NATIVE PLANT PROPAGATION AT PACIFIC FORESTRY CENTRE[1]

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Some of the shrubs which have been grown at (PFC) for research purposes, i.e. Biological Control of Forest Weeds, White Pine Blister Rust Investigations, include:

Rubus parviflorus (Thimbleberry)
Rubus spectabilis (Salmonberry)
Rubus idaeus (Red Raspberry)
Ribes sanguineum (Red-Flower Currant)
Ribes bracteosum (Stink Currant)
Gaultheria shallon (Salal)

Shrubs of interest for PFC's native landscape or other local plantings:

Arctostaphylos columbiana (Hairy Manzanita)
Arctostaphylos uva-ursi (Kinnikinnick)
Holodiscus discolor (Ocean Spray)
Philadelphus lewisii (Mock Orange)
Spiraea douglasii (Hardhack)
Symphoricarpos albus (Common Snowberry)

Trees which have been grown extensively at PFC:

Quercus garryana (Garry Oak)
Arbutus menziesii (Arbutus)

STANDARD METHOD OF VEGETATIVE PROPAGATION

Most vegetative propagation is done in Green House 5 which has 3 benches with adjustable bottom heat (usually calibrated to produce 20 degrees Celsius temperature in the flat). Intermittent mist is always supplied to bench 1 in the compartment by means of a "Mist-a-Matic". Mist can be supplied to bench 2 or 3 by opening the 1/4 turn valve to the bench. The mist is delivered with Pate L10 nozzles at 36 inch spacing (3 nozzles over each bench).

The standard media used is 1 peat: 2 perlite with no added fertilizers. Cuttings are usually set in 1 foot by 2 foot by 4 inches deep cedar flats. Flats of cell packs are sometimes used as are individual pots or styroblocks.

The standard hormone treatment is to dip the cutting in the appropriate strength of 'Stimroot' powder by Plant Products Co. Other hormone treatments are occasionally given such as liquid 'Stimroot'.

A PROPAGATION BOX FOR WOODY CUTTINGS

Please refer to figure 1 for drawing and details of this propagation frame.

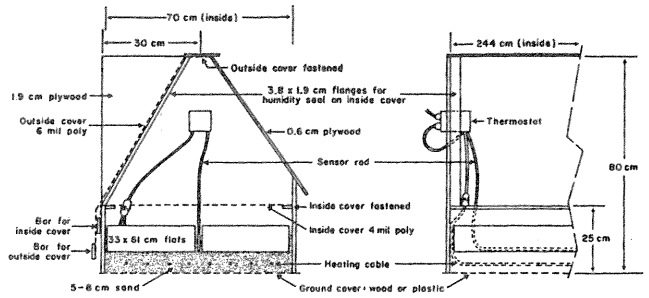

Diagram of outside propagation frames

Figure 1—A propagation box for woody cuttings. Vegetative propagation of woody plants is often promoted when cuttings are maintained in a humid atmosphere with bottom heat. This will help to increase success rates and speed the rooting process. This structure was originally designed at Pacific Forestry Centre by Dr. H. Brix to provide such an environment at minimal cost. It can be easily constructed and uses household electricity. Soil temperature is regulated using a heating cable and controller. The cable is buried in sand and a thermometer is used to monitor temperature. The front of the box is covered with 6 mil. plastic in two layers to create a high humidity environment and minimize water loss from the cuttings. This also reduces watering requirements to approximately once a week.

This propagating box can be used successfully to root a wide range of woody cuttings of native and ornamental shrubs. It requires very little maintenance (once a week watering).

PROPAGATION TREATMENTS FOR FOLLOWING SHRUBS AND TREES

Rubus parviflorus (Thimbleberry)

The traditional propagation method has been to collect root pieces in the fall. These root pieces should be cold stored until spring to ensure that they have been given sufficient cold treatment to sprout and root properly. The root pieces can be cut to 6" long for thick pieces and down to 2" long for thin pieces. They should be covered shallowly in the flats of rooting medium (1/2" covering). Once well developed shoots have formed the root pieces (with vigorous shoots) can be dug from the flats and potted up individually. The problems with this method are:

- Many times other root pieces than the target *Rubus* sp. are supplied.

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[1]Hagel, R. 1999. Native plant propagation at Pacific Forestry Centre. In: Landis, T.D.; Barnett, J.P., tech. coords. National proceedings: forest and conservation nursery associations—1998. Gen. Tech. Rep. SRS-25. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 148-153.

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- Shoot sprouting is sometimes poor if the root pieces are collected from poor plants or are collected too early in the fall.

- The method is somewhat space and labour intensive. The propagation method I use is to root softwood cuttings off of nursery stock plants which are obtained by the above method. This can be done successfully almost any time of the year, providing the stock plants are pruned to produce vigorous new shoots. Cuttings can be standard tip cuttings, second or third cuttings from tip, and leaf-bud cuttings. Stimroot #1 or #2 (or comparable rooting hormone) should be used on the cuttings to help promote rooting. Wounding can be done to the more woody lower shoot cuttings. Large, vigorous 1 gallon stock can be produced in 2-4 months from cuttings.

Rubus spectabilis (Salmonberry)
As per *R. parviflorus* above. The salmonberry cuttings should root near 100 percent and will usually be more vigorous than the thimbleberry cuttings.

Rubus idaeus (Red Raspberry)
As per *R. parviflorus* above. The red raspberry usually roots well from softwood cuttings but is slower to grow than the other *Rubus* species.

Ribes sanguineum (Red-Flower Currant)
The Red-Flower Currant is normally propagated from hardwood cuttings collected in the fall. This method is very successful and will produce large 1 or 2 gallon stock plants in one growing season. I have also been required to produce plants in the early summer. Good success can be achieved with summer softwood cuttings if treated with Stimroot and placed under intermittent mist as outlined under "Standard Method of Vegetative Propagation".

Ribes bracteosum (Stink Currant)
As per *R. sanguineum*.

Gaultheria shallon (Salal)
Salal is usually grown from seed. I have had good success rooting salal from July softwood cuttings (three collections: Bamfield, Shawnigan, and one other). The poorest rooting percentage was > 80 percent with 2 collections > 90 percent. These cuttings were rooted in styroblocks in our main greenhouse using the irrigation boom for misting and the high pressure fog system for increasing humidity and reducing stress on the cuttings.

Arctostaphylos columbiana (Hairy Manzanita)
Hairy Manzanita can be easily grown from cuttings placed under mist as outlined in "Standard Method of Vegetative Propagation". Tip cuttings root well but the next cutting down from the tip often roots quicker and better, especially if given a wounding treatment as shown on my slides. I have rooted cuttings that were taken in November, December, January, and in February with equal success (usually > 80 percent). Cuttings taken from good quality nursery stock plants will root near 100 percent.

The plants grow very vigorously in the first year in the greenhouse or shelterhouses at PFC and can be a little tricky to grow. Fertilizing from pot-up time to the end of August should only be done once a week or once every two weeks with a balanced fertilizer (such as Plant Prod 20-8-20 or 20-20-20) at 100 ppm N. To prevent plants from getting leggy it may be necessary to regularly pinch the new growth to produce a compact bushy plant. At the end of August/beginning of September it is recommended to switch to a low nitrogen fertilizer (such as Plant Prod 8-20-30) to help harden the plants and reduce the potential for a late flush to occur.

All plants produce flowers at 2 years old. At 3 years old the plants are looking much like a mature plant.

Arctostaphylos uva-ursi (Kinnikinnick)
I have only rooted Kinnikinnick from November tip cuttings. They root easily and produce good plants in one season.

Holodiscus discolor (Ocean Spray)
I grew Ocean Spray from seed for the first time last year. I found that 6 weeks cold stratification was not near enough for the seed source I had. However the germinants I did get grew well and more than filled a styroblock 45 plug (PSB615A).

This year I fall sowed my seed which gave the seed approximately 4 months cold stratification. The trays have just been brought to germinating temperature and so far the germination looks very good.

Philadelphus lewisii (Mock Orange)
Mock Orange is easily propagated by hardwood cuttings taken in November. The first year growth is very vigorous and may require stock to eventually be potted-on to 2 gallon pots in the first year. Sturdy, well branched plants 1 meter tall were the average stock produced.

Spiraea douglasii (Hardhack)
Hardhack is easily grown by seed. A fall sowing scattered in a flat with a cover over will provide the necessary cold stratification for the previously dry seed. Seedlings can be transplanted from the flat to appropriate styroblocks (PSB 415D - 77 cav./170 ml or PSB615A - 45 cav./336 ml) in early spring. Seedling stock should reach 30 cm in height with a caliper of 5 mm or greater.

Hardhack is also readily propagated by December hardwood cuttings. On December 20, 1997, I set 1 flat of cuttings with Stimroot #2 powdered rooting hormone. The flat was placed in the rooting box (fig. 1). The rooted cuttings were potted up on February 4, 1998 with a rooting success of 110/112. All rooted cuttings are currently growing very well with no after potting mortality. This stock is extremely vigorous and will easily fill out a one gallon pot in it's first year.

Symphoricarpos albus (Common Snowberry)

Snowberry can be readily propagated by hardwood cuttings taken in November and placed under mist as outlined in "Standard Method of Vegetative Propagation". The cuttings will likely do well in the propagation box as described earlier or in a greenhouse with bottom heat and only occasional mist.

Snowberry grows vigorously and will produce large 1 or 2 gallon stock in one year. The plants will also produce a profusion of flowers and subsequent berries in the first year.

QUERCUS GARRYANA (GARRY OAK)

Seed Selection

Fallen seed is all right to collect but should be done frequently to ensure that the acorns do not dry out too much before collection. Collected seed should be given a float test and any floaters should be discarded (either partially filled seed, too dry with visible cracking, or weevil damaged). Inspect seeds and discard ones with round weevil holes, very small acorns, and acorns with large cracks. Soak remaining good seed for 24 hours. Any sprouting acorns can be planted right away as there is no embryo dormancy in the seed. Place non-sprouted seed in heavy plastic bags and place in cold room that is just above freezing (0 to 1° C is ideal) for one month. Check acorns weekly to allow removal and planting of sprouted ones and removal of molding or damaged ones. The one month cold storage provides for more rapid and complete germination and also spreads out the work load. I have successfully stored and subsequently grown acorns that were stored until March.

Types of Containers

Since oaks naturally form a deep root, narrow deep containers are preferable to short wide ones. Containers must allow roots to air prune themselves at the container bottom to ensure that roots don't circle around and become "pot-bound". Container types I have used successfully are:

- Monarch Plant Band - 2"x2"x8" deep (waxed cardboard much like a milk carton). This container is the one most widely used in California. The cells begin to break down toward the end of the season and subsequently the seedlings are best planted in the fall at 1 year old.

- PSB 615A - 45 cavities per block that are 15 cm deep with a volume of 336 ml per cavity. This container is best for growing the oak seedlings for one season only, although it is possible to grow seedlings for 2 years in this container.

- PSB 623B - 28 cavities per styroblock with 500 ml volume per cavity (~ 23 cm deep). Seedlings can be grown 2 years in this container although it can be very difficult to water thoroughly enough to saturate the bottom of the plugs in the second year (up to 8 passes with wand if hand watering).

Soil Mix

It is important that mixes provide good aeration and drainage. The mix recommended by California researcher Douglas D. McCreary is listed below:

1 5-cubic foot bag of course peat
1 5-cubic foot bag of course vermiculite
4 cubic feet of fir bark (1/8" - 1/4" size)
1 pound of lime
2 pounds of Osmocote slow release fertilizer.

The rates work out to approximately 1.0 kg/m^3 of lime and 2.0 kg/m^3 of Osmocote. I used a mix comparable to this one when first growing oaks in October 1992 but added 2 ft^2 of perlite and used the following fertilizers:

coarse dolomite lime at 3.0 kg/m^3
Micromax at 0.75 kg/m^3
Osmocote 18-7-12 (9 month) at 2.0 kg/m^3

Currently I use a soil mix of 3 peat : 1 vermiculite : 1 perlite with fertilizers approximately as above. Containers should be loaded with low rates of compaction to ensure that a well drained and highly aerated soil is maintained.

Planting Acorns

If radicles on acorns have started to emerge prior to planting, position the acorn such that the radicles is pointing down. Acorns that have not germinated should be placed on their side. All acorns should be covered with 1/2 to 1 inch of potting soil, then 1/3 inch of forestry sand.

Irrigation and Fertilization

Irrigation frequency will depend on soil mix, container size and depth, and growing environment. However, the mixes should be allowed to dry down somewhat between each irrigation and not kept saturated all of the time. Fertilizing should not be required until leaves are visible (February). At that time commence regular fertilizing with a balanced fertilizer i.e. 20-20-20 at 100 ppm. of nitrogen or Plant-Prod 20-8-20 high nitrate at 0.5 g/l. At the end of August it is best to change to a lower nitrogen fertilizer such as Plant-Prod Fall Finisher 8-20-30 at 0.5 g/l.

Growing Facilities

The seeded containers are best protected in a heated greenhouse. The greenhouse can be kept at dormant winter temperatures until the end of February (i.e. 2-3° C night temperature and 10° C day). Grow the oak seedlings at approximately 21° C day temperature and 15 C night temperature from March 1st until the end of May. After that time they may be moved outside to grow the remainder of the season. To prevent scorching of the seedling's leaves move stock out under shade for two weeks prior to the full sun treatment or during a period of prolonged wet weather.

Garry Oak Growth Patterns

The oaks will normally spend several months growing a root system before the shoots emerge. The Garry Oaks will initiate root growth soon after they are collected, even while still in cold storage. By the time the shoots emerge in February or March, a substantial root system will be developed. The tap root will reach the bottom of the 15cm - 23cm containers in 4 to 6 weeks after sowing, even when they are kept at dormant winter conditions.

Shoot growth consists of a series of 2 to 4 "flushes" or growth periods. Care should be taken to prevent a late flush in the fall. Begin to restrict watering and fertilization in the late summer and also switch to a low nitrogen fertilizer at that time.

Planting

Planting guidelines are covered in a "Forestry Facts" (Appendix 1) publication prepared for a fall 1993 planting of 3000 Garry Oak seedlings by individuals in Greater Victoria. Please refer to this publication for detailed instructions.

A fall planting once fall rains have commenced has been very successful. A February/early March planting will also be successful.

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Mature berries may be collected off the trees from October to December or off the ground at the same time. The seeds should be removed from the flesh of the berry, placed in a moist medium, then given a cold stratification treatment. A 60 to 90 day stratification period may be necessary for some seed lots. Germinants will transplant readily if required. I have found the PSB615A to be an adequate container but would expect better quality seedlings from the PSB615B.

Forestry Facts

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Guidelines for Planting and Establishment of Oak Seedlings

The Garry Oak

The Garry Oak (*Quercus garryana*) is one of the more distinct and certainly one of the most stately trees growing in the Greater Victoria landscape. It is the only oak native to British Columbia, and is confined to the southeast coast of Vancouver Island and the adjacent Gulf Islands, with two isolated locations on the mainland.

Garry Oak normally grows to massive proportions on deep, rich, loam soils, but is usually a smaller, gnarled tree on dry rocky knolls and shallow pockets of soil.

Site Selection and Preparation

The Garry Oak grows best in a bright sunny location having well drained soils. Dry, rocky areas are acceptable, but avoid wet, marshy land. When choosing a location for planting, remember that over two or three generations your tree can grow to be enormous, so leave plenty of room for expansion.

An important factor that often limits growth and survival of the newly-planted oak seedling is dry soil. Vegetation (especially grasses) often competes for available soil moisture, leaving little for the oak seedling. It is therefore recommended that a .5 m-1.5 m diameter circle around each planting site be cleared of other vegetation (fig.1). This can be done by hand weeding, scalping, hoeing, scraping, or removing the grass sod on sites with heavy grass competition. This clear area around the planting spot should be maintained until the seedling is well established. Placing some type of mulch such as bark mulch, composted leaves, straw, compost, or landscape fabric around the planted seedling will help reduce future weed and grass growth as well as conserve moisture by reducing evaporation from the soil surface.

Figure 1 — Planting the seedling

Transplanting

Use a shovel to dig a planting hole approximately 40 cm deep. Backfill the planting hole half way with the loosened soil. Gently set the plug seedling in the hole with the root crown at the level of the soil surface. Fill the hole with soil, firmly tamp the soil down, and soak it. Soaking the transplant will settle the soil and help eliminate air pockets around the seedling roots. Continue to soak the planted seedling weekly until fall rains soak the surrounding soil to a depth of 15 cm.

Watering transplanted oaks

Watering, weeding, and mulching is important until the seedling is well established. For the first growing season, thoroughly soak the seedling so that water deeply penetrates the soil (10 L per seedling) every two weeks or whenever the top 5 cm of soil is dry (fig. 2). Taper off watering as the seedling becomes established—many plantings will be successful with only a few waterings during the first season. If your seedling is

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planted in an area receiving regular irrigation (such as a lawn), plant on a raised mound to ensure the area around the root crown is well drained.

Figure 2 — Watering the transplanted seedling

Seedling Protection.

If browsing by rabbits, deer, or other animals is a problem in your area you can reduce the risk of such injury by placing a protective cage over the seedling. One type of cage that will work consists of a 50x50 cm aluminum screen that is formed into a 13-cm-diameter cylinder and stapled to a 1" x 2" x 60 cm wooden stake. Drive the stake into the ground so that the cage covers the seedling, then fold the cylinder closed at the top. This cage will keep out browsing animals and some insect pests until the seedling is established.

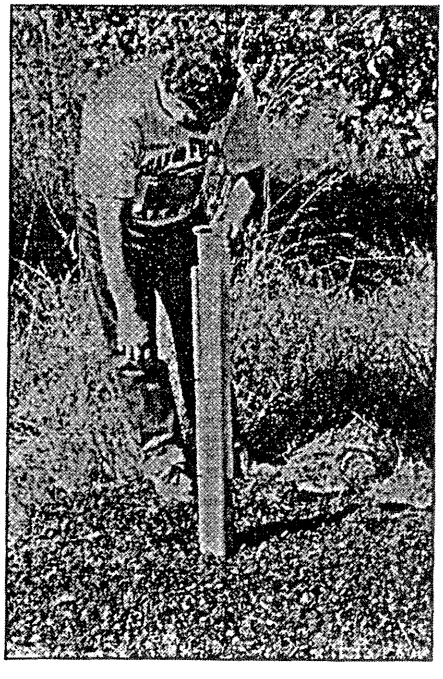

Figure 3 — Seedling protector over oak seedling

Another type of seedling protector is a rigid translucent tube. A 90 cm high tube is recommended for your oak seedling (fig.3). These shelters not only exclude browsers and some insects but also stimulate height growth as well. When the seedling grows to the top of the protector, open up the cage or remove the protector so the seedling can continue to grow. You are now well on your way to establishing a Garry oak tree.

Insect Pests

Two insects, the jumping gall wasp and the oak leaf phylloxeran, are currently causing extensive scorching of the leaves on Garry oaks throughout the Greater Victoria area. Natural biological controls are expected to reduce jumping gall wasp populations to non-damaging levels. However, damaging populations of the oak leaf phylloxeran are expected to develop on about 10% of the seedlings after planting. Seedlings chronically infested with heavy phylloxeran populations are unlikely to survive since natural biological controls have been ineffective. These seedlings should be removed.

Although damage symptoms are similar, the two pests can easily be distinguished by examining the lower surface of effected leaves. The jumping gall wasp produces small 1-1.5 mm round galls resembling mustard seeds (fig.4). The oak leaf phylloxeran is a small (1 mm) orange aphid (fig.5).

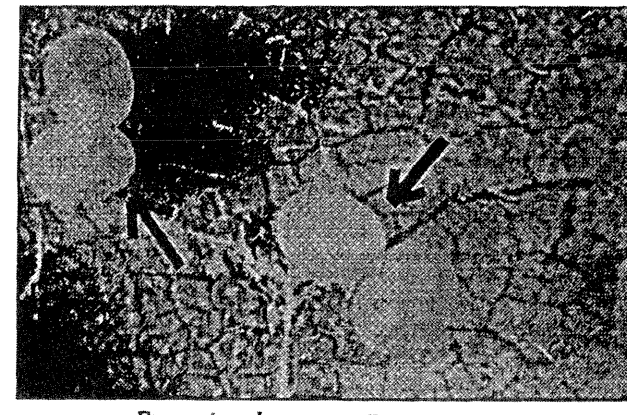

Figure 4 — Jumping gall wasp galls

Figure 5 — Oak leaf phylloxeran

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