Engineering Heat and Flood Tolerant Birches Through Grafting©

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Tolerance of heat stress and flooding/poor soil drainage have been considered limiting factors in establishing commercially popular white-barked birches in some locations. River birch (*Betula nigra*) has been found to be both more heat and flood tolerant than European (*B. pendula*), paper (*B. papyrifera*), and 'Whitespire' birches (Ranney and Peet, 1994; Ranney and Bir, 1994).

To test whether river birch is compatible as a rootstock for 'Whitespire' birch, 'Whitespire' scions were grafted onto each of the four species as well as onto 'Whitespire,' grown in containers for 1 year then planted into a sandy clay loam soil with a mean percolation rate of 0.9 inches h^{-1} at North Carolina State University's Mountain Horticultural Crops Research Station. Survival and trunk diameter following three growing seasons is shown in Table 1.

Plants of 'Whitespire' grafted on river birch were also included in the North Carolina Urban Tree Evaluation Program to determine actual performance under growing conditions in U.S.D.A. Hardiness Zones 6 to 8 under a range of soil drainage conditions. These plants performed well in all sites regardless of heat and soil drainage characteristics. Ten-year-old trees have no signs of graft incompatibility.

Table 1. Tree survival and trunk diameter (inches) following three seasons in the field for *Betula* 'Whitespire' grafted onto five taxa of birch.

Rootstock	Survival (%)	Trunk diameter (inches)
Betula nigra	100 a[Z]	2.44 ab
B. pendula	80 a	2.99 a
B. papyrifera	80 a	1.89 bc
B. 'Whitespire'	60 ab	1.73 c
B. szechuanica	30 b	2.28 abc

[Z] Means followed by the same letter within a column are not significantly different, P = 0.05.

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Flood Tolerant *Prunus* Through Grafting?©

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Considerable variation in tolerance to root-zone flooding exists within the genus *Prunus*. Research demonstrated the differences in defoliation and survival for 11 *Prunus* taxa (Ranney, 1994) as shown in Table 1.

The two taxa most tolerant of root zone flooding, F-12/1 mazzard cherry and 'Newport' plum, illustrate the potential for enhancing adaptability of less flood-tolerant *Prunus* such as Japanese apricot (*P. mume*) and Yoshino cherry (*P.* ×*yedoensis*) on poorly drained sites if they are grafted onto appropriate rootstocks. *Prunus avium* F-12/1, resistant to bacterial canker, is listed as compatible with *P. sargentii*, 'Yoshino', 'Okame', *P.* ×*subhirtella* 'Autumnalis', and 'Kanzan' cherries as

Table 1. Survival and defoliation of 11 taxa of *Prunus* for plants subjected to incremental flooding over 7 weeks.

Taxon	Survival %	Defoliation %
Carolina cherrylaurel (*Prunus caroliniana*)	0 a	82 c
Canada red chokecherry (*P. virginiana* 'Canada Red')	43 b	100 d
P. mume 'Peggy Clark' (Japanese apricot)	50 b	95 cd
Japanese bushcherry (*P. japonica*)	50 b	52 b
P. sargentii	60 b	29 a
P. ×*yedoensis*	60 b	87 cd
P. 'Okame'	70 bc	80 c
P. ×*subhirtella* 'Autumnalis'	70 bc	52 b
P. 'Kanzan' Japanese cherry	90 cd	58 b
P. avium F-12/1 mazzard cherry	100 d	27 a
P. 'Newport' (Newport purpleleaf plum)	100 d	15 a

Values are means of 7 to10 plants. Means followed by the same letter within a column are not significantly different P = 0.05. Survival was 100% for all nonflooded controls and defoliation was less than 7% for all nonflooded controls.