Beaver Plastics

Technical Bulletin
Copperblock® trays

Copperblock trays inhibit root elongation in seedlings and stimulate root branching

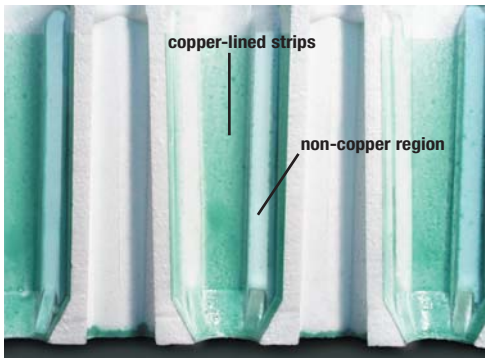
Copperblock®: Properties and function

Some tree species have aggressive root systems that adopt the shape of the cavity in which they are raised, and the root form may cause instability in the growing tree. *Pinus spp.* are most affected by seedling root form.

The Copperblock series of expanded polystyrene (EPS) trays uses copper to modify the root system of tray-grown seedlings. Copperblock trays work by inhibiting root elongation on contact with copper-lined strips on the cavity wall. Roots that come into contact with the non-copper regions may elongate downward. The result is a firm, balanced root system that is ready to grow.

The proprietary formula, with copper oxychloride as the active ingredient, is factory-applied to give a coating that will last for 3 to 5 years. The uniform layer releases copper ions steadily over this period.

The coating releases copper ions (Cu^{++}) when in contact with H^{+} (acid). As the roots contact the cavity wall and the media immediately adjacent to the cavity wall, copper is absorbed and accumulates in the root apices. This results in a slow-down or suspension of root elongation. As secondary and higher order laterals develop, they too slow or stop elongation on contact with the cavity wall. This results in a more fibrous root system with a more uniform root distribution within the cavity.



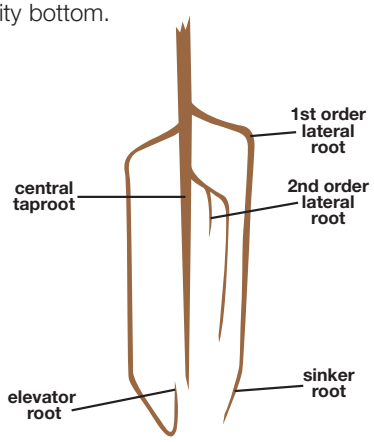
COPPERBLOCK TRAY STRIP COATING

Root form can be described as:

Ladder: root system with a central taproot from which first-order lateral roots radiate symmetrically at approximately equal distances along the taproot length.

Sinker: as in the ladder form, but with first-order lateral roots grown down the cavity wall to the bottom of the plug.

Elevator: a sinker root system with first-order lateral roots grown upwards after reaching the cavity bottom.



ROOT FORM DESCRIPTION

Root pruning. True pruning (cutting the roots) wastes seedling energy and resources and has the potential of predisposing the plant to disease through wounds and dead tissue. Copperblock seedling trays work by inhibiting root elongation on contact with the cavity wall. All biomass produced by the seedling will remain intact.

A study of Jack pine seedling roots in Copperblock revealed a total absence of sinker or elevator root form (Colombo and Chapman, 2005).

The Copperblock series of EPS trays are available in a wide range of cavity volumes and spacings in standard sized, multiple-cavity, trays.

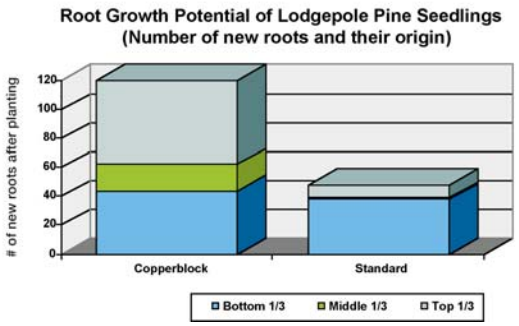
COPPERBLOCK ROOT FORM

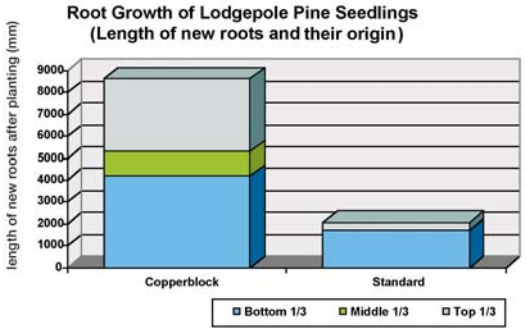
After planting the inhibited root tips begin active growth. Because there are more root tips and they are evenly distributed throughout the plug profile compared to a standard plug (Odlum, 1995; Smith and Watt, 1998), the seedling is more resistant to lodging and better able to exploit available water and nutrients.

Copper-pruned seedlings tend to have greater root growth potential after out-planting when compared to standard cavity grown plugs (McDonald et al, 1984; Arnold and Struve, 1989; Odlum, 1995; Watt and Smith, 1998).

Root growth potential is illustrated by a study of Lodgepole pine seedlings grown in Copperblock and a control. Roots were traced to their points of origin – top, middle or bottom third of the plug.

Length of new roots after planting was studied. The authors concluded that copper pruning resulted in roots that were quicker to grow and after transplanting had greater new growth from all sections of the plug (Watt and Smith, 1998).





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MANY STUDIES FOLLOW THE DEVELOPMENT OF SEEDLINGS AFTER PLANTING. THIS COPPERBLOCK LOBLOLLY PINE SHOWS ROOT GROWTH AFTER 100 DAYS.

Growing in a Copperblock tray

Acidity and water. The two most important factors affecting the growing of seedlings in Copperblock trays are media acidity and water content.

Acidity regulates the release of copper ions from the coating.

Water moves the ions out from the coating/media interface and into the interior of the plug.

Solution: Care must be taken to ensure that growing medium pH is maintained within a range from 4.8 to 5.5 and over-watering is avoided (Burdett et al, 1986).

A perched water table can develop in the bottom of a plug if irrigation is too frequent and the medium is not well drained. A young seedling may not dry out this region and copper levels can become excessive in the interior of the plug and root development may be inhibited – a negative feedback loop.

Solution: Adjust fertigation water to pH 5.5 – 6.0. Apply heavily, in cycles, allowing a thorough dry down period between applications. Limit pure water irrigation.

Low pH increases copper release and at a neutral pH the coating will have very little effect on root form. Irrigation water may be alkaline and expected, in time, to counteract the low pH of sphagnum peat moss (pH 3.5 – 4.5). A Copperblock exposed to a wet medium at pH 3.5 will release more copper than with a medium at pH 4.5 Growing media should be prepared with lime and aeration additives.

Solution: In extreme cases, raise the pH of the growing medium by applying alternate irrigations of potassium bicarbonate until target pH is reached.

Copper occurs naturally in soils and is a required micronutrient for plants. Typical foliar concentration in Copperblock-grown pine seedlings is 17 to 25ppm. However, Cu^{++} is easily taken up in preference to Fe^{++} and iron chlorosis can develop.

Solution: Apply 10ppm Fe, as chelate, in the fertigation, versus the usual 3ppm.

Sterilizing Copperblock trays

All the common procedures for EPS tray hygiene can be applied to Copperblocks:

- Hot water soak
- Steam
- Sodium metabisulphite
- Organic soap
- Hydrogen dioxide
- Hot air (wet)

Important: Steam temperature should not exceed 170ºF (77ºC).

Reusing Copperblock trays

The efficacy of the coating declines after three tree seedling crops have been raised in the Copperblock. To extend the effect, the growing media should receive less lime and have a lower pH.

The coating will prevent root penetration of the EPS and extend the useful life of the tray beyond the effective life of the coating.

Recycling Copperblock trays

The traces of copper coating incorporated in recycled materials Styrolite® and Styrogrit® have been shown to have no effect on seedling growth when the material is used in the nursery:

- Styrolite media amendment is used in the growing medium to increase aeration.
- Styrogrit seed cover is used to prevent drying of the germinating seed.

Arnold, M.A. and Struve, D.K. 1989. Growing green ash and red oak in $CuCO_3$ treated containers increases root regeneration and shoot growth following transplant. J. Amer. Soc. Hort. Sci. 114:402-406.

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Odlum, K.D. 1995. Environmental effects on root growth and other parameters. Presented at the Lustr Co-op annual general meeting. Thunder Bay, ON.

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Contact us today

Beaver Plastics Ltd.
11581-272 Street
Acheson, AB T7X 6E9

Phone: (780) **962-4433**
Toll Free: **1-888-453-5961**

Fax: (780) **962-4640**
Email: **growerinfo@beaverplastics.com**

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