



## Arboriculture Research Note

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### THE INFLUENCE OF NURSERY SPACING ON OUTPLANTING PERFORMANCE OF AMENITY TREES

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#### Summary

Close spacing of half standards and large whips in the nursery can reduce stem diameter at lifting height and diameter growth after three growing seasons on the planting site. The whole range of nursery spacings tested, from 10cm to 50cm in the rows, influenced the growth of half standard sized trees, both in the nursery and after planting out. For large whips, spacings above 20cm had little effect on tree growth in the nursery and no spacing had any effect on growth after outplanting.

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#### Introduction

1. In order to be competitive, especially with continental growers, UK nurserymen aim to produce plants of marketable quality (in accordance with British Standard 3926) at minimum cost. However, nursery stock production techniques could influence plant growth and condition after outplanting. Nursery spacing is particularly important because of its strong influence on the physical and physiological attributes of the resultant stock. Much past research has concentrated on the visual quality of nursery stock, with minimum regard for the performance of the end product in the landscape. This Note reports the results of outplanting trials of amenity stock grown at a range of nursery spacings.

#### Background to Experiments

2. Trees grown at different nursery spacings were obtained from Luddington Experimental Horticulture Station and outplanted in five experiments. These trees had received equity of treatment in every other respect. Whips (conforming to B.S. 3936, Part 1) were grown in the nursery for two years at fixed spacings of 10, 20, 35 and 50 cm in the rows with one metre between rows. In addition, half standard trees, which had been grown at nursery spacings from 10cm gradually increasing to 50 cm in the rows with one metre between the rows for one year after budding, and then lined out a standard wide spacing in the nursery for two years, were used. The species planted in these experiments were *Sorbus ari* 'Lutescens', *Malus* 'Profision' and *Prunus* 'Kanzan' (The root stocks used were *Sorbus intermedia*, *Malus* MM106 and *Prunus* 'Colt' respectively).

#### Results

3. Survival after outplanting was good and there were no significant differences in survival between trees reared at different nursery spacing in any of the experiments.
4. When outplanted, dominant trees in any batch generally perform better than smaller sub-dominants because of the competitive advantage gained in the nursery due to their size. The emergence of growth differences due to nursery treatments can thus be masked and so the effect has been accounted for by covariate analysis in the results described.
5. All three species, from both fixed and gradually increasing nursery spacings showed significant differences in stem diameter at outplanting due principally to spacing in the nursery (figure 1). The wider the spacing in the nursery the greater the stem diameter at outplanting. Significant differences in stem diameter of the whips grown at different nursery spacings had been totally lost after three growing seasons on the planting

site. Those of the half standards, particularly of *Prunus 'Kanzan'* and *Sorbus aria 'Lutescens'*, have been maintained with no indication of declining significance (table 1).

6. Spacing in the nursery had no significant influence on the height of *Malus 'Profusion'* and *Prunus 'Kanzan'* half standards at lifting, but did have a significant (P,0.01) effect on heights of the *Sorbus aria 'Lutescens'*, those grown at 40cm spacing being, on average, 15cm smaller at lifting than those grown at 10cm spacing (fig. 2). Height growth of *Sorbus aria 'Lutescens'* after outplanting maintained the initial height differences due to nursery spacing, whilst that of *Malus 'Profusion'* became significantly different due to dieback after outplanting of trees grown at the closer nursery spacings (fig.2). *Prunus 'Kanzan'* showed greater height growth of trees widely spaced in the nursery (an average height difference of 24.1cm having developed over three growing seasons after outplanting) despite there being no significant height differences at lifting.

**Table 1:** Nursery spacing experiments: height and stem diameter at 0.8m (sig =significance level; NS = results not significantly different between treatments; 0.01 etc. = probability of differences in results not being due to the treatment specified.)

Nursery spacing	at outplanting in Feb 1987							Nov 1989 (using Feb 1987 values as covariate)						
	10cm	20cm	30cm	35cm	40cm	50cm	Sig	10cm	20cm	30cm	35cm	40cm	50cm	Sig
Whips <i>Prunus 'Kanzan'</i>														
Ht (cm)	163.1	168.7		162.2		161.5	NS	183.3	180.0		179.7		179.7	NS
Sd (mm)	8.2	9.3		9.4		9.5	<0.001	15.3	14.8		15.9		15.3	NS
<i>Malus 'Profusion'</i>														
Ht (cm)	144.8	150.6		145.9		147.7	NS	170.3	163.1		166.4		170.3	NS
Sd (mm)	6.3	7.3		7.4		7.7	<0.001	9.9	10.1		10.0		10.1	NS
Half Standards <i>Prunus 'Kanzan'</i>														
Ht (cm)	252.9	254.1	255.2		256.4		NS	289.3	298.5	307.7		316.9		<0.05
Sd (mm)	19.7	20.4	21.2		21.9		<0.001	26.5	27.4	28.4		29.3		<0.001
<i>Malus 'Profusion'</i>														
Ht (cm)	193.3	193.8	194.9		194.9		NS	188.3	190.4	182.4		194.5		<0.05
Sd (mm)	11.3	12.1	13.00		13.8		<0.05	13.3	13.6	13.9		14.2		<0.001
<i>Sorbus aria 'Lutescens'</i>														
Ht (cm)	191.4	196.4	201.3		206.3		<0.01	232.0	237.2	242.5		247.8		<0.001
Sd (mm)	16.00	16.4	16.8		17.2		<0.01	28.3	29.2	30.2		31.1		<0.001

## Discussion

7. The experiments using half standards show that close spacing of trees in the Nursery tends to reduce stem diameter at lifting and can reduce stem diameter growth and height growth after outplanting. In the experiments described this reduction in growth was still apparent after three growing seasons.

8. The reasons for reduced stem diameter and height growth of closely grown trees at outplanting include increased competition for water, nutrients and light in the nursery and the reduction in the development of lower branches, which are important in the development of normal stem taper (Whitcombe, 1987). Root damage and loss as closely spaced trees are lifted and separated is also likely to affect subsequent plant performance.
9. The range of spacing treatments imposed was relatively more severe in respect of the half standards than the whips. This was shown by significant differences in stem diameter at lifting only being recorded between whips from the 10 to 20cm spacings; spacings in excess of 20cm having no significant effect on stem diameter. Once planted out, the smaller diameter whips established relatively rapidly such that differences in stem diameter at lifting were soon lost.

### Conclusions and recommendations

10. Close spacing of trees in the nursery influences stem diameter at lifting and can reduce diameter and height growth after outplanting. The whole range of nursery spacings tested, from 10cm to 40cm, maintained an influence over half standards after three growing seasons in the planting site, although the degree of response varied between the species used. Spacings of 20cm or more had little effect on the growth of whips in the nursery and nursery spacings above 10cm had no significant effect on growth after outplanting. The effect of close nursery spacing on outplanting performance is probably attributable to competition in the nursery and root damage at lifting. The minimum spacing for feathered trees is likely to be intermediate between those for whips and half standards.
11. The closer nursery spacings tested were extreme and the extent of differences in tree height and diameter between nursery spacings were less than might be expected. However, economic pressures on nurserymen encourage them to grow trees at as close spacing as possible. When purchasing plants, practitioners should specify stem diameters at the upper end of the ranges detailed in B.S.3936 Part 1. Where not detailed in B.S. 3936 a diameter should be specified, after inspecting trees of that stock type, to ensure that plants with a good taper are supplied. These, having been produced at wider nursery spacings, are likely to be less damaged at lifting and more likely to grow rapidly towards achieving their objectives in the urban landscape. In addition, such plants will be sturdy, requiring little or no staking and will be better able to withstand the attention of vandals.

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### Reference

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