

obtained provided strict attention is paid to the details of the operation, especially that the wood be healthy, mature, protected from drying and stored at a constant temperature.

MODERATOR LEACH: Thank you, Mr. Mackay.

The next speaker is Ray Halward of the Royal Botanic Gardens, Hamilton, Ontario, and he will speak on Collection, Storage and Use of Dormant Scionwood.

COLLECTION, STORAGE AND USE OF DORMANT SCIONWOOD

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Selection of Scionwood

I hardly think it necessary to delve at any length into the importance of the selection of suitable scionwood and to what extent it affects the Propagator's success in grafting. This has been emphasized in many previous papers presented to this society.

Selection of Scionwood should be from known plants whose performance in the past has been observed and found to have the most desirable characteristics of the species and varieties involved, and permanently labelled or charted to prevent errors. It is equally important to be sure that the wood to be used for grafting is kept free of insects and diseases. Weakened Scionwood is a poor risk.

Maturity of Scionwood in respect to grafting, in most cases, has not been reached until it has been exposed to a period of near freezing temperatures. This process in nature can be duplicated by the use of refrigeration. This allows early collection where necessary, particularly where importation is desirable or extreme weather conditions prevail or where scions are needed from plants which might suffer from winter injury.

Storage of Scionwood

Most of the growers were of the opinion that storage was unnecessary except for a day or two in advance of actual use. When storage for any length of time is necessary most sources were agreeable that plastic bags or wrap, and refrigeration with a constant temperature between 35 and 40 degrees is best. In some cases slightly moist sphagnum moss or sawdust is used in conjunction with plastic. Whenever storage is necessary humidity should be kept high to prevent any dehydration of scionwood. Mr. DeGroot of Sheridan Nurseries suggested layering evergreen scions in boxes, with snow between the layers, in snowbelt areas. He added a word of caution, all frozen scions should be thawed in cold water before using. An older method of storage is the use of a trench covered with boards in a shady location, using sand as medium for heeling in the Scionwood.

Use of Scionwood

The selection of the material to be used as understock is equally important as the selection of scionwood. Is the understock compati-

ble? Will it produce the best plant under variable growing conditions. Is it easy to get, or will it propagate readily? Is it abnormally affected by insects or diseases? These are some of the questions a grower must consider. I believe this is best illustrated by the change from *Juniperus virginiana* to *Juniperus chinensis glauca Hetzi* as understock for Juniper grafting.

Two methods of using dormant Scionwood are described below. One with Evergreens, the other with deciduous plants. Mr. Jens Pederson, Rose Arbor Nurseries, Oakville, explained his method of Juniper grafting using Hetz understock. About the end of October two year old understock plants are dug and graded for size and quality. They are gradually potted up and benched in a cold house. On or about the middle of December the heat is turned on. The sides of the benches are partially closed in to give a higher temperature for bottom heat. The thermostats located under the bench are set at 80 degrees. This gives about 65 degrees in the bench.

Grafting using the veneer or side graft is started about the middle of January, using scions collected the previous day and thawed with cold water if necessary. After tying with rubber or plastic bands the pots are plunged in peat at an angle and the union slightly covered with peat. The whole bench is enclosed with plastic for about five weeks. They are gradually hardened off for planting by the last of May or early June.

On bare root grafting of deciduous shrubs and trees Mr. William Vanderkruk, Watertown, Ontario, of Connon Nurseries contributed his method. The understock is lifted in late fall and layered in boxes of peat moss slightly moistened. These boxes are stored in a cold storage shed where the temperature frequently drops to well below freezing. Near the end of February the stock is brought in, thawed and grafted with scions collected as needed. On completion of the grafting operation the grafts are tied, dipped in grafting wax and re-layered in the peat. Storage temperature for the next 5 or 6 weeks is kept about 55 to 60 degrees where callusing takes place. When sufficiently callused they are moved outdoors in cold frames to await suitable conditions for lining out. This is the method used for deciduous trees and shrubs considered not difficult to graft.

Following is a list of Genera, type of scionwood, type of graft, time to graft, understock used and remarks. The list was formulated by G. Leiss of Erindale Nurseries, Streetsville.

Name of Plant	Type of Scionwood	Type of Graft	Time	Remarks — Understocks
<i>Acer palmatum</i> & Vars.	1 yr. - mature	veneer	Aug-Spring	on plants in active growth - <i>A. palmatum</i>
<i>Acer platanoides</i> & Vars.	1 yr. - mature	side, splice - whip & tongue	Spring - Late Winter	leave bud on back of understock <i>Acer platanoides</i>
<i>Acer rubrum</i> & Vars.	1 yr. - mature	side, splice	Spring "	possible on <i>A. saccharinum</i> best on <i>A. rubrum</i>
<i>Actinidia</i> vars.	1 yr. - mature	side	Spring "	on own roots
<i>Aesculus hippo.</i> & Vars.	1 yr. - mature	side in Spring T cut in Aug.	Spring "	on own roots
<i>Alnus</i> vars.	1 yr. - mature short scions	side & splice	Spring "	on own roots, potted plants
<i>Amelanchier</i> vars.	1 yr. - mature	side & splice	Spring "	bareroot possible on <i>Crataegus</i> , <i>Sorbus</i>
<i>Ampelopsis</i> Vars.	1 yr. - mature	side or splice	Spring "	on <i>Parthenocissus</i>
<i>Aralia</i> Vars.	1 yr. - mature	side or splice	Spring "	on own roots
<i>Aristolochia</i>	1 yr. - mature	splice	Spring "	on own roots
<i>Berberis</i> Vars.	1 yr. - mature	side or splice	Spring - Aug. L. Winter	evergreen varieties on <i>B. vul. atropurp.</i> or <i>B. thunbergi atropurpurea</i>
<i>Betula</i> Vars.	2 yr. -	side or splice	Spring - Late Winter	in greenhouse on potted stock grafts waxed outside possible
<i>Buddleia</i> vars.	green	wedge	Summer	on own roots
<i>Carpinus betulus</i> vars.	1 yr. - mature	side or splice	Spring "	in greenhouse on potted stock, waxed on <i>C. betulus</i>
<i>Carya</i> sp. & var.	1 yr. - mature	side or splice	Spring "	on own roots possible on <i>Juglans nigra</i>
<i>Castanea</i> sp. & hyb.	1 yr. - mature	side or splice	Spring "	on potted stock in greenhouse <i>Castanea mollissima</i> , outside also
<i>Catalpa</i> vars.	1 yr. - mature	side or splice	Late Spring	on <i>C. speciosa</i>
<i>Ceanothus</i> vars.	green	side or splice	Spring - Late Winter	forced in greenhouse
<i>Celtis</i>	1 yr. - mature	side or splice	Spring "	on own rt. potted stock in greenhouse

Name of Plant	Type of Scionwood	Type of Graft	Time	Remarks — Understocks
Chaenomeles	1 yr. - mature	side or splice	Spring "	on own roots, bare-root stock also Malus
Chionanthus	1 yr. - mature	side or splice	Spring "	on Fraxinus ornus, stock bare-root
Clematis	green	wedge	Spring	on C. vitalba under double glass
Colutea vars.	1 yr. - mature	side & splice	Spring - Late Winter	own roots, also Caragana arb.
Cornus florida vars.	1 yr. - mature	vencer	Spring "	own roots
Corylopsis	2 yr. -	vencer	Spring "	on C. spicata. potted, or Hamamelis
Corylus	1 yr. - mature	side or splice	Spring "	on C. avellana potted
Cotoneaster	1 yr. - mature	side or splice	Spring "	on C. bullata, C. acutifolia, C. dielsiana Standards on Sorbus & Crataegus
Crataegomespilus	1 yr. - mature	side or splice	Spring "	on Crataegus monogyna
Crataegus	1 yr. - mature	side or veneer	Spring "	on roots C. monogyna . C. oxycantha
Cytisus	1 yr. - mature	vencer	Spring - Aug.	on C. scoparius, or C. nigricans for strong powers
Daphne	1 yr. - mature	side or veneer	Late - Spring Winter	on roots D. laurcola
Davidia	1 yr. - mature	side or splice	Winter - Spring	on Nyssa
Diospyros	1 yr. - mature	side or splice	Winter - Spring	on D. virginiana or D. lotus potted
Elaeagnus	1 yr. - mature	side or splice	Winter - Spring	colored leaf vars. of E. pungens on E. multiflora
Evodia	1 yr. - mature	side	Winter - Spring	on Phellodendron potted
Euonymus	1 yr. - mature	side or splice	Winter - Spring	on E. europaea for standards
Fagus	2 yr. - mature	side	Winter - Spring Aug.	on potted stock in greenhouse on stock in nursery rows
Fraxinus	1 yr. - mature	side	Late Winter Spring	on own roots with bud on back of understock
Genista	1 yr. - mature	side	Late - Spring Winter	on G. tinctoria seedlings
Gleditsia	1 yr. - mature	vencer	Winter - Spring	on G. triacanthos

Name of Plant	Type of Scionwood	Type of Graft	Time	Remarks — Understocks
Hyalimodendron	1 yr. - mature	side	Winter - Spring	H. purpurea on Caragana arborescens
Hamamelis	1 yr. - mature	side or veneer	Winter - Spring	on 2 year seedlings potted of H. virg. grafts waxed
Hedera helix arb.	1 yr. - mature	side	Winter	on Hedera helix
Hibiscus syr. vars.	1 yr. - mature	side	Fall	
			Late - Spring	on H. syr.
Ilex vars.	1 yr. - mature	side or splice	Late - Spring	on potted stock in greenhouse
			Winter	on I. aquifolium, I. crenata
Juglans	1 yr. - mature	veneer or side	" "	bareroot or on potted stock in greenhouse on Laburnum anagyroides
Laburnocytisus	1 yr. - mature	side	" "	on Laburnum anagyroides
Laburnum	1 yr. - mature	side	" "	on own roots potted in greenhouse
Liriodendron	1 yr. - mature	side	" "	on potted stock in greenhouse on M. kobus
Magnolia	1 yr. - mature	side or veneer	" "	on potted stock in greenhouse, on M. kobus for slow on M. acuminata for fast
Mahonia	1 yr. - mature	side or splice	" "	on M. aquifolium for M. Fortunei and M. Beali
Malus	1 yr. - mature	side or splice	" "	American on on apple seedlings M. prunifolium
Mespilus	1 yr. - mature	side or splice	" "	on own roots or Crataegus
Morus	1 yr. - mature	splice	Spring	after sap starts to flow on M. alba
Osmanthus	1 yr. - mature	side	Winter - Spring	on Ligustrum vulgaris
Ostrya	1 yr. - mature	side	" "	on Carpinus betulus potted in gr. house
Paeonia arb.	Current seasons	side	Aug. "	on P. lactiflora, wax and tie with lead wire
Parrotia	1 yr. - mature	side	Late - Spring Winter	
			" "	on Hamamelis potted in greenhouse
Phillyrea	1 yr. - mature	side	" "	on Ligustrum vulgaris
Photinia	1 yr. - mature	side	" "	on Crataegus or Cydonia
Pyrus	1 yr. - mature	side	" "	on own root, some on Chaenomeles
Populus	1 yr. - mature	side	" "	P. Bolleana on P. nigra italica
Ptelea	1 yr. - mature	side	" "	on P. trifoliata

Name of Plant	Type of Scionwood	Type of Graft	Time	Remarks — Understocks
Quercus	2-3 yr. - mature	side or veneer	after sap flow	also on potted stock, graft on same group
Rhamnus	1 yr. - mature	side	Late - Spring Winter	bareroot or in field
Rhododendron	1 yr. - mature	side	" "	on Rhod. ponticum under dbl. glass
Rose	green with leaf	side - behind the bark	Winter	double glass
Sambucus	1 yr. - mature	side	Late - Spring Winter	on S. nigra & S. racemosa
Sophora	1 yr. - mature	side	" "	vars. on S. japonica
Sorbus	1 yr. - mature	side	" "	on S. aucuparia & S. americana S. aria on Crataegus
Syringa	1 yr. - mature	side or saddle	" "	on Ligustrum vulgaris
Ulmus	1 yr. - mature	side or splice	" "	on same species
Viburnum	1 yr. - mature	side or splice	Aug or Spring	on V. lantana, potted
Wisteria	1 yr. - mature	Whip & tongue, side or veneer	Late Spring Winter	on own roots
Zelkova	1 yr. - mature	side	" "	on Ulmus
Abies	1 yr. - mature	veneer - V cut of Terminal bud	Spring - Aug.	on potted stock, double glass
Chamaecyparis	1 yr. - mature	veneer	Late - Aug. Winter - Spring	on own root potted, also Thuja orient.
Cryptomeria	1 yr. - mature	veneer	" -Aug.	on C. japonica
Juniperus	1 yr. - mature	side or veneer	Winter - Aug.	on J. Chin. gl. Hetzi, best also J. virginians
Larix	1 yr. - mature	veneer	Spring - Aug.	
Picea	1 yr. - mature	veneer	Spring - Aug.	potted under double glass
Pinus	1 yr. - mature curren seasons- Aug.	veneer	Spring - Aug. - Nov.	on same type
Pseudotsuga	1 yr. - mature	veneer	Spring - Aug.	on own — under double glass potted
Tsuga	1 yr. - mature	veneer	Spring - Aug.	" — " " "

MR. HALWARD: I would like to mention the names of the fellow Canadian members who contributed information to this paper: Mr. Constant deGroot of the Sheridan Nurseries, Jens Pederson from Rose Arbor Industries, Oakville; William Vanderkruk, from Waterdown, John Cannon Nurseries; George Leiss from Erindale; Robert Fleming, Vineland Experiment Station and also Louie Forester from the Royal Botanical Gardens, Hamilton. If it hadn't been for these fellows, I wouldn't be up here today.

MODERATOR LEACH: Gentlemen, we are far enough behind schedule that I am afraid we are going to have to track down Mr. Mackay and Mr. Halward in the recess that is coming up in a moment and address your questions to them personally. In the meantime I want to thank Dr. Widmoyer, Professor McDaniel, Mr. Davis, Mr. Jaynes, and Mr. Mackay and Mr. Halward, for their fine contributions this morning.

The next session on the program this morning relates to the propagation of Plants by Seeds. The first speaker is Ken Reisch, of the Department of Horticulture in Ohio State University, who will talk on After Ripening as Related to Germination and Seedling Growth.

AFTER RIPENING AS RELATED TO GERMINATION AND SEEDLING GROWTH

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Seeds of many plant species do not germinate readily for various reasons or combinations of reasons and to introduce the subject I will define some common terms relating to this.

Seed Dormancy is an all inclusive term indicating that seed will not germinate and produce seedlings due to unfavorable environmental or internal conditions (the inhibitory factors may be external, internal or a combination of both).

Quiescence relates to the fact that seed will not germinate and produce seedlings due to unfavorable external conditions. Contributing factors are moisture, temperature, oxygen, light, or others such as pH, nutrients, carbon dioxide, or toxic conditions. This can be overcome by simply supplying the contributing factors at optimum for germination.

Rest or Internal Dormancy describes the situation where seed will not germinate and produce seedlings due to unfavorable factors or conditions specific to the seed. These may be classified in the following eight areas. Seed coat, endosperm, embryo development, embryo rest, epicotyl rest, root and epicotyl rest, cotyledons, and combinations of these. The inhibitory action of these factors or conditions can be overcome by seed coat treatments, furnishing food materials, cold temperatures, warm temperatures, combinations of warm