Nanobubble Insights – Case Study

Reducing Fertiliser Use in Hydroponic Lettuce Without Sacrificing Quality

Organisation: Nanobubble Insights (Microshoots Laboratory)

System: Nutrient Film Technique (NFT)

Crop: Lactuca sativa (Green Batavia lettuce)

Location: Dundee, UK

Up to 50% reduction in fertiliser input with comparable plant growth and visual quality versus a standard control.

Early laboratory trials indicate that nanobubble-enriched solutions can maintain crop performance at substantially lower nutrient concentrations.

At a Glance:

- **Objective:** Improve nutrient-use efficiency (NUE) in a controlled-environment hydroponic system.
- **Design:** Side-by-side comparison of standard fertiliser (Control) vs. NanobOx-enabled nutrient solution at 50% of the standard concentration (NanobOx treatment).
- **Monitored**: Growth/leaf quality, root development, solution stability, and routine system parameters (pH, EC, DO).
- **Outcome:** Visual parity in crop quality with markedly lower fertiliser inputs.

The Challenge

Hydroponics already conserves water and space, but fertiliser demand remains a cost and sustainability pain point. The question we set out to answer: Can we deliver the same crop quality with far less nutrient input?

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Our Approach

We integrated NanobOx technology into an NFT lettuce system at the Microshoots Laboratory and compared two treatments:

- **Control:** Standard commercial hydroponic fertiliser regimen.
- **NanobOx Treatment:** Nutrient solution operated at approximately 50% of the standard fertiliser concentration, with nanobubbles incorporated.

Environmental conditions (light, temperature, humidity) were maintained within lettuce best-practice ranges. We tracked growth and health indicators, took root/leaf observations, and monitored nutrient solution behaviour throughout the cycle.

What We Observed

- **Comparable plant growth and visual quality to the control:** normal morphology, colouration and turgor; no visible deficiency symptoms (Figure 1).
- **Healthy root development:** roots remained bright and structurally robust across the cycle.
- **Stable solution:** parameters (pH, EC) were routinely checked and adjusted to remain within the optimal range for lettuce production.
- **Early efficiency indicator:** Preliminary results suggest enhanced nutrient uptake and utilisation when NanobOx nanobubbles are present.

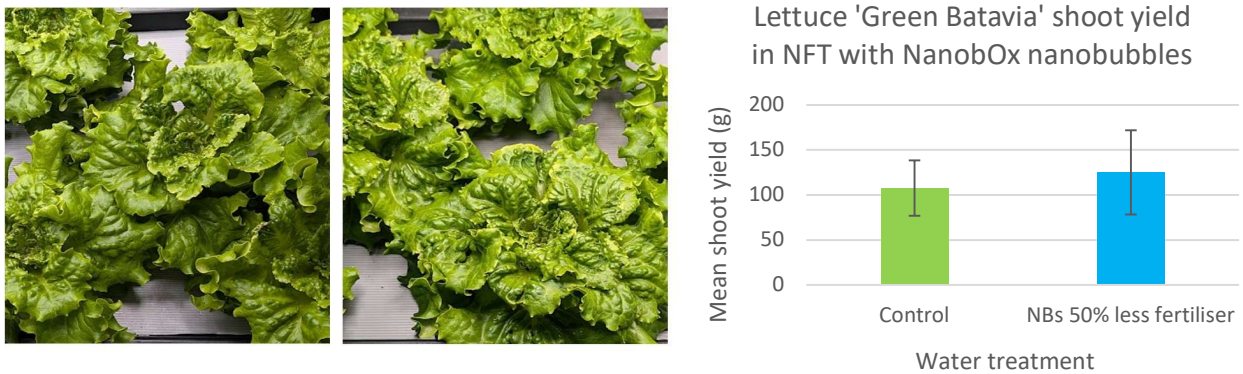

Figure 1. Control (left) vs. NanobOx-treated (right) lettuce in NFT system, and graph showing yields at harvest.

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Early Insights from the 25% Fertiliser Trial (Ongoing)

A second phase of testing is currently halfway through its growth cycle, using only 25% of standard fertiliser concentration while maintaining nanobubble enrichment.

Preliminary observations:

- Growth rate remains strong, with plants showing healthy leaf colour and morphology at mid-cycle.
- Root density appears enhanced compared to control indicating active nutrient uptake.

Why It Matters

Reducing fertiliser by 50–75% without compromising quality can translate into:

- Lower operating costs per kilogram harvested.
- Smaller environmental footprint from reduced nutrient manufacture and runoff risk.
- More resilient production under tight supply or regulatory constraints.

Current Scope & Next Steps

This is an early-stage, controlled laboratory trial. To validate and quantify the effect on a commercial scale, we are:

- Extending to replicated trials with yield, time-to-harvest, and Nutrient Use Efficiency metrics – such as nutrient uptake and utilization efficiency, and yield per unit of fertiliser applied.
- Testing across additional cultivars.
- Preparing a technical note and dataset for peer-review and partner due diligence.

Planned Future Trials

- **Trial design:** Replicated, factorial comparisons to isolate NanobOx nanobubble effects e.g. fertiliser concentration further reduced.
- **Continuous monitoring:** Using WiFi monitors to log pH, EC, ORP, and temperature continuously.
- **Uptake kinetics:** From the data logs estimate nutrient uptake rates.

- **Dosing strategy:** Compare fixed setpoint control versus dynamic dosing (small, frequent additions) to test stability and responsiveness under NanobOx nanobubbles.

How Partners Can Engage

- **R&D pilots:** Run a scoped pilot in your facility (vertical farm, glasshouse, or research site) or in the Microshoots Laboratory.

Interested in a pilot? Contact: jennifer@nanobubbleinsights.com