Overwinter Mulches
by Thomas D. Landis

Mulches are one of the oldest and most widely-used cultural practices in nurseries because they offer so many benefits (Borland 1990):

- **Conserve soil moisture** - Fibrous mulches create a textural change at the soil surface, which stops water from moving upward through capillarity and evaporating (Figure 1).

- **Reduce soil erosion** - All types of mulches dissipate the energy of raindrops and wind which can dislodge soil particles and leave them vulnerable to wind and water erosion.

- **Increase water infiltration** - Mulches stop soil crusting and allow irrigation and rainfall to slowly soak into the soil.

- **Insulate surface soils from temperature extremes** - Thick mulches form an insulating layer that dissipates solar energy and prevents soils from reaching damaging levels. When applied over cold or frozen soils, mulches slow soil warming which can prevent loss of dormancy or premature germination of fall-sown crops.

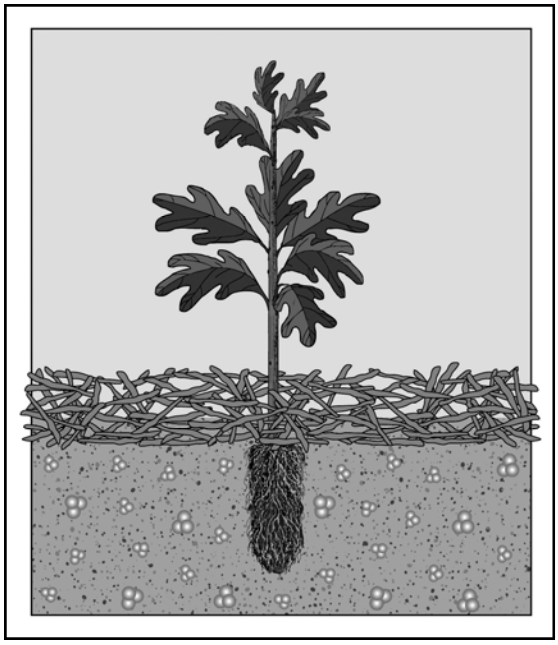

Figure 1 - Thick fibrous mulches prevent surface evaporation and wind and water erosion.

- **Stop wicking of salts** -A thick mulch can prevent soluble salts from moving upward as water is lost from the soil surface by evaporation.

- **Prevent frost heaving** - Because they insulate the soil surface, mulches prevent the recurring freeze and thaw cycles that cause frost heaving.

- **Reduce weed germination and growth** - Mulches control weeds in 2 ways: inhibition of weed seed germination by reducing light levels, and physical suppression (Mathers 2003).

Many growers use mulches after sowing or during the growing season but many people aren't aware of the benefits of using mulches during the winter season. Let's take a look at those last 2 benefits as they apply to overwintering.

Frost heaving.

At high latitudes and elevations, frost heaving can be a serious problem in bareroot nurseries and on outplanting sites. Frost heaving is a purely mechanical process whereby plants or other objects are slowly racheted out of the soil by repeated freezing and thawing (Goulet 1995). All types of nursery stock can be frost-heaved but small seedlings (Figure 2A). and recent transplants (Figure 2B) are particularly susceptible because they haven't developed a strong enough root system. Because of their smooth-walled root plugs, container plants are particularly susceptible after transplanting into bareroot beds or after fall outplanting. In fact, nurseries and foresters have avoided late summer or fall transplanting and outplanting because of concerns about frost heaving. Sites prone to frost heaving have high soil moisture and soil textures with good hydraulic conductivity (Bergsten and others 2001). The tendency to frost heave increases as pore size decreases, so silt and clay soils are most problematic. Southerly or southwesterly sites have more of a problem with frost heaving because the high solar exposure intensifies the freeze-thaw cycle.

Winter weed control.

Mulches are effective against weeds during the growing season but they can be especially valuable in controlling those pesky winter annuals. The seeds of winter annuals germinate in the fall, grow a strong tap root during the winter (Figure 3A), and then bloom and set seed very early in the spring. Winter annual weeds are difficult to control because they often go unnoticed during the winter and escape control in the spring when nurseries are very busy with other tasks like lifting and sowing.

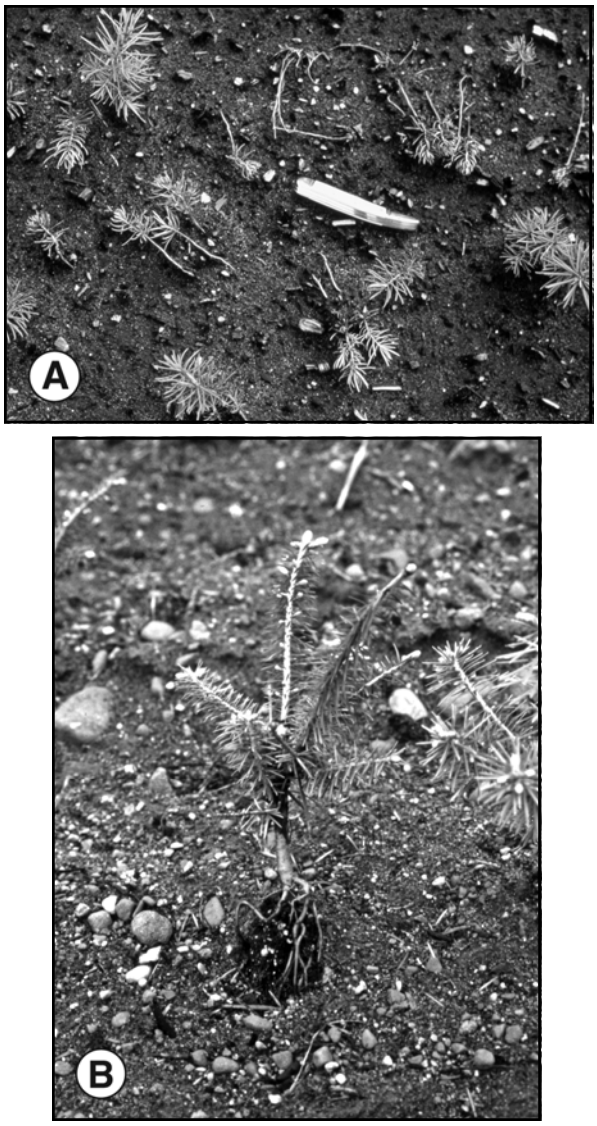

Figure 2 - Small seedlings (A) and recent transplants are particularly susceptible to frost heaving as are container plants due to the smooth walls of the plugs (B).

Some common examples of winter annual weeds include:

Purple deadnettle (*Lamium purpureum)*
Henbit (*Lamium amplexicaule*)
Field pennycress (*Thlaspi arvense*)
Shepherd's-purse (*Capsella bursa-pastoris*)
Small-flowered bittercress (*Cardamine parviflora*)
Common chickweed (*Stellaria media*)
Redstem filaree (*Erodium cicutarium*)

As previously mentioned, one way that mulches inhibit weed germination and growth is by physical inhibition. Most weed seeds need high light levels to germinate and dense or thick mulches keep weeds seeds in the dark and thereby stop germination. For example, mulberry weed (*Fatoua villosa*) is a new and invasive weed of bareroot and container nurseries the southeastern US, California, and Washington. When seed germination of this weed was measured under different mulches (Penny and Neal 2003), a mulch thickness of 2 inches (5 cm) was most effective (Figure 3B).

Mulches can also kill or inhibit weed growth through chemical means. Interestingly enough, mulches composed of immature municipal compost have shown better weed control than mature compost and other mulch types in ornamental container nurseries (Table 1). This herbicidal effect has been attributed to the buildup of organic acids, especially acetic acid, during the initial stages of composting. When they analyzed mulches of different ages, acetic acid levels were 2,474 ppm in the 3-day-old municipal compost, 1,776 ppm in an 8-week-old compost, and only 13 ppm in the mature (1-year-old) sample (Ozores-Hampton and others 2002). To avoid possible phytotoxicity to the crop plants, the authors recommend avoiding direct contact with crop plants and using them in tractor paths or in ground around containers.

Table 1 - Effect of different mulches on the germination and growth of Ivyleaf morningglory (*Ipomoea hederacea*) - modified from Ozores-Hampton and others (2002)

Type of Mulch	Emergence (%)	Shoot weight (g)	Root weight (g)
None	97	0.24	0.05
Sand	95	0.25	0.12
Immature municipal compost (3 days)	52	0.04	0.02
Mature municipal compost (1 year)	95	0.30	0.06

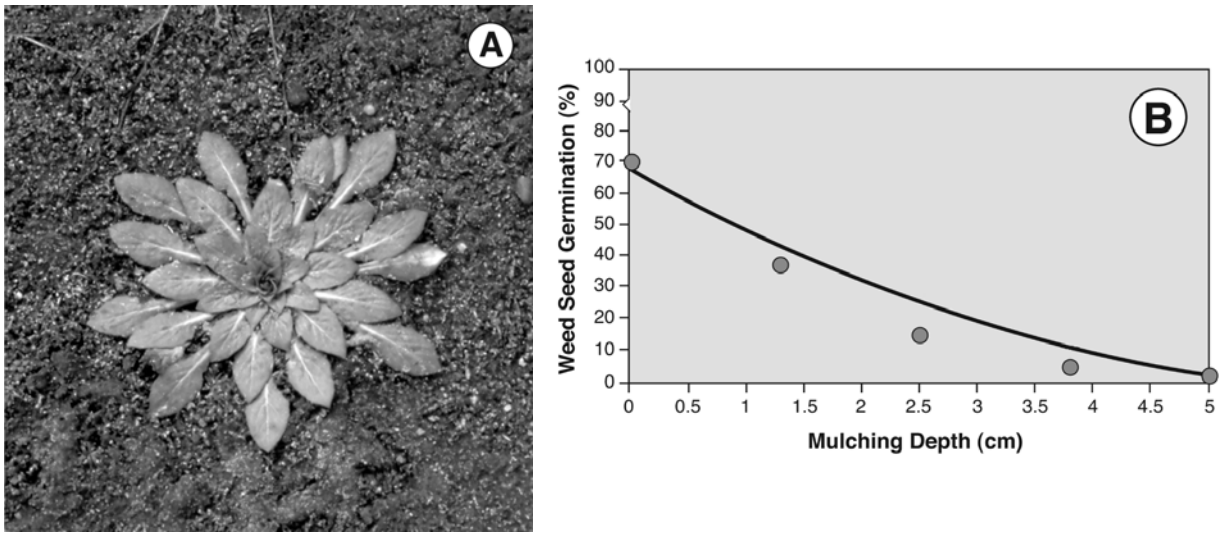

Figure 3 - Winter annuals develop a strong tap root and store energy over the winter (A) so that their shoots can grow rapidly and produce seeds early in the growing season. A 2 inch-thick mulch was most effective in preventing mulberry weed (Fatoua villosa) from germinating (B). B - modified from Penny and Neal (2003

Ornamental nurseries have also been experimenting with a novel approach to weed control in their large containers - mulches pretreated with preemergent herbicides. Bark nuggets treated with the herbicide oryzalin provided excellent weed control (Mathers 2003). I couldn't find any published information on herbicide-treated mulches in bareroot nurseries but the principle should be the same.

Summary.

Overwinter mulches can provide many benefits but preventing frost heaving and controlling winter annual weeds are especially effective. For controlling frost heaving, mulches must be thick enough to insulate and prevent repeated freezing and thawing throughout the winter. Mulches can prevent weed seed germination by physical exclusion of light and immature composts have also demonstrated chemical weed control. As always, these applications should be tested on your own crops on a small trial basis before full-scale operational use.

Sources:

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