



AVOCADOS: NANOBUBBLES IMPROVED CROP RESILIENCE, YIELD AND CALIBER

Client Case Study: Gama Avocado

Crop:	Unit Type:	Flow:	Installed:	Year 1 Results:
Avocados	XTB 50 inline	50 GPM	December 2020 - December 2022	<ul style="list-style-type: none"> • Significant improvement in plant vigor • 6% significant total production increase • 40% yield increase in fruit caliber ≥ 50 (199 + grams)
				Year 2 Results: <ul style="list-style-type: none"> • 32% increased average fruit weight • 45% more fruit per plant with a caliber of 50 or more • Less vascular browning in post-harvest fruit • Reduced soil compaction • Increased plant resilience and resistance to salinity

Gama, a Chilean research and consultancy company, sought a sustainable solution to common avocado crop challenges in their region, including soil health for better root development. They demonstrated the positive impact of nanobubbles on avocado crops by conducting a 2-year trial.

Production Challenges

Avocado growers face many challenges, particularly in irrigation. Unlike most plants, avocado trees' root zone is situated close to the surface of the soil and needs to be continuously irrigated to fight drought conditions and develop healthy roots. Avocado tree roots are also highly susceptible to anoxia, or the absence of oxygen, which is often caused by waterlogging from overwatering. Care should be taken not to overwater or underwater, both of which can lead to root damage.

Healthy Roots Need Dissolved Oxygen and Good Soil Structure

To prevent waterlogging, it's imperative to supply avocado trees with enough dissolved oxygen so they can absorb the water efficiently and ensure optimal drainage. The benefits of root zone oxygenation are well-established: avocado growers have known of the beneficial effects since the 1940s.

On the other hand, soil waterlogging hurts root development, so it is critical that water percolates through the soil, which can be challenging in soils prone to compaction. Soils with high amounts of clay particles have high water holding capacity, meaning that water is held close to the soil particles for longer than soils with high sand content. Additionally, soils with a high amount of clay can have compaction issues, reducing water infiltration to the root zone.

Both can lead to waterlogging in soil. To combat this, growers should improve the structure of the soil and practice good irrigation strategies.

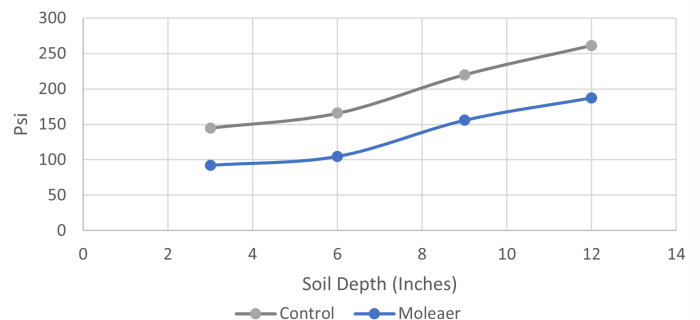
Nanobubbles Help Improve Soil Structure and Reduce Compaction

Nanobubbles increase soil flocculation, a natural process that

pulls together individual clay particles into larger aggregates. Soil flocculation provides more soil pore space resulting in better water infiltration, root development and reduced soil compaction. Nanobubbles also reduce the surface tension and contact angle of water to improve the penetration and infiltration of water through the soil profile. Improved water percolation on the roots zone translates into higher nutrient mobility, contributing to more efficient absorption of nutrients and water. Better aeration or oxygenation of the soil also means more beneficial microbial activity, while on the other hand reducing anaerobic pathogens like *Pythium* and *Phytophthora*.

In this study, soil compaction was measured using a penetrometer to measure resistance at different depths. The soil irrigated with nanobubble-enriched water showed less resistance at all depths, confirming less compaction compared with the control.

Soil Compaction (Resistance to penetration)



Improved Plant

During Gama's trial, a Moleaer XTB 50 injected nanobubbles and high levels of dissolved oxygen inline into one of the sectors of the irrigation system. The researchers found significant improvements in plant vigor, resistance to soil salinity, good postharvest parameters, and lower soil compaction. This greater resilience translated into better tree development and increased productivity. The level of salt resistance was determined by the amount of foliage damage.

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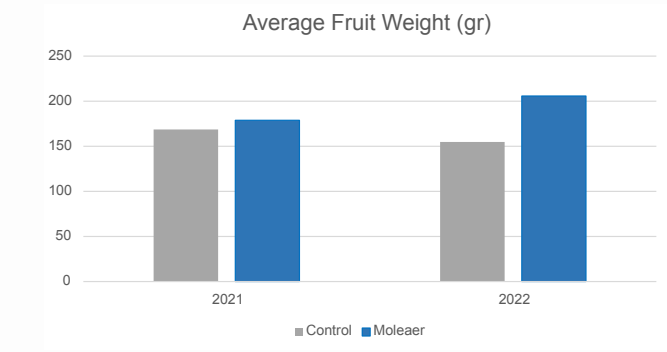
Regarding post-harvest parameters, there was a notable difference in the percentage of fruits affected by vascular browning during post-harvest. In the year 2 control, many of the fruit were impacted by vascular browning. Vascular browning can be caused by a number of different fungal pathogens. It is often associated with stem-end rots, in which case the symptoms can be severe and appear soon after harvest, affecting fruit quality, and shel life and potential losses.

Increased Production and 40% Yield Increase of High-Caliber Fruit

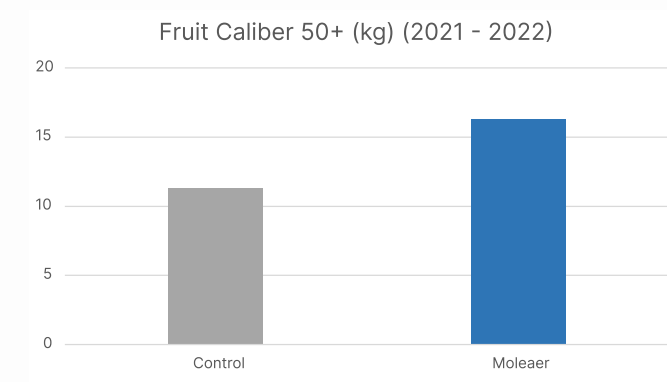
Compared to the control group, avocado trees treated with Moleaer nanobubbles showed significantly higher production. The average fruit weight in nanobubble-treated avocado trees versus untreated trees was 6% higher over the course of the first year of trial and 32.8% higher in the second year of the trial.

During the second year, the yield from nanobubble-treated trees was 40% higher than untreated trees. These results are even more striking when considering that fruit production on avocado trees usually tend to decline on the second year, especially if yield in the first year was high, like in this case.

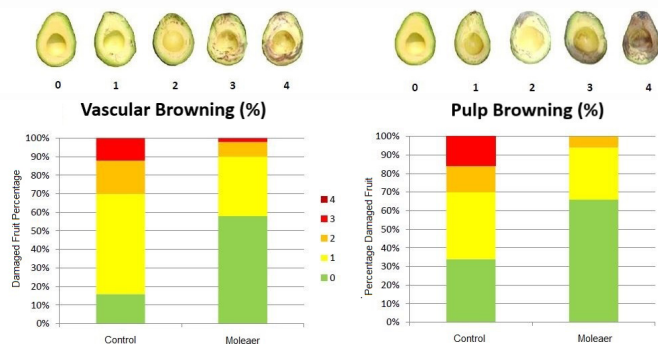
This clearly demonstrates the positive effects of nanobubbles on avocado crop production for exports. The increase in higher-quality fruit will lead to more profitability for this avocado grower.



Fruit caliber also increased with a 44% increase in fruit with a caliber of 50 or more (199 grams or 7 oz or more). Fruit caliber is a key parameter to determine the quality of fruit.



This 2-year study showed the significant benefits of nanobubble technology for avocado growers to combat some of the toughest challenges in their crop. Nanobubbles helped improve soil structure by reducing compaction, which allowed for healthier root development from improved nutrient and water uptake efficiency. Better quality roots led to healthier, more resilient crops that produced more and higher-quality fruit. These benefits can help avocado growers like this one become more competitive in their market and meet the growing demand for food production worldwide.



Learn more about how to improve soil health with chemical-free nanobubbles.

► [Download the e-Book](#)

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