



WHY COPPERBLOCK™?

For the landowner:

- tree stability from the Copperblock rootform – avoid toppling
 - rapid root egress = rapid establishment of Copperblock loblolly seedlings and
 - no ‘potbound’ seedlings if planting is delayed
- See the Technical Bulletin: Copperblock trays

For the nursery:

- EPA registered, factory coated
- resistant to fungal pathogens, easily pasteurized
- rigid, lightweight, non-abrasive for easy manual and automated handling
- stackable – after filling – for bulk transport in the nursery
- reusable, recyclable, small carbon footprint, economical
- wide selection – for a range of stocktypes (see the Copperblock specification sheet)

WHAT – IS THE PLASTIC?

Polystyrene was discovered by distilling the resin of *Liquidamber orientalis* but today is synthesized from benzene (petroleum byproduct) and ethylene (natural gas byproduct). The plastic is a hydrocarbon (hydrogen, oxygen and carbon). To make Expandable Polystyrene (EPS) a volatile blowing agent is added – this is pentane.



COPPERBLOCK LOBLOLLY 100 DAYS AFTER PLANTING. (LOWER COASTAL PLAIN, GEORGIA)

Shrinkage:

EPS containers shrink to the specified dimensions soon after manufacture. A ‘fresh’ Copperblock tray could be ¼” (6mm) over length and 1/8” (3mm) over width. Layout spacing and conveyor width should be designed to tolerate this variation.

Thermal conductivity:

- EPS = 0.033 W/mK
- ice = 1.6 W/mK

Expanded polystyrene has excellent insulation properties – it is 98% air.

Albedo (reflection):

Copperblocks (white) reflect short wave radiation and emit less long wave (heat) radiation that could stress seedling foliage.

WHERE – CAN YOU GET COPPERBLOCKS?

Beaver Plastics’ Copperblock trays are distributed throughout the USA by Stuewe & Sons of Corvallis, Oregon (Ph: 1-800-553-5331). They hold a small inventory of popular models and can supply samples – FTL orders require a lead time. See the current Stuewe & Sons catalogue.

FINANCING COPPERBLOCK TRAYS

Copperblock™ trays can be financed by agricultural equipment financing companies in the USA. Adopting a Copperblock tray lease program allows:

- use of operating expenses, preservation of capital
- predictable annual expense, extended terms
- determination of seedling cost input for the life of the container (cost per cavity)

Further details can be obtained from Stuewe & Sons or directly from the finance companies.

TESTING & TRIALING



Variations in climate and weather between nursery sites make it wise to start with a Test Buffer Zone Nursery and carefully monitor seedling growth. A test nursery should study only one Copperblock model.

Trials of different Copperblock trays may require a sophisticated irrigation system to accommodate the different cavity volumes and their different needs. Trials with a statistical design can provide a measure of assurance that the observed result is due to the treatment applied (Copperblock model) and not to irrigation inadequacies.

STORAGE & HANDLING

All plastic seedling containers will degrade in intense sunlight. The addition of ultraviolet light blockers, like carbon black, will slow the process



COPPERBLOCK STORAGE – NOTE PALLET ON TOP.

but will also absorb and re-radiate heat. Therefore, Copperblock trays should be stored under cover or stacked to minimize exposure and be secured from wind forces. Do not return empty Copperblock trays to the growing area for storage between uses.

EPS containers are 'user friendly': soft on the hands with optimal dimensions for lifting and lightweight. Compressive strength is high (>200kPa [>30psi]) – very stackable – while the tensile strength is just 10% of that – therefore the practice of carrying a Copperblock tray by inserting fingers in cavities can snap out a sidewall and should be discouraged.

SUPPORT SYSTEM

There are two Copperblock tray formats that may be used in a loblolly Buffer Zone Nursery:

- **Format 600** Measures 23 5/8" long (600mm) X 13 7/8" wide (352mm)
- **Southern Format** Measures 26 1/2" long (673mm) X 13 1/2" wide (343mm)

There is, at present, a much wider range of models in Format 600. The Southern Format is compatible with benching designed for the Hortiblock series of containers used for vegetable seedling production.

Caution: The format chosen will impact support design.

Copperblock trays need to be raised above the ground to allow air pruning of roots that would

emerge from the drainage hole at the base of each cavity. Air movement desiccates the growing tip and stops root elongation (just as root-pruning in a bare-root bed severs the downward extending roots).

Raising the Copperblock trays a few inches is effective if air movement is not restricted. Raising the crop to working height (42" = 1075mm [ISO 14738]) will be ergonomically efficient. The height should be just below elbow height for the taller workers.

The container rigidity allows the Copperblock trays to be supported only at each end. The popular aluminum T-bar support is spaced on the long dimension of the container.

STARTUP

A test nursery in a buffer zone can utilize a simple support system – e.g. 4" irrigation pipes laid 12" apart on the bare-root beds.

Support systems vary widely e.g. wires, pipes, T-bar, pallets and even old hospital beds! The design of a support system must consider:

- access (for manual tasks)
- underblock airflow (for hygiene and pruning)
- Copperblock tray handling (for layout, tasks and harvest)
- mechanization (of tasks e.g. topping)

ENDUP ↓

The support system must permit mechanization – of layout,

topping and lifting for harvest.

MECHANIZATION & AUTOMATION

Northern species growing in containers are frequently moved between cultural zones in the nursery – handling systems have been developed to meet this need. Copperblock trays in Buffer Zone loblolly nurseries take only 2 steps:

1. From seeding to layout

The first move is made with Copperblock trays stacked (on a trailer or pallet) and moved to the final location manually or by moveable conveyor and positioned by hand.

2. From layout to harvest

The second move handles Copperblock trays with mature seedlings, lifted manually to a trailer and later unloaded manually at the harvest line.

A layout rate up to 10,000 Copperblock trays per double-shift can be achieved with current mechanization (~ 1 million seedlings per day)

A harvest rate of 7,500 Copperblock trays per shift can be achieved with current mechanization (~ w million seedlings per day)

Palletized growing systems lend themselves to mechanization and automation but add cost to an otherwise simple infrastructure. Common pallets hold 20 Copperblock trays each.

CLEANING & PASTEURIZING

Immediately after harvest remaining growing medium is dislodged by directed impact followed by washing with water jets – the water is often filtered and re-used in the "block-washer".

Pasteurization is achieved with steam or, more commonly, with a hot water soak.

Hot Water Soak:
batch wise – 30 mins @145°F
high temperature short time (HTST) – 2 min @ 165°F
– 1 min @ 170°F

REUSE & RECYCLING

Copperblock trays will modify root form (root pruning) for 4 to 5 crops if the growing medium pH has remained in the range 5 - 6. Useful life can be extended at the higher pH but at pH7 no active ingredient is released.

At the end of their useful life Copperblock trays can be recycled – in the nursery – into a soil amendment (Styrolite™) or a seed cover material (Styrogrit™). Retired Copperblock trays can be marketed for reuse as "Terrafill" in landscaping – particularly in Green Roof landscaping.

Carbon Footprint (Copperblock 112/105ml):

Cradle-to-gate = 20tCO₂eq/million cavities

Use 5 times = 4tCO₂eq/million cavities

WHY USE COPPERBLOCK TRAYS?

Value-added Features:

A Copperblock loblolly pine or longleaf pine may cost ½¢ more than a container seedling without this treatment. Is it worth it?

The nursery manager will not benefit greatly from using

Copperblock trays but the landowner may benefit greatly. The Copperblock seedling choice should be regarded as insurance.

• for as little as \$3/acre.

Do you have life insurance? Sure. You have never claimed on your life insurance – is it worth it?

Tree stability:

The Copperblock trays seedling root form is not distorted by the container. The rootform is more natural with multiple root tips in suspended elongation on all faces of the root plug.

When removed from the Copperblock tray and planted in the field these root tips can resume elongation and roots will radiate in all directions naturally.

Roots radiating in all directions will provide stability for a tree subjected to wind pressure. This is critical in the first six to eight years – while top growth presents increasing resistance to wind.

Toppling effects are being experienced in the SE USA many miles from the path of hurricanes. Toppling may be the extreme of windfall or the less obvious sinuosity with attendant compression wood formation – leading to the loss of the basal log at harvest.

• \$3 per acre – is it worth it?

Rapid Root Egress:

Container seedlings permit the extension of the planting window (early and late) and the planting of non-dormant seedlings.

These conditioned seedlings can grow immediately but may also experience transplanting shock (a delay before root and shoot extension).

Copperblock trays seedlings, correctly conditioned, can rapidly establish moisture relations with the soil as root elongation can resume immediately on planting – the root tip is not pruned nor is it desiccated.

Rapid root egress leads to faster establishment, earlier and greater growth. Increased growth can benefit the landowner by shortening the rotation (similar to the benefit of planting larger stocktypes). Increased growth should also lead to earlier canopy closure and reduced weed control treatments.

• \$3 per acre – is it worth it?

Raised planting:

Containerized longleaf pine seedlings can be planted with as much as two inches of the plug above ground (Longleaf Alliance advisory). This planting technique ensures that the bud is not covered by soil after a heavy rainfall and can improve survival.

The tap root is protected by the growing medium in the exposed portion of the plug but lateral roots will be desiccated if exposed.

Copperblock longleaf seedlings can lose upper lateral roots but mid and lower laterals will not be affected. Standard longleaf seedlings with a majority of lateral roots originating in the top part of the plug may experience greater transplant shock.

• \$3 per acre – is it worth it?

Deep planting:

Bare root and container seedlings are often deep planted to ensure roots meet moist soil (sometimes to reduce transpirational moisture loss). This is usually limited by the cost of deep planting.

The Copperblock tray seedling rootform presents moisture absorbing root tips from top to bottom of the plug. Lower roots can take advantage of residual moisture in the soil and upper roots can absorb moisture from light rainfall that may not penetrate deeply. • \$3 per acre – is it worth it?

Normal Planting:

Root growth is minimal when soil temperature in the root zone is lower than about 46° F. Seedlings planted in the normal window (January-February) do not show active root growth at this time.

Copperblock tray seedlings, with viable root tips at the top of the rootplug can begin root growth as soon as suitable soil temperatures reach the top of the plug.

• \$3 per acre – is it worth it?

IN THE NURSERY:

Rootbinding:

Root deformity (potbinding/rootbinding) can be severe in standard containers if seedlings are not harvested on schedule (and most loblolly container seedlings are not cool stored). Rootbinding increases transplanting shock (Auburn Coop) and reflects reduced seedling quality.

Copperblock trays seedlings retain the same rootform if harvest is delayed.

• ½¢ per seedling – is it worth it?

Fungicidal:

The Copperblock trays treatment includes copper oxychloride as active ingredient. This is a common fungicide and these properties are not lost in the treatment, though Beaver Plastics makes no claims of efficacy.

The Copperblock trays has received EPA registration and is licensed for sale.

• ½¢ per seedling – is it worth it?

What does the Copperblock tray do?

The coating on the cavity wall releases copper ions into the water film that covers the sidewall. When a root tip grows into this area these ions are absorbed and biosynthesis of cytokinins is suspended. Cytokinin is a growth hormone produced only in the root tip and has the function of stimulating cell division in the root tip and suppressing lateral root initiation. Auxin, on the other hand (produced in leaves and in root tips) stimulates cell elongation.

With cytokinin production suspended, no new cells form – so auxins have no cells to elongate – and root growth is suspended.

Also, with cytokinin production suspended, lateral roots are initiated – and their root tips do produce cytokinins – which stimulate cell division in their root tips – and auxins then cause the elongation of these cells – and the lateral root grows... until this root tip reaches the Copperblock tray wall.

The result is a proliferation of higher order lateral roots, the fine root system. Active root tips are distributed throughout the root plug, in a state of “suspended elongation” – until removed from the Copperblock tray.