Beaver Plastics

Technical Bulletin

# Buffer Zone Copperblock Nursery : Seeding

## INTRODUCTION

Seeding loblolly pine in a buffer zone Copperblock nursery is a precision operation, which is not necessarily automated. Each unfilled cavity in a container forest nursery is a waste of resources and uniform seedling quality is achieved by providing equal resources (above- and below-ground) to seeds of equal potential.

The seed process technology developed for bareroot loblolly nurseries is essentially the same as needed for a buffer zone Copperblock nursery.

The seeding operation includes seed preparation, the mechanics of sowing and steps to provide some of the conditions conducive to rapid and uniform germination.

### Seed preparation

Normal seed preparation steps are applied:

1. Cleaning – ( 99% purity) to remove non-seed particles
2. Sizing – to group germination classes
3. Separation – to remove empty seed (flotation in water)
4. Stratification – to enhance germinative energy.
5. Priming – to enhance germination capacity ($H_2O_2$)
6. Drying – to aid seeding mechanics (surface drying).
7. Testing – to determine seeding regime.

### Seeding Regime

The nursery target is uniform seedlings in every container cavity meeting the order quantities and quality at the least cost.

**Loblolly seed <70% germination capacity should not be used in a container nursery**

**Step 1**: Determine the seedlot GC% (germination capacity)

**Step 2**: Deduct for field conditions – if the germination test was under controlled conditions (deduct ~5%).

**Step 3**: Estimate costs: per viable seed; per blank cavity; per cavity for thinning (@ 10,000 pppd); per cavity transplanting (@5,000 pppd).

**Step 4**: Calculate least cost sowing factor – single or multiple, within logistical limits, using the sowing tables below and the information from steps 1 to 3 above.

**Step 5**: Calculate Oversow (additional Copperblock trays sown) allowance:

- germination losses – see germination tables below “0 trees”.
- culling : missed doubles (poor thinning); deformed; under spec. (5% – 25%)

**Sowing rate**: The sowing table examples below reflect cavity fill when sowing 1, 1.25, 1.5, 1.75 or 2 seeds per cavity. Tables can be calculated for sowing factors (SF) appropriate to specific Copperblock trays .e.g. the CB98/105 has 14 rows of 7 cavities –

SF 1.0 : all single sow
SF 1.2 : 3 double sow rows
SF 1.3 : 4 double sow rows
SF 1.5 : alternate rows single and double
SF 1.7 : 4 rows single sow
SF 1.8 : 3 rows single sow

### Seeding Equipment

The objective is to place the seed/s in the center of the cavity –

- The loblolly seed should be released over the cavity center
- The seed should bounce as little as possible
- The dibbling (see Tech.Bull. Growing Medium) should provide a concave depression in the growing medium directing the seed to the center of the cavity.

STARTUP

**Manual seeding:**

- V-notch (handheld)~100 Copperblock trays pppd.
- vacuum bar,– single row, handheld.
- Shutterbox – full Copperblock tray ~ 800 pppd.

**Machine Seeding:** Many automated seeders are available, new and used. Loblolly seed is robust, large, clean and dry and suited to every machine.

- vibration seed separation – tube drop – row seeder
- vacuum seed selection – tube drop – row seeder
- vacuum seed selection – tube drop – whole tray
- vacuum seed selection – short drop – whole tray
- vacuum seed selection – short drop – drum seeder
- vacuum seed selection – water drop – drum seeder

The chief consideration will be production rate (ensuring that seed placement precision is not sacrificed for speed).

**VACUUM DRUM SEEDER – SINGLE REVOLUTION PER COPPERBLOCK**

ENDUP

Vacuum drum seeders will provide precision and accuracy at rates up to 1,000 Copperblock trays/hr.

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## SEED COVER

As with bareroot nurseries the conditions needed for loblolly germination are:

**heat :** 71ºF to 77ºF (22ºC to 25ºC)

**moisture :** maintain the seed moisture content reached in stratification (~32%mc). As the testa splits the seed is subject to desiccation. Keep moisture stress less than -3 atm (-300 kPa). (e.g.Field capacity = -33 kPa; TWP = -1500 kPa)

**oxygen :** AFP seed cover should be ≥ AFP growing medium. Oxygen is absorbed through the moisture film on the seed – too much water creates anaerobic conditions.

All of these conditions are supplied by placing the seed on top of the growing medium and covered with a suitable material that will also.

- provide resistance to assist the germinating radicle to penetrate the medium
- ensure extreme rainfall cannot wash the seed to the surface

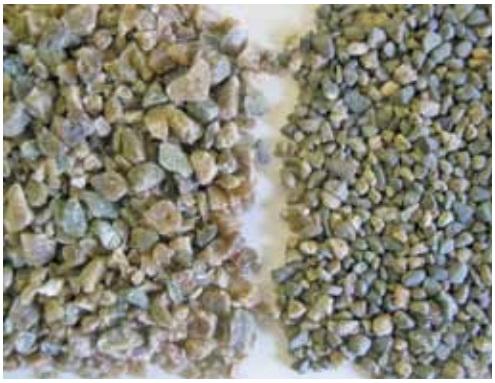
This layer is necessarily shallow in depth (loblolly = ½ in) and rapidly dries in an exposed buffer zone nursery. Frequent irrigation to maintain moisture is also conducive to the growth of algae. In a container cavity this algae can form a seal (plug) on the top of the growing medium and prevent the penetration of irrigation.

**Solution – allow the seed cover to dry between irrigations OR inject an algaecide (e.g. Zerotol) together with the irrigation.**

## Seed cover materials

**Granite grit :** pH 6.9 : BD 92lbs/ft$^3$ : EC 0.075 mS/cm

**Styrogrit:** manufactured from recycled Copperblock trays



pH 4.0 : BD 34lbs/ft$^3$ (cooler than granite grit) : EC 0.05 mS/cm (Coverage ~50 Copperblock trays/ft$^3$) AFP 40% : WHC 7.5%

**STYROGRIT (LEFT) – FRASER RIVER GRANITE GRIT (RIGHT)**

Other suitable seed cover materials are:

**PBC** (pine bark compost)

**Local sand or gravel** – check AFP and particle size (dust may cake)

**Perlite**

**Vermiculite** – lightweight and subject to windblow

**Sawdust** – conifer sawdust

## Seed cover dispensing equipment (Topper)

The objective is to apply an equal depth of seed cover material (topping) to each cavity and not provide a link between cavities where roots could grow.

STARTUP **manual :** material can be dispensed through a handheld sieve and then the surface of the Copperblock tray is brushed clean.

ENDUP **mechanical :**

- Drum – dispenses a specific volume per cavity
- Belt – speed calibrated to the Copperblock travel. Some designs are limited to lightweight seed cover materials.

## Layout

**Be alert for seed displacement by falling grit at high production rates.**

**Pre-wet** – immediately after topping with seed cover –

- prevents seed desiccation
- stabilizes the seed against vibration

**Transport** – of the Copperblock trays after seeding to the layout site in the nursery must be done with care not to further compress the growing medium or to vibrate the seed to the surface. Copperblock trays can be stacked for transport on trailers. Powered belt conveyors can provide a smooth ride. Or, if Copperblock trays are transported in a single layer, ensure that road surfaces are smooth.

**PNEUMATIC TIRED TRAILERS, HOLD 100 COPPERBLOCK TRAYS EACH.**

**Handling** – Copperblock trays should be handled with care during layout. Successive jolting can cause the seed to rise and become exposed.

**The fundamental objective is to provide uniform conditions for every seed – to achieve uniform germination – the foundation for uniform growth.**

**First irrigation** – begin with a clean water drench –

- leach excess salts and phytotoxic compounds.
- check all nozzles – ensure the system is fully functioning
- ensure complete wetting of peat moss growing medium.

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| Germination % | 2 seeds/cavity: Probability of occurrence | | |
|---|---|---|---|
| | 0 trees | 1 tree | 2 trees |
| 70 | .0900 | .4200 | .4900 |
| 71 | .0841 | .4118 | .5041 |
| 72 | .0784 | .4032 | .5184 |
| 73 | .0729 | .3942 | .5329 |
| 74 | .0676 | .3848 | .5476 |
| 75 | .0625 | .3750 | .5625 |
| 76 | .0576 | .3648 | .5776 |
| 77 | .0529 | .3542 | .5929 |
| 78 | .0484 | .3432 | .6084 |
| 79 | .0441 | .3318 | .6241 |
| 80 | .0400 | .3200 | .6400 |
| 81 | .0361 | .3078 | .6561 |
| 82 | .0324 | .2952 | .6724 |
| 83 | .0289 | .2822 | .6889 |
| 84 | .0256 | .2688 | .7056 |
| 85 | .0225 | .2550 | .7225 |
| 86 | .0196 | .2408 | .7396 |
| 87 | .0169 | .2262 | .7569 |
| 88 | .0144 | .2112 | .7744 |
| 89 | .0121 | .1958 | .7921 |
| 90 | .0100 | .1800 | .8100 |
| 91 | .0081 | .1638 | .8281 |
| 92 | .0064 | .1472 | .8464 |
| 93 | .0049 | .1302 | .8649 |
| 94 | .0036 | .1128 | .8836 |
| 95 | .0025 | .0950 | .9025 |
| 96 | .0016 | .0768 | .9216 |
| 97 | .0009 | .0582 | .9409 |
| 98 | .0004 | .0392 | .9604 |
| 99 | .0010 | .0198 | .9801 |

| Germination % | 1.5 seeds/cavity: Probability of occurrence | | |
|---|---|---|---|
| | 0 trees | 1 tree | 2 trees |
| 70 | 0.1950 | 0.5600 | 0.2450 |
| 71 | 0.1871 | 0.5609 | 0.2521 |
| 72 | 0.1792 | 0.5616 | 0.2592 |
| 73 | 0.1715 | 0.5621 | 0.2665 |
| 74 | 0.1638 | 0.5624 | 0.2738 |
| 75 | 0.1563 | 0.5625 | 0.2813 |
| 76 | 0.1488 | 0.5624 | 0.2888 |
| 77 | 0.1415 | 0.5621 | 0.2965 |
| 78 | 0.1342 | 0.5616 | 0.3042 |
| 79 | 0.1271 | 0.5609 | 0.3121 |
| 80 | 0.1200 | 0.5600 | 0.3200 |
| 81 | 0.1131 | 0.5589 | 0.3281 |
| 82 | 0.1062 | 0.5576 | 0.3362 |
| 83 | 0.0995 | 0.5561 | 0.3445 |
| 84 | 0.0928 | 0.5544 | 0.3528 |
| 85 | 0.0863 | 0.5525 | 0.3613 |
| 86 | 0.0798 | 0.5504 | 0.3698 |
| 87 | 0.0735 | 0.5481 | 0.3785 |
| 88 | 0.0672 | 0.5456 | 0.3872 |
| 89 | 0.0611 | 0.5429 | 0.3961 |
| 90 | 0.0550 | 0.5400 | 0.4050 |
| 91 | 0.0491 | 0.5369 | 0.4141 |
| 92 | 0.0432 | 0.5336 | 0.4232 |
| 93 | 0.0375 | 0.5301 | 0.4325 |
| 94 | 0.0318 | 0.5264 | 0.4418 |
| 95 | 0.0263 | 0.5225 | 0.4513 |
| 96 | 0.0208 | 0.5184 | 0.4608 |
| 97 | 0.0155 | 0.5141 | 0.4705 |
| 98 | 0.0102 | 0.5096 | 0.4802 |
| 99 | 0.0055 | 0.5049 | 0.4901 |

| Germination % | 1.75 seeds/cavity: Probability of occurrence | | |
|---|---|---|---|
| | 0 trees | 1 tree | 2 trees |
| 70 | 0.1425 | 0.4900 | 0.3675 |
| 71 | 0.1356 | 0.4864 | 0.3781 |
| 72 | 0.1288 | 0.4824 | 0.3888 |
| 73 | 0.1222 | 0.4782 | 0.3997 |
| 74 | 0.1157 | 0.4736 | 0.4107 |
| 75 | 0.1094 | 0.4688 | 0.4219 |
| 76 | 0.1032 | 0.4636 | 0.4332 |
| 77 | 0.0972 | 0.4582 | 0.4447 |
| 78 | 0.0913 | 0.4524 | 0.4563 |
| 79 | 0.0856 | 0.4464 | 0.4681 |
| 80 | 0.0800 | 0.4400 | 0.4800 |
| 81 | 0.0746 | 0.4334 | 0.4921 |
| 82 | 0.0693 | 0.4264 | 0.5043 |
| 83 | 0.0642 | 0.4192 | 0.5167 |
| 84 | 0.0592 | 0.4116 | 0.5292 |
| 85 | 0.0544 | 0.4038 | 0.5419 |
| 86 | 0.0497 | 0.3956 | 0.5547 |
| 87 | 0.0452 | 0.3872 | 0.5677 |
| 88 | 0.0408 | 0.3784 | 0.5808 |
| 89 | 0.0366 | 0.3694 | 0.5941 |
| 90 | 0.0325 | 0.3600 | 0.6075 |
| 91 | 0.0286 | 0.3504 | 0.6211 |
| 92 | 0.0248 | 0.3404 | 0.6348 |
| 93 | 0.0212 | 0.3302 | 0.6487 |
| 94 | 0.0177 | 0.3196 | 0.6627 |
| 95 | 0.0144 | 0.3088 | 0.6769 |
| 96 | 0.0112 | 0.2976 | 0.6912 |
| 97 | 0.0082 | 0.2862 | 0.7057 |
| 98 | 0.0053 | 0.2744 | 0.7203 |
| 99 | 0.0033 | 0.2624 | 0.7351 |

| Germination % | 1.25 seeds/cavity: Probability of occurrence | | |
|---|---|---|---|
| | 0 trees | 1 tree | 2 trees |
| 70 | 0.2475 | 0.6300 | 0.1225 |
| 71 | 0.2385 | 0.6355 | 0.1260 |
| 72 | 0.2296 | 0.6408 | 0.1296 |
| 73 | 0.2207 | 0.6461 | 0.1332 |
| 74 | 0.2119 | 0.6512 | 0.1369 |
| 75 | 0.2031 | 0.6563 | 0.1406 |
| 76 | 0.1944 | 0.6612 | 0.1444 |
| 77 | 0.1857 | 0.6661 | 0.1482 |
| 78 | 0.1771 | 0.6708 | 0.1521 |
| 79 | 0.1685 | 0.6755 | 0.1560 |
| 80 | 0.1600 | 0.6800 | 0.1600 |
| 81 | 0.1515 | 0.6845 | 0.1640 |
| 82 | 0.1431 | 0.6888 | 0.1681 |
| 83 | 0.1347 | 0.6931 | 0.1722 |
| 84 | 0.1264 | 0.6972 | 0.1764 |
| 85 | 0.1181 | 0.7013 | 0.1806 |
| 86 | 0.1099 | 0.7052 | 0.1849 |
| 87 | 0.1017 | 0.7091 | 0.1892 |
| 88 | 0.0936 | 0.7128 | 0.1936 |
| 89 | 0.0855 | 0.7165 | 0.1980 |
| 90 | 0.0775 | 0.7200 | 0.2025 |
| 91 | 0.0695 | 0.7235 | 0.2070 |
| 92 | 0.0616 | 0.7268 | 0.2116 |
| 93 | 0.0537 | 0.7301 | 0.2162 |
| 94 | 0.0459 | 0.7332 | 0.2209 |
| 95 | 0.0381 | 0.7363 | 0.2256 |
| 96 | 0.0304 | 0.7392 | 0.2304 |
| 97 | 0.0227 | 0.7421 | 0.2352 |
| 98 | 0.0151 | 0.7448 | 0.2401 |
| 99 | 0.0078 | 0.7475 | 0.2450 |