



Chitosan and Regenerative Agriculture

Organisan
corporation

**THE Pioneer in
Agricultural Chitosan
Technology**

Chitosan as a Bridge To Regenerative Agriculture

Regenerative agriculture is a holistic approach to food and farming that emphasizes conservation, restoration, and long-term ecosystem health. Its central goals include rebuilding topsoil, enhancing biodiversity within the soil biome, revitalizing farm soils and the phyllosphere, improving water cycling, strengthening the resilience of agricultural systems, and supporting carbon sequestration.

Rather than a single practice, regenerative agriculture integrates a range of sustainable techniques. These may involve maximal recycling of on-farm waste, incorporating compost from external sources, adopting restoration ecology principles, or applying holistic land management. Increasingly, large farms transitioning to regenerative methods also rely on practices such as no-till or reduced-till cultivation.

Within this framework, another beneficial and effective tool available to the farmer is Chitosan. Chitosan is a natural, non-toxic, sustainable, biodegradable eco-friendly biopolymer. Organisan Corporation's Chitosan-based products are a natural complement that powers regenerative farming by revitalizing soils, enhancing soil health, boosting crop resilience, and reducing dependence on synthetic chemicals - helping growers achieve healthier harvests sustainably. Chitosan is not only an ideal bridge to regenerative practices but also a valuable addition to the farmer's toolkit. Organisan Corporation is well positioned to integrate into the regenerative space. Organisan Corporation offers several Chitosan-based products that integrate with regenerative farming practices in numerous ways. We have several Chitosan-based products to fit your regenerative practices. These include, adjuvants, wetting agents, seed treatments, biostimulants, pesticides (EPA registered and minimum risk use-25(b)). We complement these products with our technology, manufacturing, research, application knowledge and a dedicated team with combined team of 80+ year's experience.

Our Chitosan products are highly versatile that can be applied through multiple methods, either alone or in combination with other agricultural products to achieve synergistic benefits. When applied to the soil, chitosan becomes incorporated into the soil matrix, where it stimulates beneficial microbial communities, enhances nutrient cycling, and supports the development of stronger, more efficient root systems. When applied as a foliar spray in dilute form, Chitosan activates plant defense pathways and can enhance photosynthetic activity, contributing to improved plant vigor and resilience.

Chitosan: What is it?

Chitosan is a natural fiber very similar to cellulose. Chitosan is derived from a parent substance, chitin, via a process called deacetylation. Most Chitosans are sourced predominantly from shellfish exoskeletons. Chitin is the second-most abundant biopolymer on the planet after cellulose. It is estimated that 1011 metric tonnes are produced per year globally. There are no accumulations of Chitosan or chitin in the environment as all of it gets recycled via biodegradation back through carbon and nitrogen cycles. Chitosan differs from cellulose in having a functional amine group (-NH₂). Chitin is fairly insoluble while Chitosan is soluble in mild solvents like weak organic acids (such as vinegar). This facile solubility makes Chitosan a more valuable and applicable material than chitin. In acidic conditions, Chitosan becomes positively charged (cationic) and this charge is the basis of many of the polymer's activities. The polymeric nature, multiple amine groups and positive charge classify Chitosan as a polycationic aminopolysaccharide.

Chitosan and Soil

Chitosan improves soil stability and plant performance by enhancing soil aggregation and supporting vigorous plant growth that helps anchor soil and reduce erosion. By strengthening soil structure, increasing microbial diversity, and improving nutrient cycling, Chitosan

is particularly effective in restoring degraded or nutrient-poor soils while fortifying overall plant resilience. As a positively charged biopolymer, Chitosan interacts strongly with negatively charged soil components such as clays and organic matter. Through electrostatic and hydrogen bonding, it binds soil particles into stable aggregates, improving mechanical strength, water retention, and resistance to erosion. These interactions reduce soil compressibility by filling pore spaces and replacing loosely bound water molecules, resulting in a more cohesive and durable soil matrix. Chitosan can initially increase soil porosity in certain soil types, improving aeration and infiltration. Over time, however -especially through natural wetting and drying cycles - the Chitosan polymer consolidates into fibrous networks that reinforce soil structure, leading to long-term stabilization and enhanced water-holding capacity. The resulting soil is better able to retain moisture, resist compaction, and maintain structural integrity under stress. In addition to its physical effects, Chitosan enhances soil chemistry and remediation capacity. Its strong chelating properties allow it to bind and immobilize heavy metals, reducing their bioavailability and making Chitosan a valuable tool for soil remediation in contaminated environments. The effectiveness of Chitosan in soil systems depends on several factors, including soil pH, mineral composition, moisture levels, and environmental conditions. Chitosan characteristics - such as molecular weight and degree of deacetylation - also influence its binding behavior and structural impact. When properly matched to soil conditions, Chitosan serves as a powerful organic amendment that improves soil health, resilience, and long-term productivity.

Chitosan and Beneficials

To better understand how Chitosan helps protect crops, it is useful to consider the natural biological processes occurring within the soil microbiome, particularly in the root zone. Chitosan influences plant health through both direct and indirect mechanisms. The discussion below provides a simplified overview of an inherently complex and dynamic ecosystem. No claim is made that Chitosan alone causes all of the outcomes described; rather, Chitosan helps establish conditions that favor beneficial fungi and bacteria while discouraging the development of plant pathogens. In soil applications, Chitosan primarily acts by mimicking and enhancing natural biological processes. It stimulates populations of beneficial microorganisms known as chitinolytic microbes—organisms capable of recognizing and metabolizing Chitosan through the production of enzymes called chitinases. As these microbial populations increase, so do chitinase levels in the soil, creating an environment that is unfavorable for many pathogenic fungi, bacteria, and nematodes. Importantly, chitinolytic microbes are naturally resistant to chitin and Chitosan, allowing them to thrive while suppressing susceptible pathogens. Exogenously applied Chitosan mirrors natural inputs derived from chitin-containing materials such as nematode eggshells, insect exoskeletons, and fungal residues. By integrating seamlessly into the soil carbon cycle, Chitosan serves as a readily available carbon and energy source for beneficial microorganisms. This stimulation strengthens the functional relationship between plants and their microbiome and enhances overall rhizosphere health. At the microbial level, Chitosan shifts community dynamics toward beneficial populations while suppressing a broad spectrum of plant stressors, including pathogenic fungi, bacteria, viruses, and nematodes. Field experience with Organisan Chitosan products consistently demonstrates improved soil structure, increased microbial diversity, and reduced pathogen pressure. Chitosan also participates in a reciprocal interaction with beneficial microbes. Acting as a prebiotic substrate, it supports the growth of plant growth-promoting rhizobacteria (PGPR) and other beneficial species. In turn, these microbes produce enzymes that break Chitosan into smaller, bioavailable compounds, further enriching the root-zone environment. This process can result in the production of beneficial metabolites, such as short-chain fatty acids, which enhance microbial competitiveness

and plant vitality. Under favorable conditions, Chitosan promotes the formation of beneficial microbial biofilms that improve nutrient availability and create protective barriers around plant roots. Its antimicrobial activity is selective, exerting stronger effects against pathogens while allowing beneficial organisms to proliferate. Through these combined and complementary mechanisms, Chitosan supports healthier soils, stronger plant–microbe interactions, and more resilient, sustainable agricultural systems.

Chitosan as a Biostimulant

Chitosan functions as both a biostimulant and an elicitor, activating plant defense pathways and enhancing resilience to biotic and abiotic stressors. This activation results in stronger, healthier crops better equipped to withstand seasonal challenges, ultimately supporting improved productivity and yield. Chitosan generally promotes root development by increasing primary root length as well as root fresh and dry weight, leading to greater water and nutrient uptake. It also influences root system architecture by increasing root tip diameter and stimulating lateral root formation. These effects are mediated in part through Chitosan's ability to induce the production of plant hormones such as auxin (IAA) and gibberellic acid (GA), which regulate cell division, elongation, and overall root growth. At the cellular level, Chitosan interacts with the plant plasma membrane, triggering signaling cascades that stimulate the synthesis of defense compounds and growth regulators. It also enhances the activity of antioxidant enzymes, helping plants mitigate oxidative stress caused by environmental pressures such as drought, salinity, and temperature extremes. Under stress conditions, Chitosan-treated plants often exhibit improved root growth and water absorption, reducing the negative impacts of adverse environments. However, application rate and timing are critical, as excessive Chitosan concentrations—particularly at early growth stages—can induce cellular stress and temporarily inhibit root elongation or alter root hair development. When applied at appropriate dosages and growth stages, Chitosan consistently supports robust root systems and improved plant performance.

Chitosan and Seed Treatment:

Coating seeds with Chitosan enhances germination and provides seedlings with a vigorous, uniform start. Organisan Chitosan delivers early-season protection against plant-parasitic nematodes and diseases while supporting the development of strong root systems - leading to higher yields, uniform foliage, and improved overall plant health. Thanks to its natural film-forming ability, Chitosan coats the seed surface effectively. Its cationic nature enables it to chelate and bind nutrients, positioning them directly around the seed for immediate availability during germination. At the same time, the coating acts as a protective barrier against dehydration, a major threat during storage, ensuring better water retention, viability, and germination potential. As a hydrophilic material, Chitosan attracts water molecules, improving absorption and resulting in synchronized germination and seedling emergence. During germination, some Chitosan penetrates the seed coat, creating built-in resilience against future biotic (pathogens, nematodes) and abiotic (drought, salinity, temperature) stresses. By stimulating antioxidant enzyme activity, it protects cells from oxidative damage caused by reactive oxygen species (ROS). Chitosan also diffuses into the spermosphere, enriching the seed's immediate environment. There, it promotes beneficial chitinase-producing microbes that suppress harmful fungi, bacteria, and nematode eggs, further supporting early growth. Beyond protection, Chitosan contributes to plant vigor and productivity. It enhances uptake of key minerals such as nitrogen, potassium, and phosphorus, while also influencing plant hormone regulation (auxins, cytokinins, gibberellins). This promotes chlorophyll synthesis, boosting photosynthesis and biomass accumulation in roots and shoots. Root elongation, branching, and root hair development further expand

nutrient and water capture. For maximum effectiveness, Organisan Chitosan should be applied directly to untreated (“naked”) seeds, allowing intimate seed-coat contact. Applying it over other coatings reduces performance by limiting film formation and seed penetration. However, Organisan Chitosan works synergistically with other natural and biological seed treatments, including mycorrhizal spores, seaweed extracts, humic/fulvic acids, and microbial biostimulants or biopesticides.

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 by all 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:

$$\text{pH} = -\log_{10}[\text{H}^+]$$

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 a 10³ (thousandfold) greater concentration of H⁺ than a pH 5 solution. pH is an important consideration for agriculturalists with regards soil and spray tank mixtures. The same applies to Chitosan in seed treatment.

From a Chitosan perspective, pH is a 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 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 crops (very low pH). With Chitosan increasing the pH (i.e. 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 U.S. 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 but 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 products, 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, testing new inerts and actives, and seeking efficiencies. 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 and 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 6,000 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 experience 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.

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THE Pioneer in Agricultural Chitosan Technology



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Vice President, Technology and Operations,
Organisan Corporation
Extensive Chitosan research and
application for 30 years.

Our proprietary manufacturing operations are located in Broussard, Louisiana, 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 to the technical

development of a process (now a U.S. 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.