



Solar Heating (Solarization) of Soil in Garden Plots for Control of Soilborne Plant Diseases

Kenneth E. Conway
Research Plant Pathologist

Laura S. Pickett
Supervisor, Plant Disease Diagnostic Lab

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Soil solarization is the easiest and simplest non-chemical alternative to control soilborne disease insects and weed seeds in garden soil. Crown rots, root rots, and wilts caused by certain plant pathogenic fungi and nematodes, or complexes of these pathogens, are often limiting factors in production of vegetables in the home garden. Traditionally, rotation of crops in a home garden or selection of another garden site has satisfactorily prevented major problems. However, when garden areas are planted year after year using neither rotation nor alternative sites, they eventually become infested with one or more soilborne plant pathogens. Therefore, soil fumigation and treatment to destroy plant pathogens, soil insects, and weeds has been recommended. (See OSU Extension Fact Sheet EPP-7614, "Chemical Fumigation of Soil to Control Soilborne Diseases and Nematodes in Home Gardens," and OSU Extension Fact Sheet EPP-7652, "Non-chemical Methods for Controlling Diseases in the Home Landscape and Garden.") However, chemical fumigation has its dangerous aspects and is rather costly. Recently a safer and much less costly soil solarization method has been demonstrated to be very effective for small and medium sized garden areas. Solarization controls a wide variety of soil pests and should be compatible with most Integrated Pest Management (IPM) programs.

Pasteurization of agricultural soils by solar heat (solarization) retained under a sealed clear polyethylene film has been achieved experimentally and is now being recommended, especially for home owners. Temperatures ranging from highs of 53°C (126°F) and 37°C (98°F) at depths of 2.5 cm (1.0 in) and 30 cm (12 in), respectively, have been recorded in research plots (Dr. K.E. Conway) at Stillwater and Bixby, OK. Soil had been covered with clear polyethylene for a week during September 1982. *Verticillium dahliae*, a fungal wilt pathogen, was controlled in these plots. Long-term solarization (16 weeks) controlled *V. dahliae*, in California, in a large-scale field experiment down to a depth of four feet. Research in other countries has demonstrated control of other plant pathogenic fungal genera (*Fusarium*, *Rhizoctonia*, *Sclerotium*, *Phytophthora*, *Pythium*, *Plasmodiophora*, *Pyrenochaeta*), nematodes (*Pratylenchus*, *Meloidogyne*, *Rotylenchus*, *Criconemella*, *Paratrichodorus*), and most annual and perennial weeds. The high temperatures obtained beneath polyethylenes sheeting will kill fungi, nematodes, many weed seeds, and soil insects. Experimental maintenance of a temperature of 37°C (98°F) to depths of at least 15 cm (6 in) achieved during a week in September indicates that solarization can be used during several summer months in Oklahoma.

Procedure

The area of the garden to be treated should be loosened with a plow, rototiller, or shovel, (Figure 1) and wetted. A drip irrigation system or sprinkler hose can be installed on the soil, to provide additional water. It is the soil water that will carry solar heat downward. Cover area with a sheet of thin, clear, polyethylene (plastic) film. This film is readily available in most hardware or garden stores.



Figure 1. Soil prepared (loosened) in advance of solarization (solar heating) treatment.



Figure 2. Prepared soil covered with clear polyethylene plastic sheeting. Note soil covered edges and placement of a drip hose for additional moisture, if needed.

The edges of the film should be sealed with soil to prevent heat loss and retain moisture (Figure 2). Leave the film in place for three to five weeks, if possible. The longer the soil is exposed to the heat generated by the solarization process, the greater the kill of undesirable organisms will be. Be sure to restrict the movement of house pets across this thin polyethylene. Dogs especially will leave holes in the film and allow heat to dissipate from beneath the film.

Principles of Soil Solarization

- 1) Use transparent (clear), not black, polyethylene because it transmits most of the solar radiation directly to the soil. Black polyethylene absorbs the heat and does not conduct the heat downward.
- 2) The thinnest polyethylene film available (25 μ -4ml) is the most effective and economical to use.
- 3) Solarization should ideally be done during the summer, June to September, when there are high air temperatures and intense solar radiation.
- 4) Soil should be kept damp to increase thermal sensitivity of fungal "resting" structures such as sclerotia, chlamydo-spores, etc. and to improve heat conduction. A single deep irrigation prior to treatment may be sufficient, but additional moisture may enhance solarization. A soaker hose or drip irrigation may be left under the film if additional watering is needed.
- 5) Longer periods of solarization will greatly improve control of pest organisms, particularly at greater depths.
- 6) Solarization has the characteristics of an integrated control process because physical, chemical, and biological control mechanisms may be involved and a variety of pests are controlled.
- 7) Solarized soil may quickly become reinfested if contaminated soil is brought into the treated area by dirty shoes, contaminated tools, flowing water, and even animals. Make a serious effort to avoid recontaminating the solarized area.

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