges along the polymer chain gradually disappear. At around pH 6.2 - 6.3 a significant proportion of these charges have been removed and chitosan solubility diminishes fairly rapidly. An important point to note is if the polycationic property of chitosan is deprived or reversed (for example by elevating pH), the corresponding antimicrobial (and so many other) capacities will be weakened or lost. Chitosan's effective cationic functionality occurs at pH below 5.0. This is an important consideration for the spray tank pH (chitosan solubility) and one of the main reasons Organisan Corporation recommends acidifying spray tank pH to 5.0 or below (to ensure optimal chitosan functionality).

About Our Company

There are a lot of things to understand about our company and its products. First, we are a market leader. We innovate. We are not a "me too" company which seems to be the trend with our competitors. Numerous aspects separate us from others in the market. Since chitosan is such an important raw material for us, we don't source from the cheapest vendor. Our chitosans are manufactured from shellfish exoskeletons that are sustainably harvested. Our chitosans are top quality food grade material. In addition, our chitosans enjoy a "Generally Recognized As Safe" (GRAS) status from the US FDA. Our chitosans are also compliant with California Proposition 65, that state's Safe Drinking Water and Toxic Enforcement Act of 1986. Chitosan quality has a significant impact on performance.

Unlike others, we do not view chitosan as just a name or the latest trend or buzzword we have encountered. We have been in this industry since 2012 actively pioneering the way forward with our chitosan agricultural technology. We are not at the cutting edge, our competitors may claim to be there. We are out in front of that edge with a file, honing it, defining it with our collective technology, experience and expertise. Chitosan is a science and a technology with a history. Chitosan is not a monolithic, one size fits all material. Far from it. Organisan Corporation has understood this from the beginning and is at the forefront developing specific chitosan-based products for a number of agricultural applications. We pioneered chitosan agricultural technology. Chitosan is known to be active in many areas. For example, chitosan is recognized as a plant growth regulator, a plant defense booster, an elicitor, has fungicidal and antimicrobial properties and is also employed as a sticker agent in adjuvant formulations. Chitosan works well with the natural biology of the soil and has been employed with much success with several commercial beneficial biological agents such as *Beauveria bassiana* in combatting the deleterious effects of many plant pathogens.

We don't stop there. We constantly refine our manufacturing processes to give you top quality, functional product, tailored to your needs. We leverage our proprietary manufacturing, technical expertise and technology to modify our manufacturing processes to create specifically crafted products with tailored chitosan properties. We constantly support and improve our manufacturing with lab work testing formulas, seeking efficiencies, testing new inerts and actives. All this builds on the already impressive experience we have with chitosan. Unlike our competitors, our products are not just chitosan solutions of various claimed concentrations. Chitosan is a functional foundational raw material for us. Our products are specifically formulated and feature chitosan as a main active component along with other actives and proprietary inerts. Our products feature chitosan incorporated in a formulation that maximizes its bioavailability, its penetration in the soil and plant tissues. Our proprietary inerts maximally enhance chitosan effectiveness that is not seen with chitosan alone. Our chitosan based products work in concert with many soil beneficials. Together, this combined synergy creates a far more rhizosphere friendly environment, keeping pathogens and pests at bay. Our chitosan products are the result of extensive research, product refinement and field testing. This means, all chitosan products ARE NOT the same, especially products we manufacture. All of our products are manufactured at our Broussard, Louisiana facility and shipped to you from there. We take the time and effort to consult and listen to our customers and formulate chitosan based products that suits their needs. And we don't walk away. We are committed to you, our customers, we work closely through all aspects of your crop's growing cycle. We listen to you, advise and recommend tailored strategies with tailored products to deliver the results you want.

By working with us, this is what you can expect and we will deliver. We are your chitosan experts. This is not a groundless claim. We are not newcomers. The Organisan team has over 80 combined years experience under one roof that comprehensively covers chitosan from raw material acquisition, manufacturing, processing, product development, R&D, sales, marketing, agronomy, and application. We have sales support 24/7. We back that sales team with technical sales support. We have invested the last 12 years developing products and applying them with success all over the country and internationally, on various crop types, environments and geographies. Years of consistent results from the field attest to this. We know chitosan, we know how to manufacture it, formulate products with it, sell in the markets we service and we know how to apply it. We maintain an in-house library of over 6000 publications gathered from the literature. This resource is available to our personnel and we are constantly searching the literature for applications, technology and other aspects of chitosan that apply to our business. So when you do business with us, you are not just buying another chitosan product, you are getting that specifically formulated product along with accessing our experiences and expertise. We are on your side and want nothing more than to see your success. That is our commitment to you.

So, if you've tried "chitosan" products and did not see the outcome you wanted, there's a good chance your product was not made specifically for your use or made by a company that knows what it is doing. That's why you should invest your hard earned dollars with a team of 80+ year's experience backing the right product to maximize your results. And you'll only get that knowledge and experience with the Organisan team and/or our authorized representatives.

The Pioneer in Agricultural Chitosan Technology

Dr. André Blanchard, Ph.D., Plant Molecular Biology
Vice President, Technology and Operations, Organisan Corporation
Extensive Chitosan research and application for 30 years.

Our proprietary manufacturing operations are located in Broussard, LA close to where our scientist lives. The "science" behind the formula was created, developed and is manufactured under the supervision of Dr. André Blanchard. Originally from south Louisiana, André spent most of his young life growing up in Inverness, Scotland (you'll be treated to both accents). He attended the University of the West of Scotland getting his bachelors in Applied Biology. André went on to gain his Ph.D. in Plant Molecular Biology at the University of Exeter in southwest England. From there, he returned home in 1992.

André brings a combined 30 years experience in academia and the private sector. André has worked with industrial scale recycling technologies and specialty chemicals manufacture. Within these industries, he has gained experience in directing product and process research and development. These efforts led in the technical development of a process (now a US Patent) for manufacturing a key raw material. André is also experienced in small business management, consulting, technology transfer, commercializing technologies, project management, process design and manufacturing strategies. He also initiated several collaborative projects with leading universities involving several external grant funded efforts from Federal agencies.

André's association with chitosan over the past 18 years has involved researching and formulating new products, designing manufacturing processes, marketing and commercialization.

André is leveraging his experiences to leading future innovations of a variety of products, and constantly improving the manufacturing process.