Comparative Studies on the Rooting of *Betula* Species©

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INTRODUCTION

This study was undertaken over period of 5 years. The intent was to look at the rooting of *Betula* species over a long period of time with variations in timing, rooting hormones, and type of cuttings. This was influenced by the availability of different species none of which were available at any one time. A particular species was chosen because it was available for experimentation from a range of sources.

METHODS AND MATERIALS

In this study, the use of liquid quick dips was consistent. Dip-'N-Gro (DNG) (Astoria Pacific Inc. Clackamas, Oregon) is a proprietary formulation with 1% indolebutyric acid (IBA) and 0.5% naphthaleneacetic acid (NAA) and diluted with water to set strengths. Phenyl-indole-3-thiobutyrate (PITB) is an experimental sulfur analog of IBA. Ethylene and propylene glycols are commercially available solvents commonly used as antifreeze.

All of the cuttings were stuck under the same conditions: clear plastic covered greenhouses with bottom heat, mist running at 15 sec per 15 min, wounded, and W.R. Grace 500 (Grace Sierra products) bag mix as a substrate. Variations were introduced via the type of cuttings and when the material was available, and the choice of the stock plant. Figure 1 shows *B. nigra* cuttings at a suitable stage.

Cuttings were generally evaluated after a tug test revealed rooting and this was on average 4 to 5 weeks from the time of sticking.

Figure 1. *Betula nigra* suitable for the taking of cuttings. White arrows pointing to proper area for severing the cutting. Note the terminal bud is still growing and the last leaf at the tip is not fully expanded.

DISCUSSION

Some trends can be immediately seen in spite of the variations. One significant feature is that the North American native birches, *Betula alleghanensis, B. occidentalis* (syn. *B. fontinalis*), *B. glandulosa, B. nana*, and *B. nigra* root better than birches from Asia and Europe (Table 1).

The reasons for this could be genetic component affecting the rooting propensity of the cuttings or it could be a genetic influence based upon the plant's response to environmental factors which in turn affect the rooting of cuttings.

In general it is understood that tip cuttings work best and once a cutting has been allowed to harden off to the point where a terminal bud is prominent and the terminal leaves are fully formed rooting percentage goes down. Also it is important that the apical tip be intact. Many plants follow this rule among them deciduous and evergreen azaleas, *Enonymus* species, *Syringa* species, and a host of others.

Juvenility does seem to be important and those cuttings obtained from greenhouse-forced plants always rooted in high percentages. Seedlings offer really good cutting material and it is presumed tissue-culture-derived cuttings would give excellent rooting potential. Some species seem to have a natural proclivity for rooting such as *B. alleghanensis* which rooted 100% with cuttings obtained from field plants. Whereas in comparison *B. pendula* taken from field plants gave a poor rooting potential. More than likely this is directly related to the brown bark as pigments of *B. alleghanensis*. Pigments are often considered to be rooting co-factors by inhibiting the breakdown of root hormones. (Bachelard and Stowe, 1962; Jackson, 1986). In the case of *B. pendula* forcing in the greenhouse might give cuttings that would root in acceptable percentages.

In looking at rooting hormones there doesn't seem to be much variation. In general DNG, PITB and IBA all are effective. In the case of *B. pendula* 'Youngii' it is interesting to note that PITB-treated cuttings did not have a leaf drop problem, whereas those treated with DNG did. Subsequently the rooting percentages were higher for the PITB-treated cuttings (71% vs. 55%). Leaf drop has often been associated with alcohol dips but since the PITB is hard to dissolve in anything other than an acetone/alcohol solvents this seems to grant the alcohol component an acquittal. Perhaps the causes of leaf drop in cuttings has more to do with the specific auxin in combination with the alcohol solvent since the PITB solution did not contain NAA. It would be interesting to repeat this with each hormone dissolved in alcohol and used alone. It should be noted that in the case of *Betula* particular solvents such as the glycols had no real bearing on the degree of rooting. The use of alternative solvents as put forth by Barnes (1989) was an attempt to overcome leaf drop problems in other species but this method show no significant difference here.

The potassium salt of IBA was used only once and did not achieve the rooting percentages as the straight acid forms of the hormones. It is hard to determine just what is the cause of the poorer rooting percentage and perhaps the dosage was just not high enough to get the best response.

Timing seems to be important with the *Betula* with cuttings taken in early June rooting better than those taken in July and August although this seems to be species specific.

Greenhouse-forced stock plants seem to root virtually anytime and perhaps this is related to the reduction in the affects of light quality on the cuttings (Bassuk, 1985).

Table 1. Comparative studies on the rooting of *Betula* species.

Species	Type of cutting	Date stuck	Hormone	Rooting (%)	Source of cuttings
Betula alleghanensis	tip cutting 2-4L	7/15/02	DNG 1110+	100	field plant
Betula costata	tip cutting 3-4L	5/4/02	DNG1/10	100	greenhouse forced
	tip cutting 3-4L	5/16/02	DNG1110	76	greenhouse forced
	tip cutting 3-4L	7/14/02	1000 ppm KIBA	62	field plant
	tip cutting 2-4L	8/15/02	DNG1110 + 5000 ppm PITB	100	rooted cutting
Betula davurica	tip cutting 2-4L	10/15/02	DNG1/10	100	greenhouse forced
Betula occidentalis	tip cutting 3-4L	4/15/02	IBA1000 ppm ethylene glycol	92	1-year seedling
	tip cutting 3-4L	6/5/02	DNG1110	88	2- year seedling
Betula glandulosa	tip cutting 2-4L	4/15/02	DNG1/10	73	greenhouse forced
Betula grossa	tip cutting 3-4L	6/15/02	DNG1/10	85	2-year seedling
	tip cutting 3-4L	8/15/02	5000 ppm PITB	100	2-year seedling
	tip cutting 3-4L	8/15/02	DNG1/10	100	2-year seedling
Betula lenta	tip removed, 2-3L	7/15/02	DNG1110	100	field plant
Betula lenta	tip removed, 2-3L	7/15/02	5000 ppm PITB	100	field plant
Betula maximowicziana	tip removed 3-4L	5/5/02	DNG1/10	75	field plant
	tip removed 3-4L	5/15/02	IBA1000 ppm ethylene glycol	78	field plant
	tip rernoved 3-4L	7/15/02	DNG1/10	80	field plant
	tip removed 3-4L	7/27/02	4000 IBA propylene glycol	100	field plant
Betula nana	ffp cutting 3-4L	4/10/02	IBA1000 ppm ethylene glycol	100	greenhouse forced
	tip cutting 3-4L	5/15/02	IBA1000 ppm ethylene glycol	78	greenhouse forced
	tip cutting 3-4L	8/14/02	IBA1000 ppm ethylene glycol	100	greenhouse forced
Betula nigra	tip cutting 3-4L	7/21/02	IBA 1000 ppm propylene glycol	87	field plant
Betula pendula	tip cutting 6-8L	6/24/02	DNG1/10	35	field plant

Betula pendula 'Laciniata'	tip cutting 3-4L	7/5/02	DNG1/10	38	field plant
Betula pendula 'Purpurea'	tip cutting 3-4L	6/24/02	DNG1/10	33	container plant
Betula pendula 'Youngii'	tip cutting 3-4L	6/15/02	DNG1/10	24	field plant
	tip cutting 3-4L	6/15/02	5000 ppm PITB	71	field plant
	tip cutting 3-4L	7/3/02	DNG1/10	55	field plant
	tip cutting 3-4L	7/3/02	5000 ppm PITB**	71	field plant
	tip cutting 3-4L	8/5/02	5000 ppm PITB	43	field plant
Betula platyphylla var. *japonica*	tip cutting 3-3-4L	4/25/02	IBA1000 ppm ethylene glycol	95	greenhouse forced
Betula schmidtii	tip cutting 3-4L	7/23/02	4500 propylene glycol	81	field plant

Abbreviations and treatment information: DNG 1/10 (Dip 'N Gro 1 part to 10 parts water); IBA concentration 1000 ppm; NAA concentration 500 ppm; PITB, phenyl-indole-3-thiobutyrate, dissolved in acetone/alcohol (1 : 1), diluted with water; cuttings treated with PITB did not exhibit leaf drop that was found with DNG 1/10; ethylene glycol solvent, 100% ethylene glycol, heated and appropriate auxin added, further diluted with water. Propylene glycol solvent, 100% propylene glycol, heated and appropriate auxin added, further diluted with water; 2-4, 3-4 L, 2-4 leaves, 3-4 leaves and, so on; tip cutting: cuttings with terminal tips intact regardless to the size of leaves at the terminal tip removed : cuttings with terminal tips removed down to the next expanded leaf

CONCLUSIONS

Some trends can be established from this study. Brown bark birches in general root better than white-bark birches. Tip cuttings are preferable with the undeveloped apical tips left intact. Wounding, mist, and bottom heat are a given. Forcing in a greenhouse is an effective tool for the production of cuttings that root easily. Seedlings are of course useful due to their juvenility. Root hormones although necessary can be quite varied provided the dosage is high enough. Here, 1000 to 5000 ppm of auxin seem to be sufficient. Timing does seem important with late spring to early summer being the most effective time plus it allows for a much longer period of time for the rooted cuttings to develop before the onset of fall and winter.

In general it seems that most in not all birches can be rooted in acceptable numbers provided certain steps are taken to accentuate the process.

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Potential for Grafting Evergreen *Ilex*: A Preliminary Investigation©

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On a visit to the Rutgers University Horticultural Farm Dr. Elwin Orton showed me some *Ilex* grafts using *Ilex* ×*meserveae* cv., Blue Princess® as an understock. This stirred up more than a bit of interest as I wanted to try grafting an experimental hybrid on to *I.* ×*meserveae* 'Blue Princess' as Dr. Orton had showed me. That combination was successful and allowed for further growing on the hybrid. Encouraged by those results this study was undertaken to see what possible graft combinations might work and were there differences in grafting to *I.* ×*meserveae* cv., 'Blue Princess'® or *I.* 'Nellie R. Stevens'. This was further encouraged by comments from Mr. Jim Berry from Plant Development Services, Loxley, Alabama who suggested that both *I. aquifolium* and the "Blue Hollies" are poor performers in the Southeastern portions of the U.S.A. He thought a suitable rootstock might make those plants more available to the Southern nursery trade.

MATERIALS AND METHODS

One-year-old potted rooted cuttings of *I.* ×*meserveae* cv., Blue Princess® holly, and *I.* 'Nellie R. Stevens' were obtained as the potential rootstocks. A range of scion material (Table l) was chosen to see what the scion/understock interaction might be. Understocks were kept in a cool greenhouse with a minimum of bottom heat set at 45°F until grafted. Scions were grafted to the understock using a side graft and wrapped with a rubber strip and sealed with Parafilm™. The completed grafts