MOLEAER
ADVANCING NANOBUBBLE TECHNOLOGY

LETTUCE: NANOBUBBLES INCREASE OXYGEN LEVELS, IMPROVE PLANT GROWTH

Client Case Study: Agricultural Research Organization, Volcani Center

The Volcani Center: Located in Israel, the Volcani Center is the nation's agricultural research and development center with over 200 scientists. In a trial at Volcani Center, the effect of oxygen nanobubble enriched irrigation water on water quality and the nitrogen cycle in drip-irrigated lettuce was examined. The study looked at yield and nutrient uptake of lettuce with and without nanobubble enriched irrigation water.

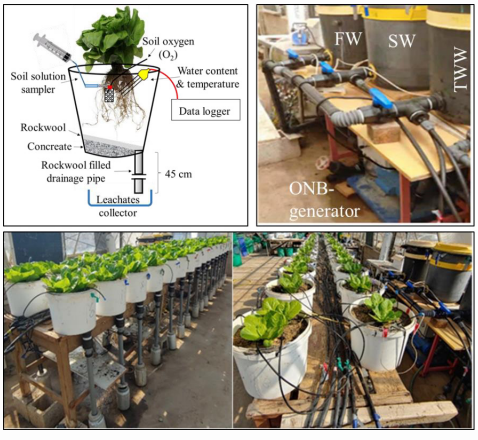
The Challenge: Farmers are faced with the continued challenges of climate change, drought and declining water quality that are affecting their crops and impacting their business. To make matters worse, costs of fertilizers and pesticides are on the rise, affecting farmers' bottom line.

Our Solution: Moleaer, the leading nanobubble technology company, uses its patented technology to improve irrigation water for better crop yields and plant health without the use of chemicals. Nanobubbles help growers optimize irrigation water to improve nutrient uptake efficiency, promote beneficial bacteria, suppress pathogens and biofilm and more.

The Study: At the Volcani Center, a team of researchers used a lysimeter setup to study the effect of drip irrigation with oxygen nanobubble enriched water of different qualities on lettuce. Six treatments were tested: treated wastewater with and without nanobubbles, saline water with and without nanobubbles, and freshwater with and without nanobubbles.

Each lysimeter was filled with a sand-compost mixture, which was washed by the irrigation water for several consecutive days. Two lettuce seedlings were planted in each lysimeter.

Each lysimeter was irrigated twice a day, with oxygen nanobubbles generated through a Moleaer XTB™ Nanobubble Generator and back to the bottom of the barrel for three minutes prior to the irrigation.

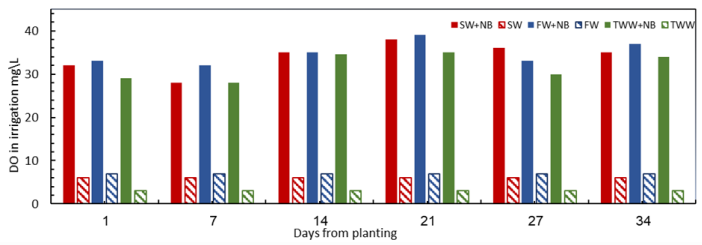


The experimental set up, including the aeration tanks and ONB generator (top right), the structure and instrumentation of each lysimeter (top left), and a side and front view of the experiment.

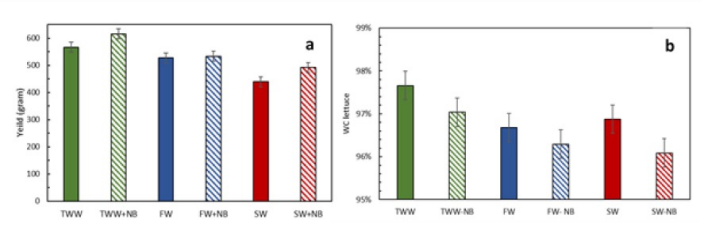
Results:

- Increased dissolved oxygen (DO) concentrations in all waters by 22 – 28 mgL-1, giving a DO concentration of 30 – 35 mgL-1
- Increased wet yield and dry mass of the lettuce heads in all water sources, most notably:
  - 12% wet yield increase in saline water with oxygen nanobubbles
  - 9% wet yield increase in treated wastewater with oxygen nanobubbles
- Improved nutrient uptake by roots as seen in reduced Nitrate-N concentrations in nanobubble water
- Improved microbial activity

The study shows that overall, irrigation water supersaturated with nanobubbles managed to increase oxygen availability in the rhizosphere, which in turn promoted plant growth and nitrogen use efficiency, regardless of the water source.



Dissolved oxygen (DO) concentrations in the irrigation waters throughout the growing period. SW – saline water, FW – fresh water, TWW – treated wastewater, NB – oxygen nanobubbles.



A) Average wet weights of lettuce heads at harvest. B) Average gravimetric water contents of harvested lettuce heads. SW – saline water, FW – fresh water, TWW – treated wastewater, NB – oxygen nanobubbles.

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