GEORGESON
BOTANICAL GARDEN

University of Alaska Fairbanks
School of Natural Resources and Extension

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Highlights - the 2010 Ohlsen Family Food Garden

by
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Soil Heating Experiment

A local gardener who uses river water to irrigate his gardens has been using solar water heaters designed for warming swimming pools to temper his irrigation water before it reaches the garden. Usually if you are using overhead sprinklers, the water will warm sufficiently before it reaches the ground. However, since we do all of the watering in our vegetable plots directly by drip irrigation, the water has little opportunity to warm up before it reaches the ground. It seemed that we should give solar heaters a try. Last summer we heated the irrigation water for two rows of tomatoes with a solar water heater (Fig. 1) and two rows were irrigated with unheated water. In all four rows, we planted 'Prairie Fire' tomato through Infra-Red Transmitting Mulch (IRT-100) which warms the soil and controls weeds. This practaice is standard for all warm season crops.

Figure 1. Solar heater for drip irrigation water.

There was no difference in tomato yield between the solar heated rows and the untreated rows, but there were differences in soil temperature during and after irrigation. In the unheated (control) plots there is daily cycle with a soil temperature minimum at about 8:00 am and a maximum at about 6:00 pm (Fig. 2). The amplitude of these cycles is dependent upon the amount of solar energy captured by the IRT mulch during the day and is greater on warm sunny days than on cloudy days. The plots with solar heated irrigation water follow an almost identical cycle until they are irrigated and then the addition of heated water causes a sharp rise in soil temperature (Fig. 2, 3). The solar heated plots remain warmer than the control plots for about 24-36 hours after irrigation. From July until about the middle of August the difference between the heated and control was only a few degrees.

Figure 2. Soil temperatures in plots with solar heated and unheated (control) irrigation water in mid August.

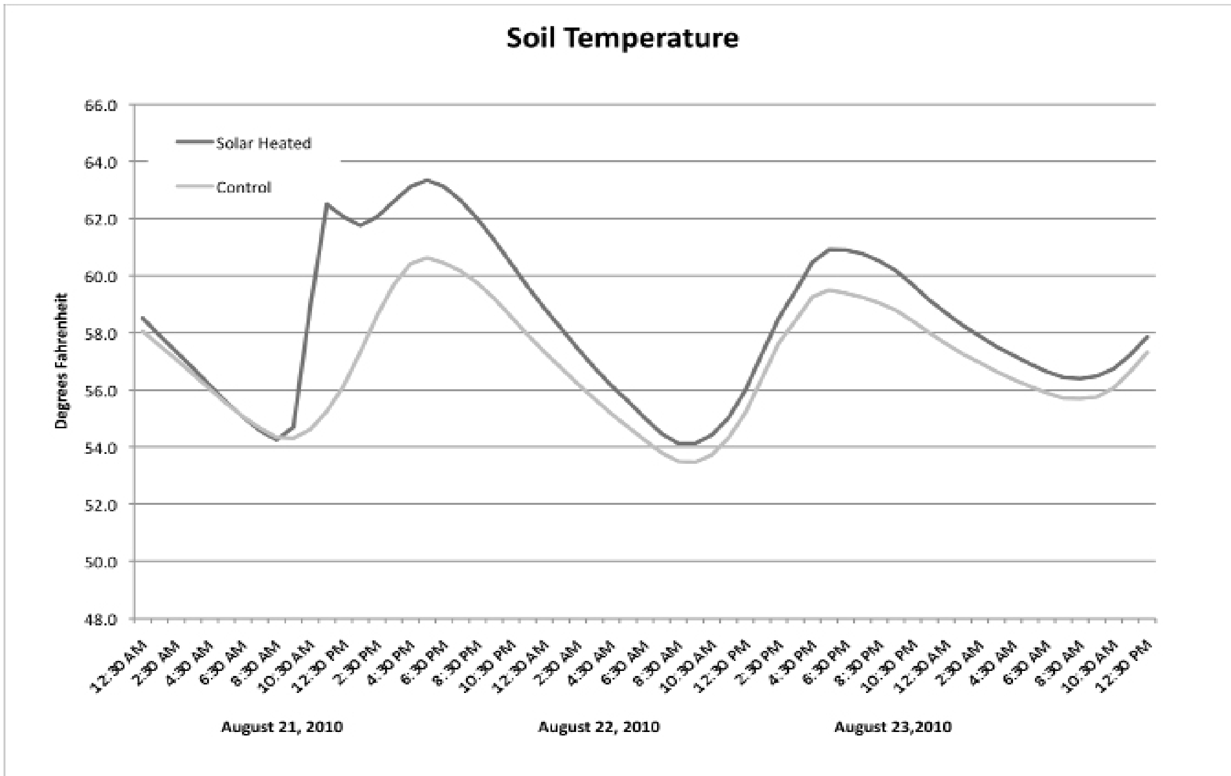
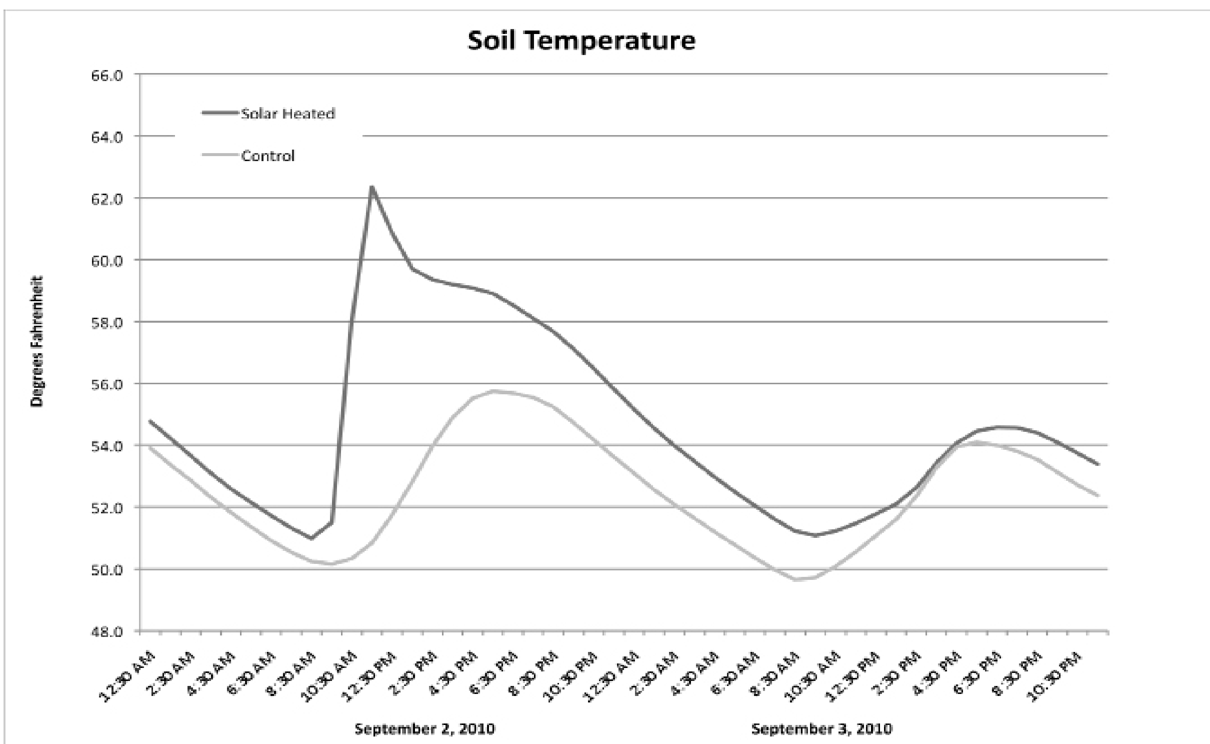


Figure 3. Soil temperatures in plots with solar heated and unheated (control) irrigation water in early September.



However, as the weather became cooler and the days shorter, the temperature difference between the heated and control plots increased (Fig. 3). The lower sun angles and shorter day lengths depressed the solar gain through the IRT mulch much more than it did in the solar heater. The total solar energy captured by IRT mulch is dependent on day length and solar energy, whereas, the energy captured by the solar heater only depends on the solar energy during the time irrigation water was being applied (9:30-11:30 a.m.). In addition, the solar heater, angled 45° toward the south, was more efficient at collecting solar radiation at low sun angles than the IRT mulch which was lying horizontally on the soil surface.

Our guess is that tomato yields were similar in the solar heated and control plots because the IRT Mulch was nearly as efficient at keeping soil temperatures warm enough for good production as the combination of IRT Mulch and solar heated irrigation water. This year we will try the same experiment with bush beans without the use of IRT mulch to see if solar heated irrigation water will improve yields when the unheated control plots do not have the advantage of being warmed by IRT mulch.

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