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FERTILIZATION REGIMES TO PRODUCE DIFFERENT SIZE CLASSES OF CELL-GROWN BIRCH, by John Morgan

Abstract

Results from an experiment to compare fertilization regimes for cell-grown birch are discussed. Basal fertilizers were associated with greater seedling growth responses than top dressings. Recommended fertilization regimes are 0.75 kg m^{-3} Osmocote miniprill with top dressings of 200 ppm N. One year after planting, survival and height increment of cell-grown seedlings were as good as or superior to bare-root transplants and seedlings on a new planting site.

Introduction

1. Birch is increasingly becoming a component of planting programmes in upland Britain. A large proportion of both *Betula pendula* and *B. pubescens* is produced as cell-grown trees by nurseries using different cultural regimes. Cell-grown birch had better survival and early height increment than bare-root plant types on restocking sites (Morgan, 1993) and when planted on a road embankment outside the normal planting season (Hodge, 1991).

2. Current size specifications for container grown birch are described in British Standard 3936: Part 4: 1984, *Specification for forest trees*. Standards were derived from early work with container grown seedlings, and set minimum height as 60 cm and root collar diameter as 6 mm. These standards are difficult to achieve using the majority of cell-grown systems in forest nurseries at present.

3. A nursery experiment was carried out in 1991 which allowed comparisons between the size specifications of seedlings produced using different fertilization regimes for cell-grown birch. The experiment was designed to extend previous recommendations for fertilization regimes for conifers made by Hollingsworth and Mason (1989). Birch seedlings are particularly responsive to fertilization, so rates applied in the experiment were the same as or below those recommended for conifers.

4. As part of a separate study, seedlings from the nursery experiment were planted in a forest experiment to compare performance of bare-root and cell-grown planting stock. The experiment provided a comparison among different size classes of seedlings within each plant type.

Experimental details

Nursery experiment

5. *Betula pendula*, Kincardine origin, 87(2001) grown in Rigipot 45–110 containers. Growing regime and compost according to Hollingsworth and Mason (1989), excepting fertilization treatments as follows:

   Basal fertilizer (Osmocote miniprill 18:6:12 NPK 2–3 months)
   Rates – 0, 0.75, 1.5 kg m^{-3}

   Top dressing (Peters 20:20:20 NPK)
   Rates – 25, 50, 100, 200 ppm N applied weekly, two months from sowing, when miniprill expected to be exhausted although not confirmed with nutrient analysis.

Forest experiment

6. New planting on a moderately exposed upland brown earth/gley mounded by excavator. Planted 09.04.92, elevation 76 m a.s.l.; rainfall 1300 mm.

   Plant type treatments (all B. pendula 87(2001))

   Bare root – 1+0 seedlings
   – 1+1 transplants

   Container – plants selected as 20 cm height
   – plants selected as 35 cm height
   – plants selected as 50 cm height

   Note: container plants selected from the complete range of nursery treatments purely on the basis of approximate height (5 replications of 20 trees).

Nursery results

7. The mean and range for height and root collar diameter are given in Figures 1 and 2. All fertilization treatments significantly improved growth rates, although the growth response to rate of basal fertilizer was greater than for top dressings. Mean root collar diameter was changed very little by fertilization rates above 0.75 kg m^{-3} basal and 200 ppm N top dressing, whereas mean height continued to increase. The effect of treatments on root:shoot ratios can be seen in Figure 3. Higher rates of fertilizer significantly reduced the proportion of root in relation to shoot and, again, basal fertilizer rates had a greater influence on dry weight allocation. (See next page for Figures 1, 2 and 3.)

Forest performance

8. Plants from the nursery experiment survived well and showed a substantial increase in height in their first growing season (see Table 1). There were no significant differences in the survival of the three height categories of cell-grown stock. The trend for better survival of larger height classes may have been associated with vole damage; smaller plants were killed, but larger individuals regrew from stem bases. Height increment was significantly different among size classes, decreasing as height at planting increased. Plants with vole damage had not begun to regrow from bases at the time of the height assessment.

Table 1. First year survival, height increment and vole damage to different types and size categories of birch planting stock

Plant type	Height at planting (cm)	Root collar diameter (RCD) at planting[1] (mm)	Survival (%)	Height increment[2] (cm)	Girdling by voles[3] (%)
Seedling	30.6	4.6	96.0	13.0	3.0
Transplant	82.0	9.0	79.0	7.5	1.4
Cell-grown, 20 cm	19.9	3.8	89.0	33.0	11.5
Cell-grown, 35 cm	32.3	4.7	97.0	27.8	11.4
Cell-grown, 50 cm	48.2	5.4	100.0	22.6	12.0
LSD @ $P < 0.05$[4]	4.0	0.5	11.2	4.1	7.2

Notes:
1. Mean RCD not comparable with nursery experiment.
2. Height increment measured on trees with no girdling.
3. Complete girdling measured on live trees.
4. LSD = least significant difference between means.

Figure 1

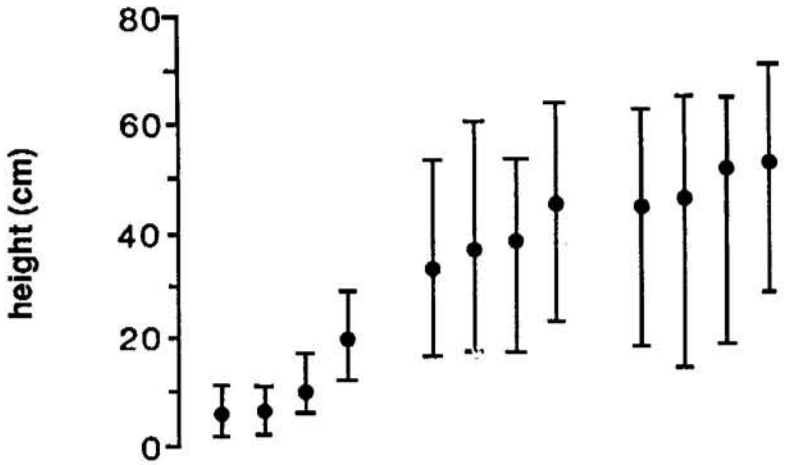


Figure 2

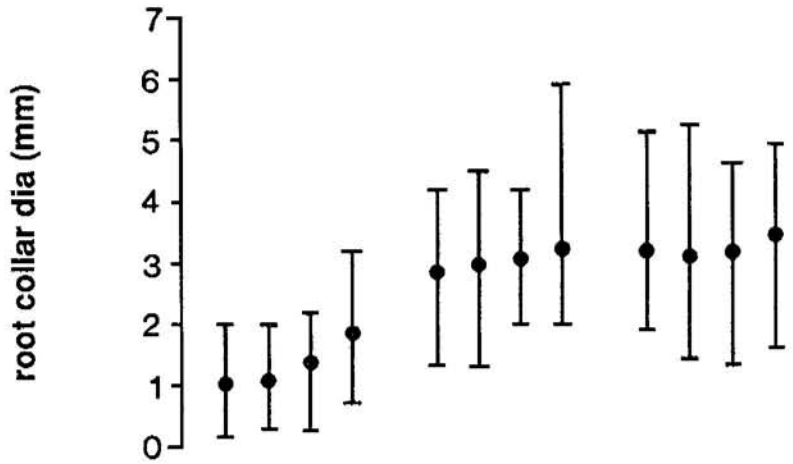
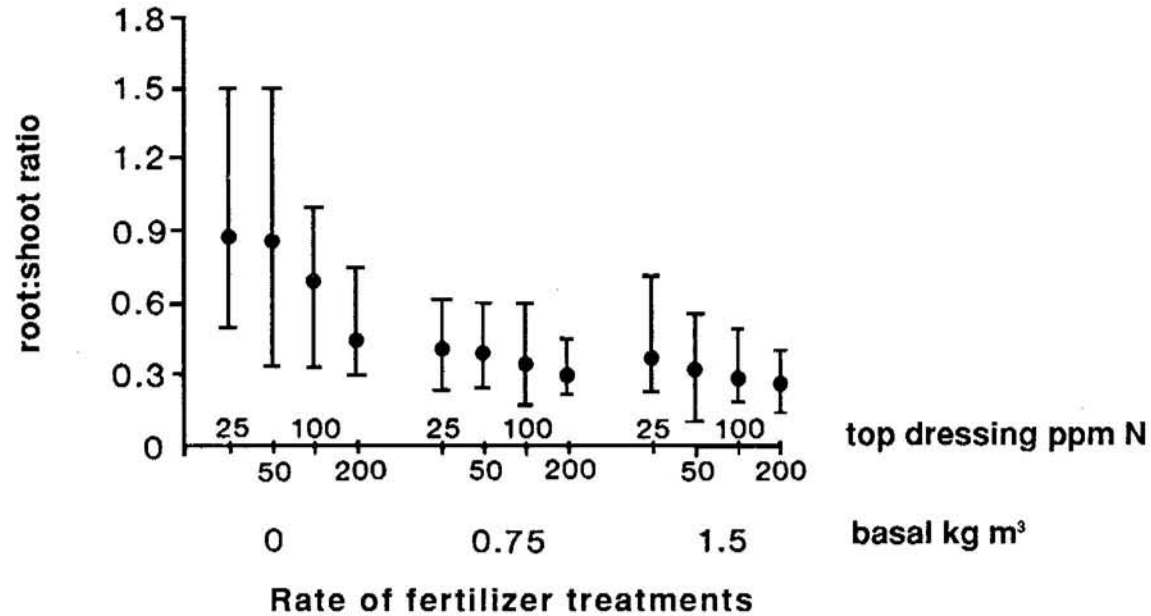


Figure 3



Figures 1–3: Seedling height, root collar diameter and root:shoot ratio for cell-grown birch seedlings with different rates of basal fertilizer and top dressings after one growing season (means with ranges for values).

9. The cell-grown plant types survived as well as or better than bare-root plants, despite significantly more girdling by voles in cell-grown treatments (see Table 1). Height increment of all cell-grown treatments was superior to 1+0 seedlings or 1+1 transplants.

Conclusions

10. Birch is very sensitive to fertilization regimes used in cell-grown systems. Acceptable growth rates for cell-grown plants can be achieved using lower rates of basal fertilizer than those recommended for conifers. Good size specifications were obtained using 0.75 kg m^{-3} Osmocote miniprill with top dressings of 200 ppm N. Basal dressings above 0.75 kg m^{-3} had a detrimental effect on root:shoot ratios of plants.

11. Satisfactory forest performance can be achieved using cell-grown birch with mean heights below minimum size specifications for planting stock described in British Standard 3936. Further work would be desirable to compare forest performance of different size classes of cell-grown planting stock.

References

BRITISH STANDARDS INSTITUTION (1984). *Specification for forest trees.* BS3936: Part 4: 1984.

HODGE, S.J. (1991). *Cell grown broadleaved stock.* Arboriculture Research Note 98/91/ARB. DoE Arboricultural Advisory and Information Service, Farnham.

HOLLINGSWORTH, M.K. and MASON, W.L. (1989). *Provisional regimes for growing containerised Douglas fir and Sitka spruce.* Research Information Note 141. Forestry Commission, Edinburgh.

MORGAN, J.L. (1993). *Forest performance of different birch plant types.* Research Information Note 228. Forestry Commission, Edinburgh.

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