

Soil Solarization **(Harnessing the Sun to Control Weeds and More)**

On a sunny day while doing house maintenance, have you ever laid a window down on the grass, only to come back and find you have made a lot more work? Namely having to replace or reseed the grass under where the window laid. It does not take long on a sunny day for the heat of the sun to cook the grass leaving a dead brown spot.

Soil Solarization is the harnessing of this same technique on a larger scale in agriculture and home gardens to control many pests and improve the soil. It can be used to control weeds, nematodes, bacteria, and fungus as well as condition the soil. The technique uses no chemicals or pesticides and works well on both large and small sites with a little planning. All you need to be successful using the technique is a little labor, plastic sheeting, time and some sunlight.

If you have been by the Gardening 101 Site at the Northland Arboretum this summer you have seen Soil Solarization in action. Early this spring the Crow Wing County Master Gardeners, the University of Minnesota and Northland Arboretum determined in person gardening classes could not be held due to COVID-19. This meant a large section of the raised garden beds would not be used and being left unattended they would become overgrown with weeds and pests. An extraordinary amount of work next spring would be required to return these raised beds to usable condition.

To save the soil and gardens, the decision was made to cover the unused garden beds with plastic sheets to keep the weeds down and use Soil Solarization to improve the beds. The method involves heating the soil by covering it with plastic during the heat of the summer when the most solar radiation occurs. The plastic traps solar radiation and heat thereby cooking the underlying soil and killing many weeds and pests. I know what some of you are thinking, namely: "How can that work in Minnesota where we don't have the strong sun like in California or Florida?"



The reality is we don't have the same amount of daylight hours, the sun is at a lower angle giving us less energy and our air temperatures are lower. So northern gardeners and farmers must improvise a little compared to our southern neighbors. For example, in southern climates clear plastic is the best choice as it lets in light to heat the soil quickly thereby killing most unwanted weeds before they can get started. In our Northern climate Black Plastic is the better choice it eliminates light that might trigger weed germination while the soil is slowly heating.

The goal is to increase the surface soil temperature high enough and long enough to kill whatever pathogen you are trying to control. For example, the temperature of the top 1 – 6 inches of soil must reach 110 – 125 degrees to kill most harmful weed seeds, nematodes, bacteria and fungus.¹ These temperatures are relatively easy to reach in the south and why the technique is widely used for pest management. In the north these temperatures can also be reached but it may take longer due to our weaker sun and cooler air temperatures.

Solarization is primarily a broad-spectrum control technique. Its effects are greatest at the surface and diminishes as depth increases. So, when the plastic is removed it is best to lightly till the soil to avoid bringing pests which may have survived at greater depths back to the surface. While the technique is non-discriminatory and may harm some beneficial soil bacteria and fungus, studies have shown the good bacteria and fungus recover much quicker and easier than their bad counterparts in solarized soils.²

So back to the question “Can Solarization Work in Minnesota”? During the months of June, July and August we have been monitoring the surface and subsurface of the covered gardens at the Northland Arboretum. While time of day, air temperature, wind and whether the day is clear or cloudy impacts the soil temperatures the results are remarkable.

¹ See <https://local.extension.umn.edu/local/le-sueur/master-gardeners/article/solarization-the-garden>

² See <http://ipm.ucanr.edu/PMG/PESTNOTES/pn74145.html>



This surface temperature of 151.3 Degrees was on a partly cloudy 74 Degree day. But what really counts with Soil Solarization is the temperature below the surface where the weed seeds, nematodes, bacteria and fungus reside. A few spot checks showed that on this same day temperatures 4 inches deep were an astonishing 147.9 Degrees. Soil Solarization definitely can work in Minnesota!



There are a few things to keep in mind when using the technique. First, try to have the plastic lay on the soil as closely as possible. This avoids having an air pocket which could insulate the soil from some of the heat you are trying to generate. Second, make sure the soil is wet before adding the plastic. This helps magnify the heating effect.

Since the point of the technique is to have the sun provide the most heating energy it works best on flat sites or sites that slope to the sun. Sites that slope away from the sun will allow much more of the sun's energy to be reflected away and temperatures will be cooler.

Finally, solarization is both time- and temperature-dependent. The cooler the soil temperatures, the longer the plastic needs to remain in place to raise the temperature to desired levels. The goal is to maintain daily maximum temperatures in the top 6 inches of soil at or above 110° to 125°F. Use of a soil thermometer or temperature probe can verify achievement of these temperatures.

Four to six weeks of soil heating during the warmest time of the year is usually enough to control most soil pests. In cool, windy, or cloudy locations, or if there are pests present that are difficult to control, it may be necessary to leave plastic in place longer. Conversely, during very hot weather, pests may be controlled with a shorter period of solarization.

In the case of the Gardening 101 site at the Northland Arboretum the plastic has been in place for over 12 weeks which is much longer than necessary to control most pests. This extended period of solarization will not harm the soil and aids with the breakdown of organic materials in the soil. So when we Gardening 101 starts next spring these raised beds should be in excellent shape from a little plastic, labor, time and free sunshine.

By: Dan E. Lee a University of Minnesota Crow Wing County Master Gardener