ED MEZITT: We had trouble with hot water heat in our outdoor beds and finally gave up on heating. Do you find any difference in rooting without heat?

ROBERT GOUVEIA: Yes. *Taxus* cuttings the first year did not have heat outside and by September they were not ready to transplant.

ED MEZITT: I was talking about deciduous softwood cuttings.

ROBERT GOUVEIA: They do not have bottom heat.

RICHARD WOLFF: Did you find any effect of reduced light? We have a similar set up and observed no effect.

ROBERT GOUVEIA: The reduced light does not appear to be a problem.

CAMERON SMITH: Polybutylene, used as a piping for hot water in beds, is specifically made not to be damaged by freezing. This is not so for polyethylene and PVC.

WILLIAM STUDEBAKER: How often do you change your sand.

ROBERT GOUVEIA: We take it out every 2 years.

HARDWOOD CUTTING PROPAGATION AT MCKAY NURSERY

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Propagation by hardwood cuttings is an important part of the propagation procedures at McKay Nursery. Hardwood cutting propagation has several important advantages over other methods;

1. It is the second most economical method of propagation — after seedlings.

2. Liners from hardwood cuttings are larger than those from softwood cuttings.

3. The cuttings do not require special handling in storage.

4. The cuttings are more easily transplanted.

A limiting factor is the many stock plants necessary to make large numbers of hardwood cuttings.

Our hardwood cuttings are prepared and stuck at two times of the year — fall and spring. We prefer fall cuttings as

they perform better, and many of them callus before the soil freezes. Some species, however, suffer bark splitting when stuck in the fall, so cuttings of these species are stuck in spring.

FALL CUTTINGS

We start making fall hardwood cuttings as soon as the wood is ripe. The cutting material is ready when you can remove the leaves without tearing the bark. This is usually around September 15 in Wisconsin. Current season vigorous shoots are cut from 2-year-old field-grown plants. They are then stripped and sawed into 8 in. cuttings with a band saw. We usually make 2 to 3 cuttings per cane. The tops, which are not mature enough, are discarded. With some species and cultivars, the position of the cuttings on the cane is recorded and cutting batches are kept separate, because the rooting percentage varies depending on whether it is the first, second, or third cut. The cuttings are then counted, bundled with elastic bands, waxed on the tops (mainly to indicate the orientation of the cuttings) and stored until planted. Table 1 lists fall-propagation hardwoods.

Table 1. Plants propagated by hardwood cuttings in the fall and special treatment required.

Lonicera × *xylosteoides* 'Clavey's Dwarf'	
Populus species	
Potentilla cultivars, except 'Katherine Dykes'	
Prunus × *cistena*	2500 ppm IBA quick-dip
Prunus glandulosa 'Sinensis'	Soaked in 1000 ppm IBA solution for 16 hours then dipped in Benlate powder
Rosa × *rugosa* 'Belle Poitevine'	
Rosa × *rugosa* 'Theresa Bugnet'	
Ribes alpinum	
Salix species	
Spiraea × *bumalda* 'Anthony Waterer'	
Spiraea × *bumalda* 'Froebelii'	
Spiraea × *bumalda* 'Goldflame'	
Spiraea × *vanhouttei*	

Preparation of the soil to receive the hardwood cuttings begins the previous spring. Fertilizer is applied at the rate of 160 lb. N, 35 lb P_2O_5, and 130 lb K_2O per acre. Following plowing, sudex is sown at the rate of 30 lb/A. When the sudex reaches 5 to 6 ft, it is chopped. We usually chop two or three times before plowing under by mid-August. At plowing time we apply 100 lb/A of urea.

At planting time the land is worked and leveled with a Niemeyer power harrow. Cuttings are placed in paired rows, 9 in. apart, separated by 48 in. aisles to facilitate cultivation and

digging. Trenches to receive the cuttings are made with two knife-like chisels mounted on a 130 Farmall tractor.

Cuttings are stuck 7 in. deep, 1 in. apart in the trenches and firmed by stepping along the rows. They are then sprayed with Devrinol at the rate of 5 lb, Ai/A and covered with marsh hay to keep them from freezing too hard and subsequently heaving. This year we are trying some cuttings without hay and covered completely with soil.

SPRING HARDWOOD CUTTINGS

These are divided into 3 subgroups.

1) Easy-to-root — which are handled in the same manner as the fall-planted hardwood cuttings.

2) Cuttings which require special attention, such as shading, warmer soil, or watering. These include: *Potentilla*, *Ligustrum*, *Philadelphus*, and *Cornus alba* 'Elegantissima'.

3) Cuttings which will be planted directly in the field for finished plants. For these we use heavy cuttings since the subsequent growth is directly related to the size of the cuttings. These cuttings are planted 1 ft apart in the row, 48 in. between rows, and include *Sambucus*, *Cornus*, *Physocarpus*, *Spiraea* × *bumalda* '*Froebelii*', and *Salix*.

The spring hardwood cuttings are prepared in February from wood collected in early December in the field and from plants in storage. Proper care should be taken to keep the wood from desiccating. We also collect some wood in March if we are short and there are no signs of winter injury.

The cuttings are prepared in the same way as the fall cuttings, except for a few which, because of long internodes or because they perform better, are cut by hand under a bud — or set of buds — at the proximal end of the cutting. Such is the case with *Cornus*, *Hydrangea*, *Philadelphus*, *Forsythia* and *Weigela*. After processing, the cuttings are stored in a 50/50 mixture of peat and wood shavings, and put in a cooler until ready to plant (See Table 2 for plants propagated by hardwood cuttings in the spring).

The spring cuttings are not mulched. Success with spring cuttings depends a lot on the weather. If we are unable to get the ground ready early enough and the temperature rises from 60 to 80°F in a very short time, buds may break dormancy before the cuttings have a chance to form roots. After sticking, we apply Surflan at the rate of one quart per acre. If necessary, the cuttings are fertilized during the growing season with 100 lb/A of urea.

Table 2. Plants propagated in the spring by hardwood cuttings and special treatments required. (Treatments given prior to sticking)

Cornus — dipped in Fermate powder
Cornus alba 'Elegantissima' — Rootone 10 + Fermate
Forsythia — 2500 ppm IBA + 1000 ppm Ethrel, quick-dip
Ligustrum — Rootone 10
Philadelphus — 2500 ppm IBA + 1000 ppm Ethrel, quick-dip
Potentilla cultivars — Rootone F
Sambucus
Spiraea
Symphoricarpus
Weigela — 2500 ppm IBA + 1000 ppm Ethrel, quick-dip

The rooted cuttings are dug in the fall with a modified potato digger and put in a cooler where they will be graded, counted, and trimmed for planting in the field the following spring.

MIKE DODGE: Have you had any success with lilacs from hardwood cuttings?

BERNARD FOURRIER: Yes with *Syringa* × *chinensis*

STOCK PLANT ETIOLATION FOR IMPROVED ROOTING OF CUTTINGS

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Abstract. The practice of stock plant etiolation, whereby dormant plants are grown under severely restricted light levels and then allowed to green up while shoot bases remain etiolated, using a covering of black adhesive tape, produced significantly better rooting of cuttings. Rooting was improved from 5% to 68.5% for *Fagus sylvatica*, from 15% to 42.5% for *Carpinus betulus*, and from 53.3% to 83.3% for *Pinus strobus*. Cuttings from 6 hybrid lilac cultivars also showed improved rooting with prior etiolation and, moreover, the period over which lilac cuttings could be propagated successfully was lengthened considerably.

INTRODUCTION

Using etiolation or, the exclusion of light, in the stimulation of adventitious root growth is a well established practice. As early as 1537 there is mention of light reduction having a favorable effect on the rooting of apple cuttings (3). The practices of stooling and other types of layering routinely use this