

A Conversation with Gaston Salinas

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CEO, Botanical Solution Inc., Davis, CA, USA

Many useful compounds can be found in nature, and consumer demand for natural materials is set to skyrocket. The traditional botanical market is expected to exceed \$17.8 billion in value by 2025 across diverse market segments that include pharma, food and beverages, and cosmetics among other relevant industries. However, traditional botanical products are seriously affected by critical issues related to supply and quality of raw materials, often obtained under exploitation of natural resources with a sizeable environmental footprint.

Botanical Solution Inc. (BSI, Davis, CA, USA) has developed a proprietary technology that allows a scalable and sustainable supply of key botanical products with none of the issues related to current production of traditional botanical raw materials and active ingredients. The Biotechnology platform, based on plant tissue culture, allows BSI to discover and develop botanical products that are sustainable, highly consistent and cost effective.

The company's ABM-01 is an advanced botanical material based on the native Chilean plant *Quillaja saponaria Molina*. ABM-01 is the active ingredient in BSI's broad spectrum biofungicide Botristop®. The product prevents and controls *Botrytis cinerea*, one of the most harmful fungal diseases in high-value crops worldwide, responsible for hundreds of millions of dollars in losses every year. Botristop is commercialized in Chile through a partnership between BSI and Syngenta since 2019, and will soon be registered in a number of key Latin American countries. Additional regulatory progress is also expected in the US and European Union during 2021. Launch of an alternative source for sustainable production of the vaccine adjuvant, QS-21, also based on ABM-01 is expected soon. QS-21, which has been in commercial vaccines since 2017, is currently used in one of the latest approved COVID-19 vaccines and it's expected to be in short supply due to high demand and to strict deforestation laws in Chile.

In late December, BSI secured \$3.3 million in funding with a second round planned for spring. The funding will boost BSI's proven ability to discover and develop novel botanical products that are sustainable, highly consistent and cost effective.

Industrial Biotechnology recently interviewed CEO Gaston Salinas to discuss the outlook for biopesticides and the poten-



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tial for plant tissue culture to revolutionize the botanicals market.

INDUSTRIAL BIOTECHNOLOGY: *Can you start by telling us a little bit about yourself and BSI?*

GASTON SALINAS: My background is in industrial engineering. I'm Chilean but have been living in the US for roughly 14–15 months. I am the founder and CEO of Botanical Solutions Inc. (BSI), a company that started operations back in 2013 in Santiago, Chile. We started in the biotech space working with high-quality, high-consistency botanical extracts for agriculture. And, in the last 10–12 months, we have been rushing to tap into a missed opportunity in the pharma-

ceutical space with our vaccine adjuvant.

What makes our work so different from others in botanicals is that we have internally developed a platform to produce practically any plant material in our lab to supply key active ingredients. Depending on the plant species, sometimes you can address shortfalls in the supply of those materials or, just as importantly, improve quality. If you grow plants in the same area, there will still be variations in how much light or irrigation each plant receives—ultimately changing the chemical composition of the extracted botanicals.

To address this, we're controlling and vertically integrating the process from plant production all the way to final product. We start with growing plants in vitro for 30–60 days. We inoculate in a bioreactor systems to achieve two things. The first objective is to grow the biomass really quickly, and at the same time, produce specific chemical compounds. The plants are biofactories; we are able to produce as much as needed of this biomass all year-round. The other objective is really that no matter if you take one gram, one kilogram, or one ton of this fresh material, the technical composition evaluated batch to batch of those materials are almost identical. This consistency cannot be achieved with traditional growing and extracting.

Botanicals is a particularly complicated business, especially for end markets such as pharmaceuticals and crop protection. There are two reasons for this—supply limitations and quality issues. First, it doesn't matter what plant material you work with, at the end of the day you always end up with a limited supply. Supply can be especially limited if the plants or growing region are under conservation or there are geopolitical issues facing the region where you grow. The other critical

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factor is quality; once you change suppliers or geography, the chemical composition of those raw materials changes dramatically. There is high variability batch to batch, which increases your cost of goods and creates significant regulatory hurdles.

IB: *Can you discuss your molecules and what makes them so commercially relevant?*

SALINAS: In the case of the biopesticide, we're working with a phenolic fraction that is generated as part of the plant's stress mechanism. We are controlling light exposure or changing the media culture, temperature, and many other factors to create some stress in the plant while its growing. These phenolic compounds are secondary metabolites that have unique biological activity against *Botrytis cinerea*, a significant headache high-value crops in many exporting countries.

In the case of pharmaceuticals, we are targeting a single molecule in the mixture: QS21. This molecule has been studied for decades in the pharmaceutical space and has emerged as a very important vaccine adjuvant. It improves the efficacy of any given antigen. This has significant potential as vaccine production ramps up for COVID-19.

QS21 has been extracted from the tree bark of *Quillaja saponaria* Molina for years. It's a tree that takes up to 15 years to grow before it is ready to be harvested. But, amid a global pandemic, you can't wait to grow trees to get sufficient access to raw materials and produce the compound in high volumes. Since we have our own biofactory and we control all the growing conditions, we are now in a position to supply as much of this specific compound as is needed and in the near future.

IB: *Can you discuss details of your current production scale and commercial sales, and your plans for expansion over the next couple of years?*

SALINAS: In the agriculture market, we have our first product commercially available in Chile through an exclusive distribution agreement with Syngenta. We are planning to expand our footprint throughout Latin America. We're expecting to launch our product in Peru by the second quarter of 2021, and launch in Mexico and California by the end of 2022.

On the pharmaceuticals side, we are preparing to move from non-GMP grade manufacturing to GMP-grade manufacturing so we can begin to sell QS21 to different customers. Some of the capacity we built for agriculture is useful here. So, when we look at our internal capabilities, we're in a good position to become the world's largest supplier of QS21. And, because QS21 is part of a solution that the pharmaceutical industry has already received approval for, we should be able to avoid further regulatory hurdles if we meet the technical specifications for this compound.

Another nice thing about our technology is the geopolitical freedom; we can produce our molecule anywhere in the world. Currently, we produce in Santiago, Chile, and we're expecting to keep our production hub there, but we are pretty flexible. In the mid-term, we will be looking for additional options. The great thing about our process is that, with just a 500-square-meter facility, we are in a position to serve nearly all the markets we have been discussing.

IB: *How is your partnership with Syngenta helping you accelerate to market? And what are your financial goals?*

SALINAS: Syngenta is our exclusive distributor in the Chilean market, where our product is a key component of a technical recommendation package that combines traditional chemistry with natural products. In Peru, we will be announcing our distribution partner very soon. We are really excited to help growers in Peru be more competitive.

As far as financials, we are about to sell our first million dollars in Chile. We expect to hit \$30 million in annual sales from Botristop by 2029. We also have an ambitious goal to reach \$90 million in sales by the end of 2029 from Botristop as well as four additional products we expect to launch between 2023–2026.

IB: *What's next in your pipeline?*

SALINAS: In the ag space, we're expecting to launch additional products based on the *Quillaja saponaria* tree, including an additional biopesticide. We're also expecting to launch two more products endemic to the Chilean continental territory. Another target we are interested in is a well-known active ingredient already on the market. We are not only trying to develop novel products but also looking into the market for existing recognized ingredients that for whatever reason have supply constraints.

IB: *What do you think the future of agriculture will look like?*

SALINAS: We know that agriculture is facing challenging times. The sector is facing pressure from sustainability macro-trends while at the same time having to figure out how to feed 9 billion people by the year 2050.

Our philosophy has always been, it doesn't make sense to grown and harvest a full hectare of a natural resources to then be used to grow a hectare of table grapes or cherries. I think the way we are looking at botanicals will become much more common. We are not one more supplier of active ingredients; We are trying to change a broken paradigm. There are a lot of opportunities ahead to deploy this technology.