SOIL SOLARIZATION

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Soil solarization is an environmentally friendly method of using the sun's power to control pests such as bacteria, insects, and weeds in the soil.

The process involves covering the ground with a tarp, usually a transparent polyethylene cover, to trap solar energy (Fig. 1). The sun heats the soil to temperatures that kill bacteria, fungi, insects, nematodes, mites, weeds, and weed seeds.

Figure 1. A raised bed being solarized. *(Source: Garden Betty, www.gardenbetty.com)*

To solarize your soil:

1. Clear the area of plants and debris.
2. Water the soil deeply until it is wet.
3. Cover the area with clear plastic (such as 1 to 4 mil painter's plastic). Don't use white or black plastic; they don't allow enough heat to get to the soil.
4. Bury the plastic edges in the soil to trap the heat.
5. Leave the plastic in place for at least 4 weeks in the hottest part of the summer.
6. Remove the plastic.

Soil solarization works best on heavy soils—those containing clay, loam, or mixtures of them. They can hold more water than can light soils, long enough to produce steam every day. Steam is needed to kill nematodes, weed seeds, and insect eggs in the soil.

Solarization may be less effective on sandy soil, which drains faster and produces less steam. To maximize the benefit of solarization in sandy soils, lay drip irrigation lines under the clear plastic cover and add water regularly.

Normally, water beads will appear on the underside of the plastic early each morning and disappear by noon after the water has turned to steam. The next day, the water beads appear again. When fewer beads appear in the morning, it is time to turn on the irrigation and replenish the water in the soil.

Any area can be solarized as long as the plastic cover is large enough to cover the intended area (Fig. 2). Keep in mind that you need weed-free soil, plenty of water, and plastic with the edges buried for 4 weeks in July to get the most benefit from solarization and still have time to plant your fall garden.

Soil solarization is also used on a commercial scale (Fig. 3). To reduce labor cost of removing the clear plastic and laying down black plastic for production, the clear plastic is sprayed with white-wash after the soil has been solarized. Once the soil temperature drops to normal levels, the growers can plant their crop directly into the beds.

Research by horticulturists of the Texas A&M AgriLife Extension Service has found that soil solarization can suppress weeds both short and long term.

We studied the effects of soil solarization under varying conditions in 2011 and 2012. In each study, we prepared two 10- by 10-foot plots by removing all plant debris

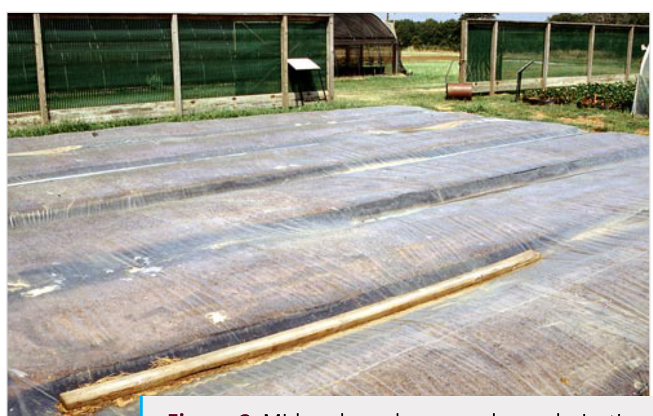

Figure 2. Mid-scale, or large-garden, solarization. *(Source: The Samuel Roberts Noble Foundation, www.noble.org)*

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Figure 3. Application of transparent polyethylene film to solarize a field on an organic vegetable farm in the San Joaquin Valley, California. *(Source: University of California)*

and saturating the soil with water to a depth of 6 inches. Then we covered one plot with clear plastic and secured the edges to contain the heat and steam produced.

The study compared the air and soil temperatures of bare-ground and solarized soil for about 30 days in 2011 and 2012 (Figs. 4 and 5). In both years, the solarized soil reached much higher temperatures—up to 180°F—than did the control plot, which reached only 115°F and 120°F.

In 2011, the lowest soil temperature recorded in the solarized plot almost equaled the highest temperature in the bare-ground plot, about 120°F. In 2012, the minimum soil temperature in the solarized plot was 98°F, compared to the maximum temperature of 108°F in the bare-ground plot.

Four weeks after removing the tarp, we found 90 germinated weeds in soil taken from non-solarized plots and three from soil taken from solarized plots in 2011.

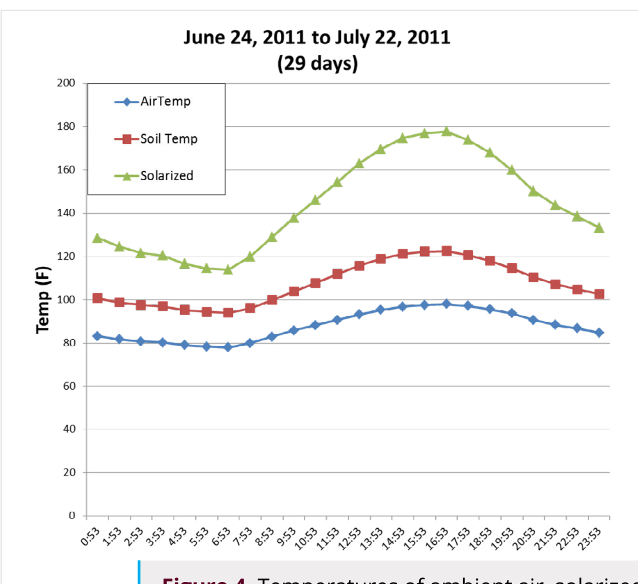

Figure 4. Temperatures of ambient air, solarized soil, and non-solarized soil recorded in College Station, TX, from June 24, 2011, to July 22, 2011.

In 2012, we found 300 germinated weeds from non-solarized soil and 19 from solarized soil.

In another study, we measured the temperature of solarized and non-solarized soil for 73 days beginning September 23, 2012. We rototilled two 10- by 10-foot plots and removed all plant debris from them. An overhead sprinkler applied water to the plots for 24 hours.

One day later, we covered one of the beds with clear plastic and secured the edges of the plastic with soil. The control bed consisted of bare ground.

We recorded air and soil temperatures daily at a 6-inch depth in both beds (Fig. 6). We removed the plastic on December 4.

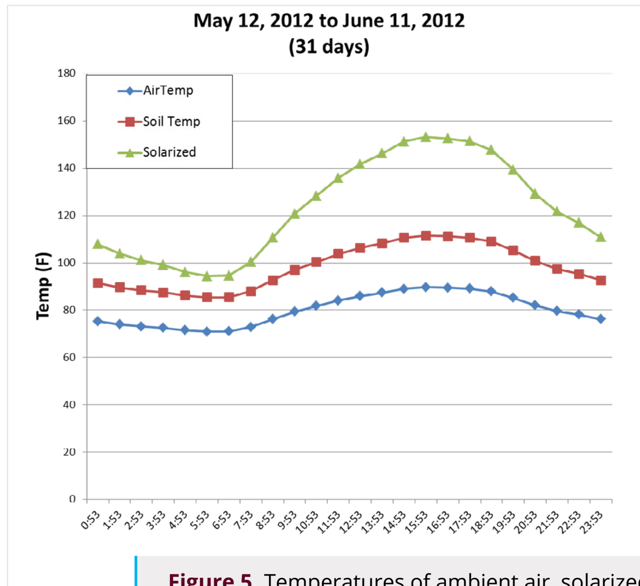

Figure 5. Temperatures of ambient air, solarized soil, and non-solarized soil recorded from May 12, 2012, to June 11, 2012, in College Station, TX.

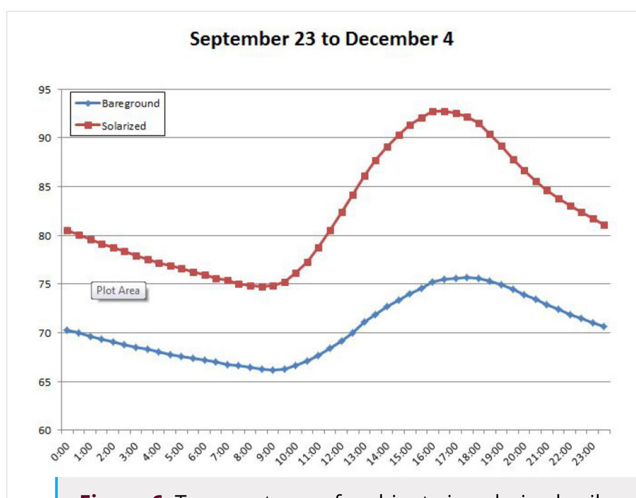

Figure 6. Temperatures of ambient air, solarized soil, and non-solarized soil recorded in College Station, TX, from September 23, 2012, to December 4, 2012.

As in the previous study, the minimum soil temperature of solarized soil in 2012 was about the same as the maximum temperature of soil in the control plot of bare ground. Immediately after the tarps were removed, the solarized plot had no weeds.

Figure 7 shows the weed pressure 3 weeks after the plastic cover was removed. The solarized bed had few weeds, and those present consisted of newly emerged grasses, mostly near the edges of the plot. The bare-ground plot had significant pressure from both annual and perennial weeds.

On March 12, 2013, or 147 days after the plastic cover was removed, the solarized plot had only perennial weeds (Fig. 8A). The control plot (Fig. 8B) had broadleaves as well as annual and perennial grasses.

CONCLUSION

Home gardeners and crop producers can use solarization to significantly reduce weeds long and short term.

However, because solarization kills all organisms—even the beneficial ones—farmers and gardeners should replace the beneficial organisms by adding compost to the soil after it has been solarized.

FOR MORE INFORMATION

"Solarization and biofumigation help disinfest soil." By J. Stapleton, C. Elmore, and J. DeVay. 2000. *California Agriculture* 54(6):42–45. University of California.

Soil Solarization for Gardens & Landscapes: Integrated Pest Management for Home Gardeners and Landscape Professionals. University of California Agriculture and Natural Resources. *http://ucanr.edu/sites/Solarization/files/114635.pdf*

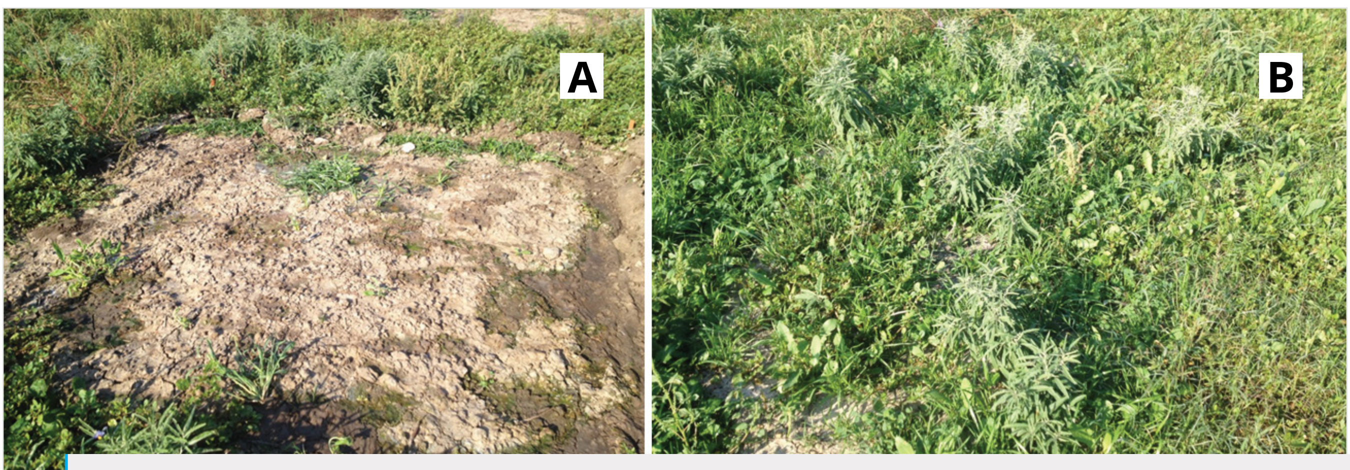

Figure 7. Plots of A) solarized soil and B) non-solarized soil 3 weeks after the plastic cover was removed from the solarized plot.

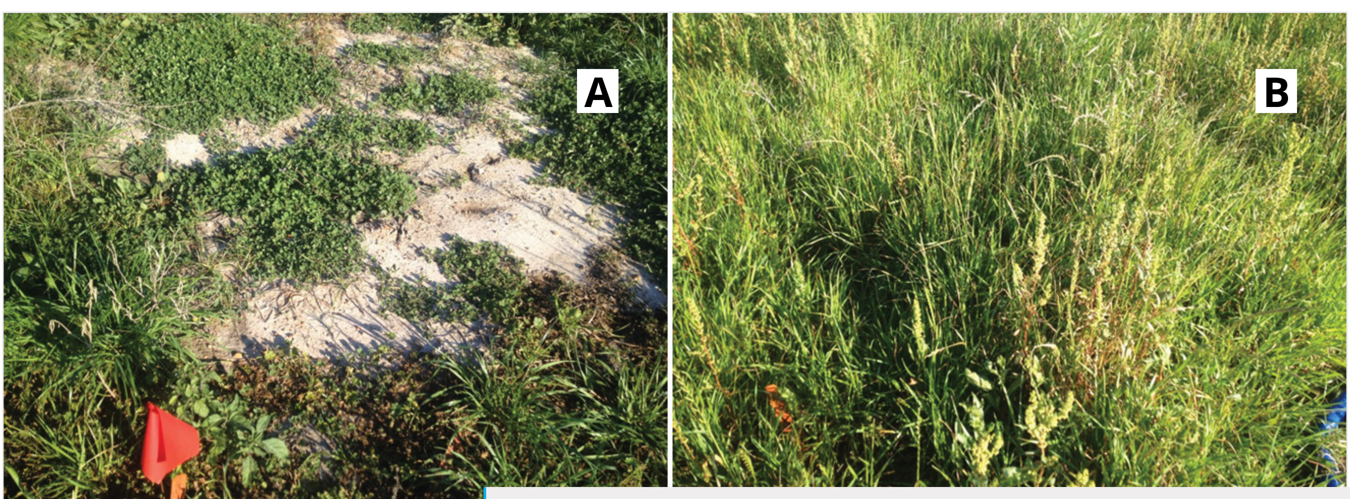

Figure 8. Plots of A) solarized soil and B) non-solarized soil on March 12, 2013, which was 147 days after the plastic cover was removed from the solarized plot.