

16 July 2018

Roots completes world-first pilot in a commercial operation combining RZTO temperature control and Nutrient Film Technique (NFT) technologies

- **Robust lettuce growth and 20 percent shorter growth cycle where NFT nutrient solution temperatures remained stable despite greenhouse temperatures of nearly 40 degrees**
- **NFT greenhouse technology is a collaboration with greenhouse leader Teshuva Agricultural Projects**
- **Cooling achieved using ground source heat exchange only using marginal energy consumption**
- **Technology first unveiled at the International Agri-Tech Israel Exhibition and Conference in May 2018**

Roots Sustainable Agricultural Technologies Limited (ASX: ROO, Roots or Company) has combined its Root Zone Temperature Optimization (RZTO) with NFT technology developed by Teshuva Agricultural Projects (**TAP**) to cool the nutrient temperature of NFT hydroponic lettuce in Bnei Atarot in Central Israel.

The two technologies combined to ensure the water that delivered dissolved nutrients to hydroponic bare plant roots remained within favourable growing ranges more than 11 degrees lower than the ambient air temperatures in the greenhouse of nearly 40 degrees.

This increased production quality and shortened the growing cycle by about 20% compared to traditional plantings where no nutrient temperature control is used.

The successful RZTO and NFT operation, which Roots unveiled at the recent AgriTech Israel conference in early May 2018, shows the ability of the technology to allow farmers to stabilise nutrient temperatures to increase yields and profits dramatically through more efficient crop management – even in extreme summer weather conditions.

Roots CEO, Dr Sharon Devir said, “This is a major breakthrough in greenhouse crop control. No other commercial company in the world, as far as we know, is offering RZTO and NFT cooling systems for hydroponics or other substrates such as grow bags or soil. Until now, the only option farmers had to reduce heat load in greenhouses was to use large evaporative cooling systems with several fans. However, they are expensive to buy and operate, use a lot of energy, and increase humidity levels within the greenhouse which increase disease levels on plants.”

“RZTO cooling systems have none of those issues and focus on retaining core temperatures at the root zone – not in the ambient air. Cooling the NFT nutrient solution was made by ground source heat exchange only, using a circulating pump which consumed only 1.5kw/h of energy.”

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“Since installation at this site there were several days close to 40 degrees centigrade accompanied by very strong wind storms, one of which caused shade nets above most greenhouses in the region to blow away. While many nearby greenhouse crops did not survive these extreme weather conditions, the Roots’ cooled crop survived four hours of strong wind and severe heat without any shade net. The RZTO and NFT cooling system was effective in stabilising the crop temperatures despite these extreme external weather conditions where the fragile crops were completely open to the heatwave and windstorm conditions.”

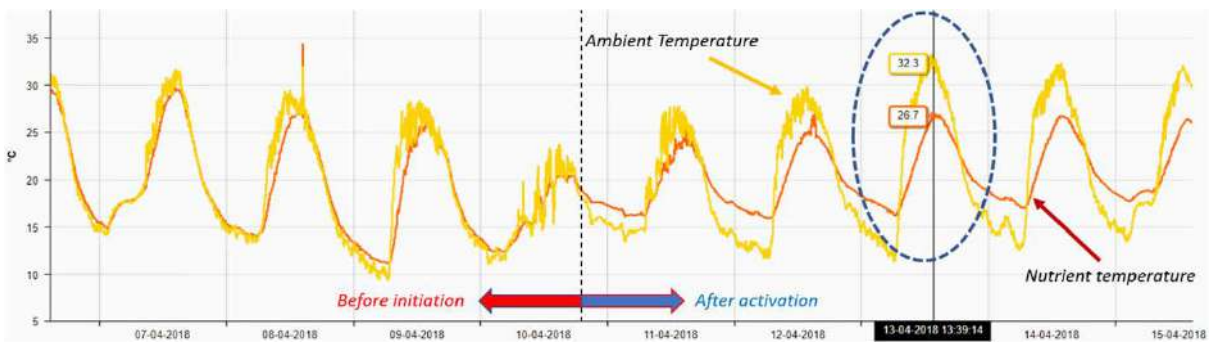
“In NFT greenhouses without the combined RZTO and NFT technology, the nutrient temperature of crops closely followed the air temperature in the greenhouses.

Nutrient temperature before system activation.

Nutrient temperature (red) follows ambient air in the greenhouse (yellow) closely

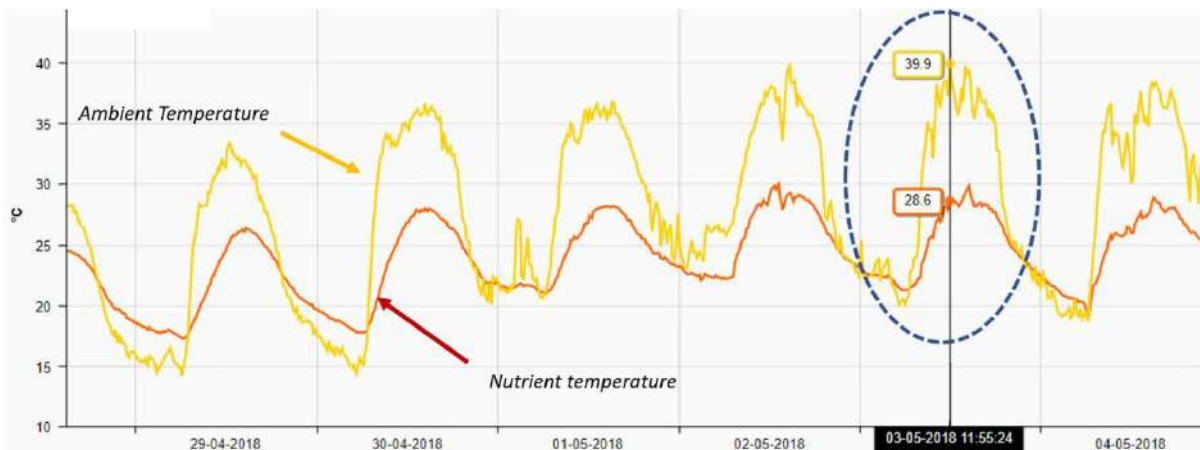
Nutrient temperature after system activation.

Optimum nutrient temperature range is now detached from greenhouse ambient temperature.



However, using the RZTO and NFT system, the farmer was able to stabilise and monitor the plant roots to ensure they remained at an optimum temperature, irrespective of the greenhouse’s ambient air temperature.”

Nutrient temperature (red) kept within the favourable growing range even when ambient air temperature (yellow) reaches nearly 40 degrees Celsius in the greenhouse



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Nutrient RZTO and NFT technology successfully cooled the nutrient temperature of hydroponic lettuce.

The system ensured the water that delivered dissolved nutrients to hydroponic bare plant roots remained within favourable growing ranges of more than 11 degrees lower than the ambient air temperatures in the greenhouse which reached nearly 40 degrees.



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About Roots Sustainable Agricultural Technologies Ltd:

Israeli-based, Roots Sustainable Agricultural Technologies Ltd. is developing and commercialising disruptive, modular, cutting-edge technologies to address critical problems being faced by agriculture today, including plant climate management and the shortage of water for irrigation.

Roots has developed proprietary know-how and patents to optimise performance, lower installation costs, and reduce energy consumption to bring maximum benefit to farmers through their two-in-one root zone heating and cooling technology and off the grid irrigation by condensation technology.

Roots is a graduate company of the Office of the Israeli Chief Scientist Technological Incubator program.

More information www.Rootssat.com

About Root Zone Temperature Optimization (RZTO):

Root Zone Temperature Optimization (RZTO) optimises plant physiology for increased growth, productivity and quality by stabilising the plant's root zone temperature. Leveraging the principle of Ground Source Heat Exchange (GSHE), Roots installs a closed-loop system of pipes. The lower part is installed at a depth where soil temperature is stable and not affected by weather extremes, and the upper part in the target crop's root zone just below the soil surface. Water flowing through the lower pipes is charged by the soil's stable temperature. The heated (or cooled) water is pumped through the pipes installed in the root zone, where the heat (or cold) is discharged.

This significantly increases yields, increases growing cycle planting options, improves quality, mitigates extreme heat and cold stress while significantly reducing energy consumption by stabilising and optimising the roots zone temperature.

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