



Water solutions for the world.

Oxygen-Powered Growth for Citrus.

CLEANER WATER.
HEALTHIER TREES.
BIGGER RETURNS.

E BOOK

A large, vibrant photograph of a citrus tree branch with several ripe, orange-colored fruits hanging from it. The leaves are green and glossy. The background is a soft-focus green field. A dark blue diagonal stripe runs from the top right corner towards the bottom left, separating the text area from the image.

www.SolariWater.com.au

WELCOME

INTRODUCTION

OVERVIEW

Across the world's citrus regions, growers face increasing pressure to produce more with fewer resources — less water, fewer chemical inputs, and tighter margins. Yet the challenges beneath the soil often go unnoticed. Low oxygen levels, soil compaction, and persistent root diseases quietly limit growth and reduce yield potential season after season.

Traditional irrigation systems deliver water, but not always the oxygen trees need to thrive. In oxygen-poor conditions, beneficial soil microbes decline while pathogens such as *Phytophthora* and *Pythium* take hold. The result is slower growth, declining fruit quality, and greater input costs.

Nanobubble irrigation technology transforms this process. By infusing billions of ultra-fine oxygen bubbles into irrigation water, it restores oxygen to the root zone, encouraging stronger roots, improved nutrient uptake, and natural disease suppression — all without chemicals or additional fertilisers.

The outcome is clear: healthier soil, higher yields, and more resilient orchards. With nanobubble irrigation, every drop of water becomes an investment in productivity and long-term orchard health.





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About The Author

Doug Fletcher

Through our work in water oxygenation and nanobubble irrigation across diverse environments, we've witnessed how the right technology can revitalise soil, strengthen plant health, and significantly improve productivity. The consistent results seen in orchards and farms inspired us to share those findings more broadly, and this eBook was created to help others understand the opportunity.

Our goal is simple — to make advanced water technology practical and accessible for growers. By harnessing the power of oxygen, farmers can improve yields, restore soil health, and reduce their reliance on chemicals and additives. It's an approach that benefits both the land and the bottom line.

Look out for future Solari Water eBooks that explore nanobubble applications across other industries and crops, as we continue to document results and share practical knowledge from the field.



OXYGEN-POWERED Irrigation

The Smart Way to Grow
Stronger Citrus Trees





THE OXYGEN ADVANTAGE

TRANSFORMING EVERY DROP INTO A GROWTH ADVANTAGE

Water is more than a carrier — it's the lifeline of every citrus tree. When oxygen is limited, trees can't absorb nutrients efficiently, root health declines, and soil ecosystems lose balance. Solari Water's Nanobubble Generator transforms ordinary irrigation water into a powerful oxygen delivery system that revitalises the soil from the ground up.

Each generator produces billions of microscopic oxygen bubbles — smaller than a red blood cell — that stay suspended far longer than conventional aeration. This sustained oxygenation improves water quality, increases the availability of dissolved oxygen (DO), and delivers measurable benefits to plant health and productivity.

These tiny bubbles penetrate deep into the root zone, improving soil structure and supporting aerobic microbial activity. Over time, the result is a stronger, more resilient orchard ecosystem — one that resists disease, optimises nutrient uptake, and sustains higher yields year after year.

Solari Water's nanobubble systems are designed for agricultural precision, tested under real irrigation conditions, and built for reliability.

Choose equipment designed for your growing environment. The Solari Water Nanobubble Generator is engineered for dependable oxygen delivery, helping maintain high dissolved oxygen levels and clear irrigation lines throughout the system.

Each unit converts power to oxygen with exceptional efficiency (SAE), producing billions of stable nanobubbles that improve water quality and circulation. This process keeps irrigation networks free from biofilm and stagnation, while promoting healthier soil conditions and stronger, more active root zones.

Solari Water technology integrates easily into new or existing irrigation systems, providing a flexible solution for drip, micro, or surface applications. Built for long-term reliability and low maintenance, it delivers consistent performance across changing conditions.

The outcome is measurable:
*cleaner water, healthier soil, and
higher yields — season after season.*





APPLICATIONS IN CITRUS IRRIGATION

FLEXIBLE INTEGRATION ACROSS EVERY SYSTEM

Every orchard operates under different conditions — from soil types and irrigation layouts to water quality and climate. The Solari Water Nanobubble Generator is designed to integrate easily into any irrigation network, improving oxygen availability wherever water flows. Whether installed at the source or within delivery lines, it maintains stable dissolved oxygen levels for cleaner water and stronger trees.

Drip and Micro Irrigation Systems

In precision irrigation systems, oxygen-rich water reaches the root zone directly, improving soil aeration and reducing anaerobic conditions that promote root disease. Consistent oxygenation enhances nutrient uptake, promotes healthy microbial activity, and supports even growth across the orchard.

Reservoirs, Tanks and Channels

When installed at the water source, the system continuously infuses oxygen to prevent stagnation and algae growth. This stabilises water quality, reduces odours, and ensures a consistent supply of clean, high-oxygen water feeding into the irrigation system — all without the use of chemicals.

From storage to soil, Solari Water nanobubble technology keeps oxygen moving where it's needed most — helping citrus trees thrive naturally from the ground up.

Soil Recovery and Orchard Rejuvenation

In mature or compacted orchards, oxygen nanobubbles help re-energise soil life and support root recovery. Regular irrigation with oxygenated water restores microbial balance, improves soil structure, and promotes root resilience after stress or disease.



DISEASE CONTROL IN WOODY FRUIT CROPS

Validated Results from Global Oxygenation Studies

Higher Oxygen Levels Reduce Pathogen Activity

Research across citrus, almond and berry crops shows that maintaining dissolved oxygen (DO) above 7 mg/L creates aerobic soil conditions unfavourable to pathogens such as *Phytophthora nicotianae* and *Pythium* spp. Growers recorded faster root recovery, improved canopy growth and visibly healthier orchards when irrigating with oxygen-enriched water.

Enhanced Microbial Balance in the Rhizosphere

Oxygenated irrigation supports beneficial aerobic microbes that outcompete harmful fungi and bacteria. These microbes accelerate organic-matter breakdown and nutrient cycling, restoring biological balance and creating a living defence against soil-borne disease.

Improved Root Function and Nutrient Uptake

Nanobubble irrigation doesn't just raise oxygen levels — it reshapes how trees access nutrients. By maintaining aerobic conditions around fine root hairs, the technology boosts root respiration and keeps essential uptake pathways active even under stress.

Studies in multiple fruit species show that sustained DO levels above 15-20 ppm enhance microbial nutrient cycling and improve soil structure. These aerobic microorganisms convert organic matter into plant-available forms more efficiently, cutting fertiliser requirements by up to 18 %. Advanced omics research also reveals that oxygen-rich irrigation activates genes linked to nutrient transport and assimilation, confirming a direct physiological benefit within the plant.

Field trials in commercial citrus and other orchards report denser root networks, higher canopy vitality and improved fruit set — yield gains of 10-15 % within two seasons of use. The result is a self-reinforcing cycle of healthier soil, smarter nutrient use and sustainable productivity that strengthens both grower returns and environmental outcomes.

The benefits extend beyond plant physiology. As soil oxygenation increases, compacted layers gradually break down, allowing deeper infiltration and stronger capillary action during irrigation. This creates a more stable soil-water environment where nutrients remain available for longer periods, even under fluctuating moisture conditions. The combined effect of improved structure, active microbial populations and oxygen-enriched water transforms orchard performance — from the ground up.





PATHOGEN SUPPRESSION MECHANISMS

How Oxygen Nanobubbles Create a Defensive Root Zone

The Science Behind Pathogen Control

Nanobubble technology offers a proven, multi-layered approach to controlling soil-borne diseases in woody fruit crops. During the collapse of nanobubbles in irrigation water, reactive oxygen species (ROS), including hydroxyl radicals, may form. These naturally occurring oxidants help reduce microbial activity and improve water quality without the need for added chemicals.

This oxidation process, combined with sustained high dissolved oxygen (DO) levels, creates a root zone environment hostile to anaerobic pathogens such as *Phytophthora*, *Pythium*, and *Fusarium*. Trials conducted in Belgium's Proefstation Research Centre showed 74 % reductions in *Pythium* levels and significant suppression of *Phytophthora cryptogea*, confirming the strong antimicrobial effect of oxygen nanobubbles.

Oxygen as a Biological Shield

Oxygen-enriched water fundamentally shifts the soil's microbial balance. Beneficial aerobic organisms thrive under these conditions, outcompeting disease-causing fungi for space and nutrients. Over time, the root zone transforms from a disease-prone, anaerobic environment into a living barrier of biological resistance — a naturally sustained shield against reinfection.

Australian citrus trials (Redland Fruit, Mildura) demonstrated that after installation of nanobubble irrigation, *Phytophthora*-related root rot symptoms declined sharply and new tree establishment improved dramatically, even in previously infected soils.

Sustained Dissolved Oxygen Levels

Unlike conventional aeration methods, nanobubbles remain stable and suspended for extended periods, maintaining DO concentrations above 20 ppm in irrigation water — more than triple the typical 6–8 ppm baseline. This persistent oxygenation ensures that every droplet reaching the root zone carries active oxygen long after injection, providing continuous biological and chemical benefits within the soil profile.

As these oxygen-rich water molecules circulate, they disrupt anaerobic pockets where root pathogens typically thrive, keeping the entire rhizosphere oxygenated and balanced. This not only suppresses harmful organisms such as *Phytophthora* and *Pythium* but also promotes a flourishing population of beneficial aerobic microbes that drive nutrient mineralisation and decomposition of organic residues.

Long-term field use shows that sustained oxygen delivery stabilises water quality throughout irrigation networks, preventing biofilm accumulation and line blockages — resulting in cleaner, more efficient water distribution and long-term system reliability.





ORANGE ORCHARD

DISEASE MANAGEMENT

Cleaner Water, Stronger Roots, Healthier Citrus Trees

Citrus trees are among the most sensitive orchard crops to low oxygen and poor soil aeration. When irrigation water becomes depleted in dissolved oxygen, root zones quickly turn anaerobic, encouraging the growth of soil-borne pathogens such as *Phytophthora nicotianae* and *Pythium* spp. These diseases weaken feeder roots, restrict nutrient flow, and create a cycle of canopy decline and uneven fruiting that is difficult to reverse.

By delivering oxygen directly through irrigation water, the Solari Water Nanobubble Generator interrupts this cycle from the ground up. The constant infusion of microscopic oxygen bubbles restores aerobic conditions in the rhizosphere, giving trees the environment they need to recover naturally. In trials and grower installations, oxygenated irrigation has consistently reduced visible root-rot symptoms, improved new-root flush, and stabilised soil microbial balance.

Field data from citrus sites in South Australia and Mildura demonstrate a measurable reduction in pathogen counts within the first month of operation, followed by observed improvements in canopy density and higher uniformity in fruit size and colour. Growers also report cleaner irrigation lines, reduced odour in water storage, and less dependence on chemical root treatments or fungicides.

The outcome is a more resilient orchard system — one that relies on oxygen, not chemicals, to manage disease pressure and promote consistent tree health throughout the growing season.



RESULTS & ROI

Proven Field Performance and Tangible Grower Returns

Commercial citrus growers using Solari Water's Nanobubble Generator technology report rapid and measurable improvements in yield, fruit quality, and operational efficiency. Field trials and commercial installations have shown that oxygen nanobubble irrigation can enhance biological soil function and financial performance within one to two growing seasons.

In Mildura, where the Redland Fruit citrus operation is based, nanobubble-treated irrigation has been successfully applied to address Phytophthora challenges and support better tree establishment and fruit quality. Broader commercial trials of nanobubble technology have demonstrated yield increases of 15–30%, improved fruit size uniformity, and earlier maturity — up to two weeks ahead of control blocks. This earlier harvest enables access to premium market prices, boosting grower profitability.

Beyond yield performance, input cost reductions are equally significant. Trials document up to 25% reductions in irrigation water use and 20–40% lower fertiliser and pesticide requirements, driven by improved nutrient cycling and reduced pathogen pressure. Soil compaction decreased by around 20%, improving infiltration and water-holding capacity — key for sustainable production in variable climates.

Economic analyses across multiple fruit sectors indicate that the technology typically pays for itself within 1–2 seasons, through the combined effects of yield uplift, input savings, and improved fruit quality. As one of the most energy-efficient oxygenation systems on the market, Solari Water's nanobubble solution converts power to oxygen with outstanding SAE efficiency, delivering high returns with low ongoing costs.

In short, the numbers speak for themselves:

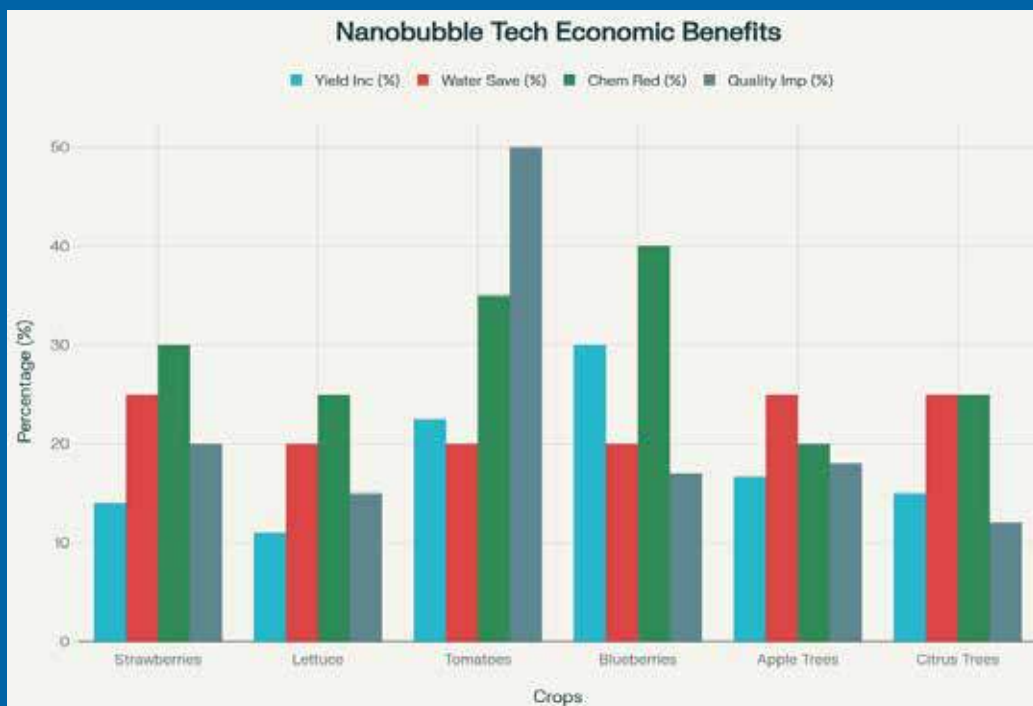
Up to 30% yield increase

Up to 25% water savings

20–40% reduction in fertiliser and chemical inputs

15–20 ppm sustained dissolved oxygen

1–2 season ROI payback window



For growers seeking cleaner water, healthier trees, and higher long-term profitability, nanobubble irrigation represents a proven, chemical-free investment in orchard resilience and productivity.



READY TO REIMAGINE YOUR IRRIGATION?

Cleaner Water | Healthier Trees | Bigger Returns

Solari Water works with growers and irrigation professionals across Australia and beyond to deliver measurable results in orchard health, water efficiency, and profitability. Our nanobubble generator systems are designed for practical on-farm performance — built to integrate seamlessly into existing irrigation networks and backed by decades of aeration expertise.

Whether you're tackling root-zone disease, chasing higher yields, or simply wanting to do more with less, oxygen nanobubbles offer a smarter, chemical-free path forward.

💬 Let's talk about your orchard.

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