*By Dan Kane*

Every summer, many farmers and gardeners re-learn the sometimes unfortunate reality that the weather is out of their control. Vegetables wilt in the heat and the rain never seems to come when it's needed. In parts of sub-Saharan Africa, where the summer heat is intense and water shortages are common, it can be particularly difficult to keep crops healthy and productive through the growing season.

But the company Roots Sustainable Agriculture Systems Ltd. (Roots Ltd.) has developed a system that could help farmers beat the heat. The company's Root Zone Temperature (RZT) Optimization technology uses geothermal energy to help farmers control soil temperature at plant root zones, dramatically increasing growth and production.

Controlling the temperature at a plant's root zone can dramatically increase growth and production. (Photo credit: Roots Ltd.)

Using a low pressure pump that can be easily powered by a solar panel, water is circulated from an above ground tank into a system of pipes buried six feet underground that acts like a radiator. In the summer the ground cools the water, and in the winter the ground warms the water. This water is then circulated back up to closed pipes embedded beneath the vegetable rows, cooling or warming the roots before it goes back to the tank to be used again.

By maintaining plant roots in an optimal range of 72 to 86 degrees Fahrenheit, this system can increase the rate of carbon dioxide exchange in plants, as well as the transport of sugars from leaves to roots, boosting plant growth. In trials conducted by Roots Ltd. on Israeli farms between 2007 and 2010, the system successfully raised yields of strawberries, cucumbers, and peppers and helped crops reach maturity earlier.

Roots Ltd. has also developed a similar technology that irrigates crops by condensation. Instead of going through an underground radiator, the water is pumped through a solar-powered unit that chills it. The chilled water is then circulated through un-perforated pipes next to the plants, causing water vapor in the air to condense on the pipes, just as it would on a glass of ice water. The condensation then drips off, simultaneously irrigating and cooling the crops. By utilizing water in the air, this system conserves other water sources.

These innovations can be used on both covered and uncovered crops, require very little energy, and can operate "off the grid," meaning they can be installed in remote locations. Following installation, costs are minimal and upkeep is simple, making them inexpensive, viable options for small farmers in developing nations. By keeping it cool (and hot) Roots Ltd.'s technologies could help smallholders grow more food at less cost.

*To read more about innovations that are helping farmers grow more for less check out: Getting Water to Crops, Water Harvesting, Water Out of Thin Air, Handling Pests with Care Instead of Chemicals, and Improving the Harvest, From the Soil to the Market.*

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