Chives study case, Beit Halevy, September-October 2018

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Background

Chives (garlic chives) are bulb-forming herbaceous perennial plants, growing to 30–50 cm tall. Chives are high-value edible vegetables that are rich in flavor and grown for their scapes and leaves. Chive plants are a cold-tolerant species, adapted to a moderate, cool-season climate. In summer, chive plants suffer in high temperatures and high radiation. Therefore, both harvested production and quality decrease dramatically, leading to market shortage.

Root heating outcomes on different crops were examined in order to conclude that the temperature-controlled root zone has a positive effect on plant species[1][2].

ROOTSSAT root zone temperature optimization (RZTO) is low energy, two-in-one, root-zone heating and cooling system. The RZTO system is the first commercial scaled-up commercial or POC system that can perform field-scale experiments to study the effect of RZT (root zone temperature) on plant development and yield production.

The results revealed that cooling the root zone of the chive plants significantly increased the production of harvested leaves, compared to the control with an uncooled root zone (Figure 2). The difference is statistically significant using paired T-test for means (P>0.001). The average weight of cooled chives in the experiment area was more than two times higher (257%) when compared with uncooled plants.

The objective of this experiment was to study the effects on harvested production of cooling chive root zones during the summer in Israel. The ROOTSSAT RZTO hybrid system was used to achieve the required root zone temperature in this experiment.

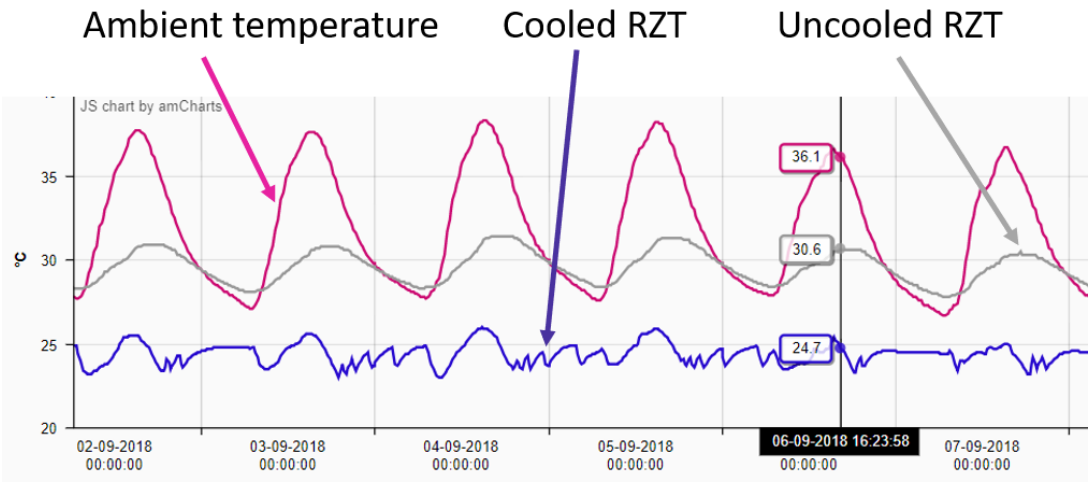
Methods

The experiment commenced on the 20th of August 2018 by planting chive seedlings in the soil at the Beit Halevi greenhouse. The root zone of the plants was cooled both day and night by the

[1] Pahlavanian, A. M., & Silk, W. K. (1988). Effect of temperature on spatial and temporal aspects of growth in the primary maize root. *Plant Physiology*, *87*(2), 529-532.
[2] YAN, Q. Y., DUAN, Z. Q., MAO, J. D., Xun, L. I., & Fei, D. O. N. G. (2013). Low root zone temperature limits nutrient effects on cucumber seedling growth and induces adversity physiological response. Journal of Integrative Agriculture, 12(8), 1450-1460.

ROOTSSAT RZTO hybrid system (powered by combined Underground heat exchange coils and a heat-pump) to 25^{0}C at 10 cm. Uncooled soil was set up as the control (Figure 1).

Each treatment included 100 seedlings planted in two lines per row, at a spacing of 30cm between plants in the line and 40cm between the lines. Harvesting samples started 20 days after being planted, with a marked increase in yield observed. The mean weights of 5 plants were summed up for analysis.



Results

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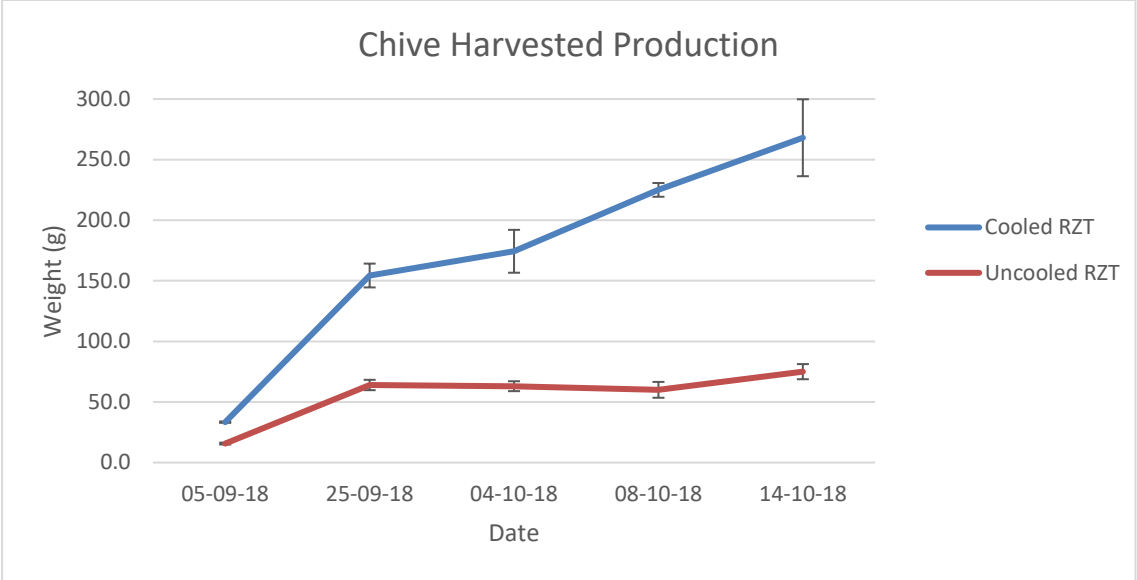

Figure 2. Cooled (blue) and uncooled (control, red) chives yield in grams.

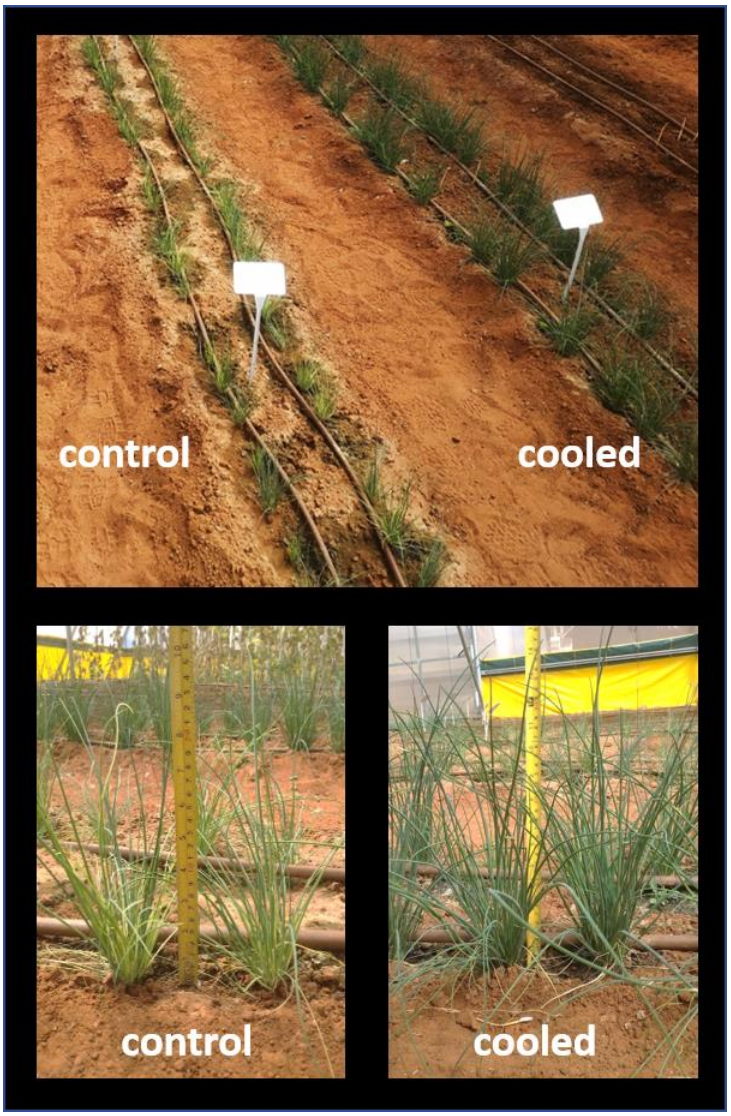

Figure 3. Cooled and uncooled (control) chive plants 45 days after planting

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Conclusions

By using the ROOTSSAT RRZTO hybrid system, we increased the chive yield by more than double and were able to grow quality leaves with a dark-green color. This experiment shows that using the RZTO system can extend the chive growth season to the summer by cooling the RZT alone and without any need to control the ambient conditions of the greenhouse.

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