Nature's superfood ready to defend our health

by Avram Slovic, Head of Commercial, South America

The citrus industry stands at the ready in times of need

No other drink says breakfast like a glass of orange juice. It is nature's first superfood. Sweet, tart and packed with vitamin C and antioxidants. Humans have probably been juicing oranges since they started cultivating citrus in China, ca. 300 BC, but we generally didn't drink orange juice until early 1900, when California growers developed the marketing campaign "Drink an Orange" to deal with the excess of fresh fruit they were producing.

Later, to deal with scurvy in WWII, the Florida Department of Citrus and the U.S. Government developed frozen concentrated orange juice (FCOJ), which today is largely what's shipped across the world to supply the global juice market. In 2021, global orange juice sales topped $6B and demand is expected to increase by 3.9% per year reaching over $7.6B in sales in 2027.

Florida isn't the only game in town

U.S. consumers associate orange juice with Florida, but times have changed, and the industry has become more complex. The global supply chain of orange juice is supplied by at least 6 countries, creating a decentralized web of growers, processors, trading companies, blending houses and juice packers, before it gets to our table. Florida supplied the majority of orange juice in the U.S. until the mid 1980's, when climatic issues including frosts and hurricanes hit the region hard, and increasingly modernized agriculture in other countries allowed them to fill the gap.

'Today Brazil, the United States, China, Mexico, Egypt and Spain dominate the world market with Brazil being by far the largest supplier, crushing 12 times more oranges than the United States, and supplying 80% of European and 50% of the U.S. juice market.'

New challenges facing the citrus industry

While global orange production is at an all-time high, the sector is being plagued by several diseases that are devastating groves in the Americas, forcing growers to change their practices, and incurring increasingly greater costs. A bacterium called *Candidatus liberibacter* (Clas) has infected orange groves across the world, forcing major juice producers to rip up groves and start anew.

Like the malaria parasite transmitted by mosquitoes, the citrus psyllid (*Diaphorina citri*), introduces Clas into the tree's vascular system through a bite on a leaf. Once inside, the

bacteria lodge and replicate, feeding off the sugars in the tree's phloem (the "arteries" of the tree), until they clog it up, and the plant starts to die. Oranges stay green, and don't mature, so the disease is called "greening" or "HLB" from the Chinese Huanglongbing (Yellow Dragon Disease).

When field crops such as soy or corn are affected by disease, the crop may be lost but could be replanted the following year. Orange trees, however, live and mature over 20 years, and are not productive for the first few years of their life. Yearly replanting is not a sustainable or effective option.

Challenges of global concern

Citrus producers have found temporary management strategies to deal with the onslaught of HLB, adopting costly and unsustainable strategies to address this disease, including extensive insecticide spraying and destruction of groves or even moving their groves to new land.

In Brazil, the world's largest orange juice provider, orange production is an impressive 3 times larger than that of Florida and California combined and spans the states of São Paulo and Minas Gerais in the country's southeast. Growers are able to destroy their infected trees and replant their groves, migrating towards the southwest of São Paulo state, where the cooler climate is less hospitable to the citrus psyllid than the dryer northeast. These measures have managed to keep the juice flowing, but at tremendous costs, and they're seemingly losing the battle to citrus greening.

To support growers with the latest scientific knowledge, several highly qualified research foundations including Fundecitrus and the IAC (Instituto Agronômico de Campinas) in Brazil have been established to develop solutions and strategies for industry partners.

'Because of HLB, since 2009, juice output in Florida decreased 72% while fresh fruit output decreased 21%. For Brazilian farmers, on average, HLB impacts about 20% of the acres in Brazil and has led to the elimination of at least 52 million trees since 2004. That's about one third of the total stand.'

Working together on a solution

At Invaio, we have scoured the world to find the most promising and sustainable technologies that could meaningfully address Citrus Greening, and we can see light at the end of the tunnel. Specifically, we are proving our precision infusion approach to reducing HLB using well studied bactericides and are exploring next-generation nature-inspired solutions in both Florida and Brazil. In this effort, we have partnered with several Universities across the globe to explore next generation nature-derived biomolecules to demonstrate the power of combining them with our precision delivery platforms and are seeing very promising results. Our approach ensures that

product can be delivered directly where it is needed, dramatically reducing the need for expensive and wasteful chemical sprays.

We have started working with the top leaders in the global citrus supply chain to get our solutions in their hands and bring value back to their production. Working together with brands and research foundations such as Fundecitrus across the U.S. and Brazil, our global team is forging new ground, as we develop precise and nature-derived tools to bring back the citrus industry from the brink of collapse. Together, we're striving to ensure that a glass of cold, nutritious orange juice remains on our table far into the foreseeable future.

Avram is a Senior Executive with 15 years of experience bringing innovative industrial and agricultural biotechnology products to market in Latin America. His technical, operational, and commercial expertise span diverse crops and geographies. Through his career Avram has led high-performance teams in product development and sales of green fuels, chemicals, and biological agricultural inputs. An entrepreneur with proven success starting a successful company and raising Venture Capital, he has a strong command of global agricultural B2B and B2C business and the regulatory environment.

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