Use of Frost Fabric as a Seedbed Mulch and Frost Protection Method

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Abstract—Spring frosts can cause substantial losses to seedling nurseries. Frost fabric - a spunbonded polypropylene product - is found to keep surface soil temperatures above freezing during frost events. It may be an alternative to irrigation and other traditional frost control methods. It is also a satisfactory seedbed mulch. Application and removal methods and equipment have been developed to facilitate use of this fabric on a production basis.

WHY FROST FABRIC?

The Colorado State Forest Service Nursery produces 2.5 million seedlings annually. Over 35 different species are grown, the majority are produced using bareroot methods. The seed dormancy of most of these species requires fall sowing. This takes place in early October. Seedling emergence occurs from late March through early May depending on species.

Erratic spring weather conditions lead to frequent periods of freezing temperatures. Damage, ranging from slight to catastrophic, often occurs.

Traditional frost control methods such as irrigation have not been effective for the writer. At another nursery, shade frames were found to warm soil surface temperatures as much as 2°F.

FROST FABRIC DESCRIPTION

This nursery began evaluating frost fabric as a frost control alternative. This product was originally developed to cover and protect established plants such as tomatoes. The fabric is a light spunbonded polypropylene plastic (Figure 1).

Figure 1. Field covered with frost fabric.

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FROST BARRIER SPECIFICATIONS

Spunbonded Polypropylene

1.5 ounces per square yard

Grab Tensile Strenght - 25 LBS.

Trapezoidal Tear Strength (MD-CD) 7.8-6.6 LBS.

Mullen Burst - 48 PSI

Frazier Permeability (cfm / sq. ft.) - 500

Thickness (inches) - 0.011

UV TREATED

It is UV treated to resist decomposition in sunlight and is reusable. Product cost is under four cents per square foot.

TEST RESULTS

Initial use of the fabric was for frost control only. In spring, at time of seedling emergence, the nursery's traditional mulch of sudan grass straw was removed and replaced with a covering of frost fabric. 5 foot 3 inch rolls were laid over top of 4 foot wide seedbeds.

Temperature was determined in covered and uncovered areas using a *Taylor* maximum-minimum temperature thermometer. The thermometer was placed flat on the bed surface. Minimum temperature differences between covered and uncovered areas ranged from 4° to 9°F. By using frost fabric, soil surface temperatures averaged 5° warmer than uncovered areas. The coldest soil surface temperature in uncovered areas was 25° with 32°F under the fabric (Table 1.)

Table 1. 1993 Minimum soil surface temperatures with frost fabric covering (fabric) and without (open).

Date	Fabric		Open		Difference	
	°F	°C	°F	°C	°F	°C
4/15	39°	4°	32°	0°	7°	4°
4/16	36°	2°	32°	0°	4°	2°
4/19	32°	0°	28°	-2°	4°	2°
4/20	32°	0°	25°	-4°	7°	4°
4/21	32°	0°	28°	-2°	4°	2°
4/23	32°	0°	28°	-2°	4°	2°
4/26	36°	2°	30°	-1°	5°	3°
4/28	45°	7°	41°	5°	4°	2°
4/29	39°	4°	32°	0°	7°	4°
5/03	36°	2°	27°	-3°	9°	5°
AVG. DIFF.					5°	3°

Table 2. 1993 Maximum soil surface temperatures with frost fabric covering (fabric) and without (open).

Date	Fabric		Open		Difference	
	°F	°C	°F	°C	°F	°C
4/15	97°	36°	68°	20°	29°	16°
4/16	90°	32°	68°	20°	22°	12°
4/19	106°	41°	79°	26°	27°	15°
4/20	91°	33°	79°	26°	12°	7°
4/21	97°	36°	75°	24°	22°	12°
4/23	97°	36°	75°	24°	22°	12°
4/26	109°	43°	72°	22°	37°	21°
4/28	113°	45°	84°	29°	29°	16°
4/29	120°	49°	90°	32°	30°	17°
5/03	106°	41°	84°	29°	22°	12°
AVG. DIFF.					25°	14°

Maximum soil surface temperatures under the fabric were quite high averaging 25°F warmer than uncovered areas. The highest maximum temperature recorded was 120°F (Table 2.)

Humidity levels underneath the fabric appeared high as well. While no obvious symptoms of heat damping-off were noted future practice will include irrigating for cooling to reduce these temperatures to sub-lethal readings.

USE AS A SEEDBED MULCH

Traditional mulching methods at this nursery have been using

some form of a thick straw mulch. In recent years sudan grass and alfalfa were used for this purpose. The objectives of mulching were to maintain adequate soil moisture for the overwintering process and keeping soil temperatures cool to prevent early germination.

In comparison, frost fabric does an adequate job of moisture retention but may require more frequent irrigation than straw mulch. Seedling germination and emergence seems to occur up to two weeks earlier. However, one can leave the fabric on during emergence where the straw much should be removed.

Nursery soils are sandy clay loams prone to crusting. The fabric keeps the soil surface friable. Fabric has been used with spring sown beds to improve soil surface moisture and seedling emergence.

Application and removal of straw mulches is very labor intensive. Use of fabric mulch has significantly reduced hand labor. Additionally, the UV treated product can be reused, reducing its cost. The initial test sample was used for three successive seasons.

APPLICATION AND REMOVAL EQUIPMENT

To facilitate using this fabric and further reduce hand labor, Ron Huser and Rex Davidson of the nursery developed and fabricated equipment for the process. The applicator is designed after "weed barrier machines" in common use for conservation tree planting in Colorado (Figure 2).

The edges of the 5 foot 3 inch wide fabric are pushed under and covered by a small layer of soil. Seedbed ends are secured by hand dug trenches. This anchoring method is sufficient to withstand Chinook winds of 90 mph.

For reuse the fabric must be rolled up into a tight roll with smooth ends. A machine was developed for this purpose using a hydraulic motor for spooling up the fabric (Figure 3).

POTENTIAL DISADVANTAGES

Use of frost fabric has improved stand densities, reduced frost damage and improved surface soil moisture and tilth during the critical emergence period. These advantages combined with labor efficiencies has lead to the decision to use this product as the mulching method on all fall sown nursery seedbeds.

Potential disadvantages are also noted. Insect populations seem higher under the fabric. The micro-climate created may increase insect survival. This nursery has never used soil fumigation. While the fabric is quite light seedlings can be bent over from the weight but this seems temporary. The high temperatures were quite surprising. Irrigation for cooling will need to be continued to reduce chances for heat damp-off.

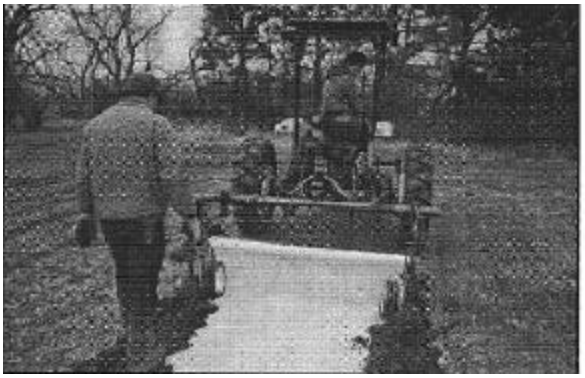

Figure 2. Applicator

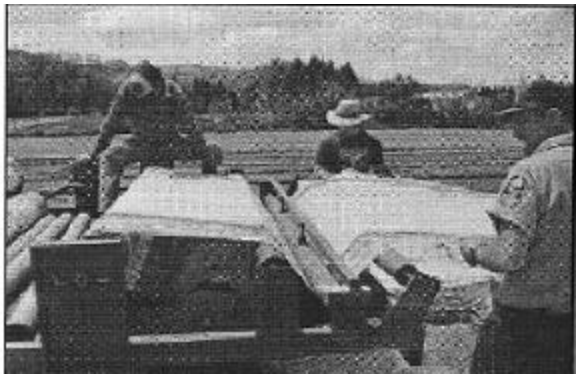

Figure 3. Roller-upper.