SEED PROPAGATION AT THE SARATOGA HORTICULTURAL FOUNDATION

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Our average annual quantity of plants grown from seed is 90,000. Twenty-five per cent of these are used as understock for our selected forms of magnolia, liquidambar, ginkgo, etc. A further 15% are California natives, the remaining being eucalyptus and miscellaneous trees and shrubs. We collect our own seeds where this is economically feasible, or when seed is not readily available from commercial sources.

We keep accurate records of our seed collections, time of year, location, etc.; but, despite this information, it is interesting to note that each year our timing appears to be astray, and it is usually necessary to return to the site for further inspections of the new crop of seeds before collection. These extra trips usually prove fruitful, although in some cases very time-consuming, especially if we are collecting natives from high elevations, such os the hubkleberry oak, *Quercus vaccinifolium*, or the pine mat manzanita, *Arctostaphylos nevadensis*. The current season at Saratoga and in the local foothills appears to be two weeks later than in 1968. This may be reflecting the abundant late rains we had during the past winter.

The stage of ripeness at which seed should be gathered also appears to be variable according to season. During the summer of 1967, we attempted to collect *Dendromecon californica* from a site at an elevation of 1,500 feet in the local foothills, only to find the pods had dehisced. Not wishing to lose the 1968 crop, we visited the area several weeks earlier and gathered the pods while they were still green. They were placed in a shallow tray to dry. The seeds inside the pods soon turned from green to black and we sowed them promptly, obtaining good germination. Attempting to repeat this performance, we collected the 1969 crop at the same stage of development as last year (i.e., while the pods were still a straw green color) only to find that, when the pods dehisced, the seeds inside had not ripened, but had shriveled.

Much has been written on the timing of seed collection, some of the following characteristics being recommended indications of maturity:

(a) Fullness
(b) Size.
(c) Color.
(d) Milkiness.
(e) Hardness of seed coat.
(f) When the first seeds begin to fall naturally.

From our limited experience, it would appear that the last point is probably the most important; however, it introduces the possibility of competition from birds and animals.

It is reported that some trees consistently produce high quality seeds. On the basis of this, we collected seeds of *Pistacia chinensis* from selected individuals over a four-year period. The result was inconclusive, but it did show quite clearly that point (f) was the most important factor, regardless of which trees we collected from, and at this stage of maturity the seeds have turned from red to blue, making point (c) a useful guide.

Many seeds require special handling after collection to ensure that they will germinate well. Our methods of pretreatment are fairly standard, and have been used and recommended for many years; i.e., cold stratification for various lengths of time, ranging from 30 to 120 days. We mix the seeds with an equal volume of 50% moist peat moss and 50% Sponge Rok, and enclose them in a polyethylene bag.

Other pretreatments include scarifying, using a knife or a file. We have found this method works well on *Cercis occidentalis*, especialy if the seed is subjected to a hot-water treatment first, which for us means placing the seeds in a container and then pouring boiling water over them. They are then left in the water overnight. The next morning they have swollen sufficiently to be held individually. A small cut is then made through the seed coat with a knife. Also used in pretreatment methods are acid, freezing, hot/cold, and burning. The latter method has been used on seeds of *Dendromecon californica* and *Arctostaphylos* species. This consists of sowing the seeds in a flat and covering with ¼″ of soil. Three to four inches of straw or excelsior wood is then placed over the soil, lighted, and allowed to burn out. This method does not give consistently good results, which may be due to several variables; i.e., the amount of moisture present in the sowing media, speed at which the cover burns, etc.

Our normal practice of handling seeds which we have not grown before is to check the available literature for recommendations. If none can be found, we divide the total volume of seed into three equal amounts. One batch is sown immediately, the second batch receives 30-days stratification at 40°F., and the third group is stratified at the same temperature for 60 days. If these methods prove unsuccessful, we try various other pretreatments.

We are currently growing *Quercus* species and *Ceratonia siliqua* by direct seeding into 2½″ and 3″ peat pots; otherwise, the containers we use are flats measuring 16″ x 19″ x 2½″. For small quantities of seed we use clay pots and pans. Our compost is, by volume, one part coarse sand and one part fine peat moss. On occasion we have made changes in this combination, especially with some of the more difficult species, attempting to simulate mineral or organic soils which may have some effect upon germination. This has not been successful on the trials we have made to date. Following seed sowing, the containers are covered with glass, and newspaper is used for shading. Covering the flats with burlap, instead of glass,

conserves moisture and eliminates the need for extra shading; however, there is a problem with fungi and we have discontinued this practice.

We have found that a number of species germinate more readily if given bottom heat. For example, our annual crop of *Magnolia grandiflora* is stratified at 40° F. for 60 days and placed on benches in a glasshouse, using bottom heat. Germination takes approximately 27 days. An alternate placement employed for some years was to use plastic-covered cold frames without artificial heat; under these conditions, germination took 72 days, and our percentage of good seedlings was also less. We are currently germinating all of our seeds under glasshouse conditions, using bottom heat for many species. Once germination is complete, we remove the flats to a cold frame, or lath house, to ensure that the seedlings will be sturdy. An added advantage of seed propagation under glass is that we do not have to take precautions against birds (bluejays) eating the acorns and mice consuming the magnolia crop, as they have done in the past. The main disadvantage is that seedlings can quickly become soft and leggy if they are not removed to a cooler environment soon after germination is complete.

Despite our efforts to follow all of the rules, we consistently have difficulty in germinating some trees and shrubs. One in particular is *Carpinus betulus*. For several years we have purchased seed from the east, and have pretreated various lots in the aforementioned ways. An additional treatment tried was freezing the seed for a 6-week period. To date we have been unable to raise a crop of any significance. In 1968 we received a small batch of seed from Mr. Frank Knight of the Royal Horticultural Society Gardens, Wisley, England. This seed was divided into four equal parts and subjected to the following treatments:

(1) Stratified at 40° F. for 60 days.
(2) Frozen for 60 days.
(3) Hot/cold treatment for 60 days.
(4) Hot/cold treatment for 120 days.

Treatment No. 1 resulted in 20% germination — by far our best results to date — which would indicate that the source or the freshness of the seed may be important with this species, and the pretreatment critical.

Carpinus caroliniana, which we have also been raising from seed bought in the east, has not presented any problems, germinating well after a 130-day cold stratification period. We would appreciate any information, comments, or suggestions from propagators having had experience with *Carpinus betulus.*

At the other end of the scale, eucalyptus seeds appear to be the fastest germinating and easiest trees and shrubs to raise of any plants with which we are currently working. We recently sowed seed of 63 different species without any pretreatment. Of this number seed of 61 had germinated by the

tenth day; seed of the other two species failed to germinate, which would indicate that they may require special handling.

The case with which we are able to raise some plants from seed and the challenge and uncertainty afforded by the "difficult" ones makes this phase of plant propagation a fulfilling experience to those of us who are fortunate enough to be employed in this field.

MODERATOR CLARKE: We will go right along and save the questions until later. The next speaker is a member of a nursery family, a graduate of Oregon State University and now has a wholesale nursery at Vancouver and, I believe, he recently has branched out into the retail business. Jack Doty is going to talk about direct seeding into peat pots, Jack:

DIRECT SEEDING INTO PEAT POTS

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We are all aware of certain plants which are difficult to transplant. In view of this, one can readily see the advantages of direct seeding into peat pots so as to reduce transplanting shock to a minimum.

Seeds selected for our tests were *Arbutus menziesi* (Pacific madrone), *Mahonia nervosa* (Cascade mahonia), and *Cornus nuttallii* (Pacific dogwood). It should be noted here that for the first two plants there is no problem if more than one seed were to germinate in a pot. Therefore, in the case of arbutus and mahonia, two to three seeds were used per container, but only one per pot for *Cornus nuttallii*.

Two types of containers were used: (1) 2½" x 3⅛" peat pot filled with a standard potting mix, and (2) Jiffy "7's", which are basically a fertilized peat contained in a plastic net. Both the peat pots and the Jiffy "7's" were placed in standard 15 x 20 in. nursery flats to facilitate production seeding. An assembly line was set up on roller conveyers. Peat pots were filled at the potting bench, flatted, and fed onto the conveyor where they were dibbled, seeded, and then covered lightly with a fine peat over the whole flat for better moisture control. In the case of the Jiffy "7's", it was necessary to set up tubs for soaking, as they come in a dehydrated form and expand to size when wet.

In direct seedling, one must give careful consideration to seed stratification. As all seeds used have a dormancy problem, we felt it best to stratify them, at least partially, before seeding. However, this could be done naturally by seeding in the fall and maintaining the moisture content during the winter. In our case, direct seeding worked out very well in the