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Tarping and Occultation Techniques in Gardening and Farming

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What Is Tarping and Occultation?

Occultation or tarping covers the soil with light blocking plastic to kill vegetation (Figure 1). The technique prepares areas for planting and if applied long enough can control difficult to kill perennial weeds. Other uses include protecting areas from wet spring conditions that would make traditional tillage and bed prep difficult and the termination of cover crops without the use of heavy equipment. Stale seeding or the sprouting and killing of weeds prior to planting is another use for tarping. Tarping is sometimes confused with solarization. Solarization uses clear plastic and is only effective when high temperatures are achieved during non-cloudy conditions and warm weather. The high temperature of solarization can kill seeds as well as weeds. This factsheet focuses on tarping with light blocking material.

Figure 1. Occultation in a community garden. (Shawn Jadrnicek, Virginia Cooperative Extension)

Tarp Materials

Materials choice for tarping will determine the lifespan and application technique. Most small-scale growers use silage tarps for tarping techniques. Silage tarps are impermeable to water, white on one side and black on the opposite with UV inhibitors to increase lifespan. The UV rating on silage tarps ranges from 1.5-4 years, but the lifespan will increase to 6 years if the longer lasting tarps are removed from sunlight when not in use. Silage tarps vary in width and length with lengths ranging from 20 ft to 1000 ft and widths available in 10 ft increments from 20 ft to 150 ft. Black plastic sheeting available from hardware stores is not comparable to silage tarps and typically does not contain UV inhibitors. Without UV protection, the sheeting will photodegrade within a year's time and break apart into many small pieces making removal difficult. Reusing plastic sheets from billboards is sometimes used for tarping. However, billboard tarps may be made with an outer layer of Polyvinyl Chloride (PVC) which is not allowed as a mulch in organic production due to leaching concerns (NOP 205.601)

Nursery grade woven polyethylene ground cover traditionally used in plant nurseries and greenhouse operations is also used for tarping techniques (Figure 3). The material comes in different weights and grades that will last from 3- 20 years. Typically, a 3 oz material with UV inhibitors is used lasting from 5-10 years. The woven material is semi-permeable allowing water to pass through as well as a small amount of sunlight. Research is needed to determine if the permeability changes the amount of time required to kill weeds once covered in comparison to

impermeable silage tarps. Woven poly ground cover comes in widths varying from 3 ft, 4 ft, 5 ft, 6 ft, 8 ft, 10 ft, 12 ft and 15 ft and lengths up to 600 ft but more typically 300 ft. All cuts and holes in woven polyethylene should be made with a soldering torch or hot knife. Metal or wood templates with specific hole sizes ensure the plastic does not burn out of control. Avoid landscape fabric and non-UV treated plastic found at hardware stores for tarping techniques as the material may not sufficiently block light and/or may photodegrade prematurely.

Figure. 2. This 10-15 lb. bag used for securing occultation or solarization tarps is not UV resistant and will photodegrade within a year. (Shawn Jadrnicek, Virginia Cooperative Extension)

Application, Use, and Removal

The considerable weight of silage tarps makes them difficult to handle and move and smaller sizes are employed especially when moved by hand. A 5-mil silage tarp 50’ x 100’ will weigh approximately 120 lbs. The rolls are folded along the width so unrolling 20 ft and then cutting will provide a tarp that is 20 ft x 50 ft or 1/5 of the total size and reduce the weight to 24 lbs. When moved by hand, tarps that are less than 50lbs are suitable for a single person.

Unfolding and folding of tarps is considerably easier when two or more people conduct the operation. First, position the tarp at one edge in the field or area intended for use. The tarp should be long enough to cover the entire length of the field. If not, the impermeable nature of tarps will concentrate rainfall causing erosion of bare soil areas at the lower portion of the field where water runs off. Runoff and erosion control should be carefully planned especially when large areas are covered by ensuring the runoff occurs in areas vegetated with sod, cover crops or materials resistant to erosion. Properly grade the field before applying the tarp so the slope of the land is continuous without any low spots. Low areas will pool water which is difficult to remove without pumping or siphoning the water off. Every gallon of water weighs 8.3 pounds, and any amount left on the tarps will make moving difficult. If low areas cannot be removed, consider using woven poly ground cover instead of silage tarps to allow the water to pass through the material.

Prior to applying the tarp, incorporate all soil amendments and form mounded earth raised beds if needed or desired. Applying silage tarps over the top of wooden or metal beds is not effective as the sharp edges on these structures will rip through the plastic material. Instead, use woven poly ground cover which resists tearing. Water the area thoroughly to ensure that any weed seeds under the tarp will have enough moisture to germinate. These seeds will grow and then die from lack of light leaving a weed free surface. Any soil disturbance that occurs after the tarp is removed will bring additional weeds seeds to the surface that will then germinate and compete with crops so soil disturbance after removing the tarp should be avoided by doing all bed preparation prior to tarp application.

Tarps are secured using weight bags placed around the edges at regular intervals as well as the center. The distance between weight bags will depend on the amount of wind the location receives and adding windbreaks will not only improve plant growth but will also reduce the amount of weight needed to hold tarps down. Typically, weight bags are placed at 5’ intervals along the edge and 10’ intervals down the center. Weight bags should be constructed of UV resistant material which is typically black due to the carbon black in the material that creates the UV protection. If the weight bag is white or any color except black UV protection may not be very long (Figure 2). Sometimes manufacturers will state how many hours a bag may hold up under sunlight, but caution is advised. For example, if the manufacturer states the bag withstands 2000 hours of sunlight it may only last 1 year in field conditions. Rolls of black mesh tubing is also available to make weight bags and offers an inexpensive option. An overhand knot is made in the tubing to form the base and another knot is made to secure the weight material inside the tube. Carefully add weight to the bags so

each bag weighs between 10-15 pounds. If lighter, they may not be effective and if heavier you will be moving unnecessary weight. Since 70 bags may be needed to secure a tarp 50’ x 100’ bags weighing 5 pounds more than needed mean 350 extra pounds will need to be moved. Some bags are designed to stand upright preventing having to bend over as far to lift and move bags. Moving bags is facilitated by using a forklift on a tractor and placing bags on pallets. Avoid using sharp objects like t-posts, wood or cinder blocks to weight silage tarps as these may create holes in the tarp material which will allow light to reach weeds below reducing effectiveness (Figure 5).

Killing Perennial Weeds with Tarps

Tarps will effectively kill perennial weeds when applied at the correct time of year and for the appropriate duration. By eliminating perennials weeds, subsequent gardening or farming will be easier and more productive. Tarping kills weeds by blocking the light and preventing photosynthesis, eventually exhausting root reserves of energy leading to plant death. Deer walking on tarps and sharp objects used as weights create holes rendering the technique less useful (Figure 5,6). Perennial weeds should be actively growing with green leaves for the tarping to be effective. For example, bermudagrass (wiregrass) is a perennial that is dormant during the winter. Therefore, for tarping to be effective the bermudagrass would need to be covered when it is actively growing which will vary by location. In hardiness zone 7b bermudagrass usually emerges early-May and goes dormant when it freezes in late October. Research was conducted in 2023 in Roanoke, Virginia to determine the timeframe required under cover to kill perennial weeds and is available in Table 1. For this research, all plots were tarped at the same time on May 9th and then every two weeks three new plots were uncovered, irrigated and left uncovered for two weeks to determine what weeds regenerated. An edge effect was observed during this research showing perennial weeds may have survived if they were within a few feet of the edge of the tarp. Observations show that some weeds like nutsedge survived long periods under tarps and the nutsedge was not readily noticeable until the tarping killed the other weeds. Some notable results with perennial weeds include bermudagrass (*Cynodon dactylon*) was killed 14-16 weeks after tarping and Johnson grass (*Sorghum halepense*) was killed 14 weeks after tarping. More research needs to be conducted to determine if less time is needed to kill perennial weeds by applying tarps at different times of year and under various climates. For example, personal observations showed bermudagrass was killed when a tarp was applied mid-August remaining in place into the winter. The bermudagrass was under the tarp for approximately 10 weeks before it went dormant for the winter and was killed completely the following year. Herbicide applications to kill bermudagrass are also more effective when applied prior to the bermudagrass going dormant. Understanding the minimum time required to kill weeds allows fields to enter production earlier while also ensuring weeds will be killed.

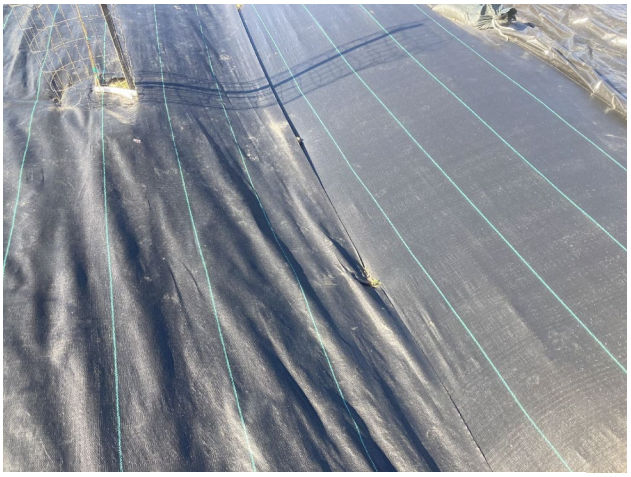

Figure 3. A woven polyethylene landscaping tarp. (Shawn Jadrnicek, Virginia Cooperative Extension)

Figure 4. A torn non-UV-treated black tarp. (Shawn Jadrnicek, Virginia Cooperative Extension)

Figure 5. Light penetrating a torn UV-treated silage tarp allows weeds to persist (Shawn Jadrnicek, Virginia Cooperative Extension)

Figure 6. Deer damage on a UV-treated silage tarp. (Shawn Jadrnicek, Virginia Cooperative Extension)

Killing Cover Crops with Tarps

Killing cover crops with tarps provides an opportunity to terminate the cover crop with minimal equipment. The cover crop residue is either left on the surface as a mulch or the reduced residue after tarping makes incorporation easier with a tiller or shovel. The timeframe under tarps will depend on the time of year the plants are covered. Personal observations in Virginia and South Carolina showed a winter cover crop of cereal rye and crimson clover required 5 weeks under cover to kill the cover crop by March 1. However, observations in New York showed a cereal rye cover crop could be killed in 3 weeks when covered between late April and mid-May (Lounsbury 2022). Likely, temperature and maturity of the cover crop determines how long it takes to kill cover crops, but more research is needed. If the cover crop is mown before covering with tarps the remaining stubs of the residue may poke holes through the tarp if a silage type tarp is used but will have no effect on stronger woven poly tarping material. Alternatively, the cover crop is rolled or pushed down before covering with a lawn roller, a disengaged rotary tiller or a 2 x 4 or t-post attached to a rope.

Terminating cover crops with woven poly has an added advantage. After termination, holes are burned and transplants placed into soil beneath the residue under the cover. However, research shows residue under tarps insulates soil creating soil temperatures lower than tarps contacting bare soil or bare soil alone (Lounsbury 2021, 2022). Personal observations show slower growth and more susceptibility to cold damage when residue is left under woven poly in spring planted vegetables.

Table 1. Timeframe required to kill weeds

	2 weeks		4 weeks		Week 6		Week 8		Week 10		Week 12		Week 14		Week 16	
Weed Species	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A
Bedstraw *Galium aparine*	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Bermudagrass *Cynodon dactylon*	3	3	3	2	3	3	3	3	3	3	3	3	3	1S1R	3	0
Black medic *Medicago lupulina*	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0
Blackberry *Rubus spp.*	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0
Buff Petal *Rhynchosida physocalyx*	0	0	0	0	0	0	0	0	0	1S	0	1S	0	0	0	0
Bulbous Buttercup *Ranunculus bulbosus*	1	0	1	0	2	0	3	0	1	0	0	0	1	0	0	0
Carolina geranium *Geranium carolinianum*	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Corn Gromwell *Lithospermum arvense*	0	0	1	1	0	0	0	0	1	0	1	0	0	0	2	0
Crabgrass *Digitaria sp.*	0	0	0	0	0	1S	0	1S	0	0	0	1S	0	0	0	0
Curly Dock *Rumex crispus*	1	1	1	2	1	1	0	0	1	0	2	0	1	0	1	0
Dandelion *Taraxacum officinale*	0	2	2	2	0	2	0	3	1	2	1	2	1	1S	2	1
Fescue *Festuca arundinacea*	3	3	3	2	2	0	2	0	2	0	3	0	3	0	2	0
Field Bindweed *Convolvulus arvensis*	0	1	1	0	0	2	0	1	0	0	0	0	0	0	0	0
Ground Ivy *Glechoma hederacea*	0	0	0	0	1	0	2	0	1	0	1	0	0	0	0	0
Hairy Ruella *Ruellia humilis*	2	1	2	1	1	0	1	0	2	0	3	0	1	0	2	0
Johnson Grass *Sorghum halepense*	2	3	2	3	2	0	1	0	1	0	1	1	2	0	2	0
Morning Glory *Ipomea sp.*	0	0	0	0	0	1S	0	0	0	1S	0	1S	0	0	0	0
Mugwort *Artemesia vulgaris*	2	2	1	1	3	3	1	2	1	2	3	3	2	2	2	2
Nutsedge *Cyperus spp.*	0	2	0	3	0	3	0	2	0	2	0	3	0	2	0	3
Pigweed *Amaranthus spp.*	0	0	0	1	0	1S	0	2S	0	2S	0	3S	0	0	0	1
Plantain *Plantago major*	2	2	0	1	3	0	3	0	2	0	2	0	3	0	1	1
Purple Deadnettle *Lamium purpureum*	0	0	1	0	2	0	1	0	0	0	0	0	1	0	1	0
Purple violet *Viola sororia*	1	1	3	3	1	2	0	1	2	2	3	3	0	0	3	0
Red Clover *Trifolium pratense*	2	1	3	0	1	0	2	0	1	0	1	0	1	0	2	0
Rescue Brome *Bromus spp.*	2	2	1	0	3	0	1	0	1	0	2	0	2	0	2	0
Sow Thistle *Sonchus oleraceus*	0	0	2	1	0	0	0	0	0	0	0	0	0	0	1	0
Speedwell *Veronica persica*	0	0	0	0	0	1	1	0	1	0	0	0	0	1S	0	0
Vetch *Vicia spp.*	3	0	2	0	3	0	3	0	3	0	2	0	3	1S	2	0
White Campion *Silene latifolia*	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
White Clover *Trifolium repens*	1	1	1	0	0	0	1	0	1	0	0	0	1	0	1	0
Wild Garlic *Allium vineale*	1	0	0	0	0	0	0	0	1	0	2	0	0	0	1	2
Yellow woodsorrel *Oxalis stricta*	1	1	0	0	0	0	0	0	1	1	1	3	0	0	0	0

Source: Trials conducted on 8’ x 8’ plots in Roanoke, Virginia starting May 9, 2023.
Note: B = number of plots with weeds before treatment; A = number of plots with weeds after treatment; S = weed growth from seed; R = weed growth from rhizome

References

Birthisel, Sonja K., Eric R. Gallandt, and Ana Eliza Souza Cunha. "Solarization and Tarping for Weed Management on Organic Vegetable Farms in the Northeast USA." (2018).

Birthisel, Sonja K., and Eric R. Gallandt. "Trials evaluating solarization and tarping for improved stale seedbed preparation in the Northeast USA." *Organic Farming* 5, no. 1 (2019): 52-65.

Kubalek, Roger, David Granatstein, Doug Collins, and Carol Miles. "Review of Tarping and a Case Study on Small-scale Organic Farms." *HortTechnology* 32, no. 2 (2022): 119-128.

Lounsbury, Natalie P., Nicholas D. Warren, Seamus D. Wolfe, and Richard G. Smith. "Investigating tarps to facilitate organic no-till cabbage production with high-residue cover crops." (2018).

Lounsbury, N. “Cover Crop-Based No-Till for Small Farms: Tradeoffs of termination time, method, and ecosystem services (Doctoral Dissertation, University of New Hampshire) (2021).

Lounsbury N., Birthisel, S., Lilley, J., and Maher, R. “Tarping in the Northeast: A Guide for Small Farms.” (2022)

Rylander, Haley, Anusuya Rangarajan, Ryan M. Maher, Mark G. Hutton, Nicholas W. Rowley, Margaret T. McGrath, and Zachary F. Sexton. "Black plastic tarps advance organic reduced tillage I: Impact on soils, weed seed survival, and crop residue." *HortScience* 55, no. 6 (2020): 819-825.

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