Re: SX87206Q Seedling Density Trial

Introduction

The cavity volume and spacing in existing Styroblock designs were acceptable when stock specifications were easier to achieve, but growing crops to current standards can be difficult at high seeding densities. Several trials in production nurseries have demonstrated that without substantially reducing yields of plantablea per unit area of growing space, seedling densities of about 700/m² produce superior quality crops compared to those grown at over 900/m². The most commonly used block is the PSB 313A, which has 198 cavities with a volume of 57 ml each (932/m²). One way to achieve better spacing is to use the PSB 313B which has 160 cavities per block (765/m²). The 313B has an appropriate ratio between seeding density and soil volume, but it's use complicates block inventories and orders, and limits the possibility of ever increasing densities above 160 per block. The better choice is to modify the existing 313A to fulfill most requirements for 1-0 crops, while maximizing flexibility of choice.

For today's stock standards, most of the small and mid-size styroblocks are somewhat too densely spaced for the soil volume they contain, or conversely, they have too much soil volume for their designed densities. The PSB 313A is an anomaly in being even further from optimum than most.

<table>
<thead>
<tr>
<th>Container</th>
<th>Cavities Per Block</th>
<th>Cavities Per M²</th>
<th>Area Per Seedling CM²</th>
<th>Cavity Volume ML</th>
<th>Area Per Unit Volume CM²/ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSB 211</td>
<td>240</td>
<td>1135</td>
<td>8.8</td>
<td>37</td>
<td>.238</td>
</tr>
<tr>
<td>PSB 313A</td>
<td>198</td>
<td>932</td>
<td>10.7</td>
<td>57</td>
<td>.188</td>
</tr>
<tr>
<td>PSB 313B</td>
<td>160</td>
<td>764</td>
<td>13.1</td>
<td>65</td>
<td>.201</td>
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<tr>
<td>PSB 415B</td>
<td>112</td>
<td>527</td>
<td>19.0</td>
<td>102</td>
<td>.186</td>
</tr>
<tr>
<td>PSB 415A</td>
<td>80*</td>
<td>438</td>
<td>22.8</td>
<td>130</td>
<td>.176</td>
</tr>
<tr>
<td>PSB 615</td>
<td>45</td>
<td>212</td>
<td>47.2</td>
<td>336</td>
<td>.140</td>
</tr>
</tbody>
</table>

*Not standard block size.
Note that the area per ML soil volume (last column) increases as container cavity sizes decrease. A low of .140 CM^2/ML is acceptable for 615B's because only so much growth can occur in one season, and seedlings will not be overly crowded. At the other end of the scale it is critical to have adequate spacing per unit of soil volume. At .188, the PSB 313A has the same area per ML as the 415B, but it should be well over .2 to fall between the figures for 211's and 313B's. This can easily be accomplished by removing the top 1/2" of the 313A blocks, resulting in a soil volume of about 50 ML. The area per unit volume would then be .215, bringing it into line with other container designs.

A reduced volume PSB 313A would have several advantages as the container to be used for most 1-0 crops. Starting with 198 cavities allows flexibility in utilizing full stocking for some species, and reducing densities by sowing or roguing to appropriate densities for other species, or in allowing for the location and expertise of individual nurseries. This would also solve the annual problem of matching container sizes on hand in Ministry nurseries with block orders and stock requests.

The proposed all purpose block for 1-0 crops would be cut down in height from the top, resulting in a block with 198 cavities 12 CM (4 3/4") in height and about 50 ML in volume. If plans go ahead to design a "castelated" cavity interior to replace ribs, volume would be further reduced. It should be noted that any plan to simply modify existing blocks must be made on the original styles and not Econoblocks.

The reduced soil volume will give nurseries a better chance of controlling excess height growth and will increase the probability of growing to specifications at higher seedling densities. Initially the proposal would also be to reduce seedling densities to those found optimal in past trials. For spruces, Douglas fir, cedar, hemlock and larch, this would be about 160 trees per block. This can be achieved in several ways.

1. Two rows can be blanked out on the seeding drums, resulting in 162 cavities to be sown, or a configured pattern can be designed to maximize space for all seedlings.

2. All cavities can be sown and blocks separated in the nursery layout.

3. All cavities can be sown and the smallest germinants rogued out, reducing block fill to 160+ seedlings.
4. All cavities can be sown and the smallest seedlings rogued out in July, resulting in 160+ trees per block and supposedly increasing air movement by removing plugs with the culls.

Option 2 assumes that separating blocks is as effective in increasing quality as the spacing of seedlings within the block. This may be so for hemlock, and is the method chosen by one nursery to minimize handling and therefore the potential for Botrytis infections. Options 3 and 4 have an advantage over #1 in that there is a built in buffer against germination rates being lower than anticipated.

Optimum seedling densities for many species at current stock specifications appear to be about 160 trees per block. Others like Amabilis and dry belt interior fir would be grown at full stocking, i.e. as close to 198 trees as possible. It is proposed that this latter spacing is also appropriate for lodgepole pine. Yields from lower mainland nurseries and some interior nurseries are often poor, and decreasing densities of lodgepole pine crops would improve quality. At Surrey in 1986, there were only 12 additional trees per block lifted from 211's compared to 313A's, and the quality of the 313A's was superior. The cost-benefits of reducing densities of P1 at a location like Vernon remain to be seen, but this is probably one of the few nursery-species combinations that may not benefit from decreased seedling densities.

The proposed container design changes and density reductions offer the following advantages.

1. Design changes to existing blocks are not necessary in order to try out the proposal on a fairly large scale in production nurseries. Trial quantities of blocks can be produced by cutting 1/2" off the top of PSB 313A blocks with a hot wire cutter.

2. Only one block size would be required for most 1-0 crops, with the possible exception of P1 and requests for large stock (415B).

3. The reduced soil volume would help limit height growth and improve stock quality. The "castleated" design would assist in further reducing soil volume.
4. There would be several ways of achieving the desired seedling density, resulting in maximum flexibility in meeting any combination of circumstances, i.e. species x location x facility x past production record. Individual nurseries could determine the optimum number of trees per block for their conditions and capabilities. As experience increases or facilities improve, some species would be moved toward more complete stocking. Species like Amabalis, dry belt interior fir, yellow pine and lodgepole pine would be fully stocked from the outset.

This trial will be small and will be more of a demonstration of a potential solution to several problems. An attempt will also be made to include some cut down PSB 313A's in production nurseries to compare lift figures on a more realistic basis.

**Experimental Design**

Since greenhouse space is already limiting in Saanich Test Nursery this year, this trial will be limited to species that can be grown in the outdoor compound. There will be only a few treatments to demonstrate the potential of this approach without investigating all the alternatives.

All treatments will be based on 3:1 peat-vermiculite containing 130 g/m³ FTE 503, and 3 kg/m³ 10 mesh and finer dolomite lime. Nutrients will be provided with Peters starter, grower and finisher at 75, 125, and 50 ppm N respectively.

Seedlots to be sown are:

- **Cw** (SZ 1070) 92J11/B3/3546/.86 -84%
- **Fdc** (SZ 1090) 92M10/B3/7752/.46 -94%
- **Ss** (SZ 1100) 930 3/B3/3981/.04 -95%
- **Pl** (SZ 2030) 82L 3/B2/2620/1.43 -81%
- **Lw** (SZ 4030) 82J 4/B2/5102/1.24 -86%

All treatments will be comprised of 6 Styroblocks each, and will be double sown and thinned to one seedling per cavity.

**Treatments**

2. Utilize PSB 313A blocks which have been reduced in height by 1/2" to 4 3/4" (12 CM). Full stocking.

3. Utilize cut down PSB 313A blocks, leaving rows 4 and 8 blank (162 usable cavities).

4. Utilize cut down PSB 313A blocks, roguing germinants to leave 160 seedlings per block.

Observations Required

All treatments will be analyzed for morphological description in late 1987. At this time, H. Mueller should be requested to assist in determining the number of plantable trees per treatment. Subjective observations on relative problems and susceptibility to disease should be noted.

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