

days we mist twice a day, once in mid-morning and again in the afternoon. The grafts remain in the bench for 6 to 8 weeks.

**Taking grafts from the grafting house.** At this time the understock is cut off and the grafts are placed back into a greenhouse at 65°F. The soil in the beds is loosened up and leveled off before plunging the pots half way down and set 1 in. apart.

**Taking grafts from the greenhouse to the beds.** During the last week in May or first week of June we plant the maple grafts outside. The grafting elastic is cut off and after watering, the grafts are brought to the outside beds. The outside beds are 6 ft wide and the grafts are placed 12 in. apart. They are planted by trowel and then shade is applied.

**From the beds to the field.** After two yr. the maples are dug from the beds in the second week of May. After pruning the tops and roots, they are then watered, placed into boxes, and taken to the field for planting. They are planted 30 in. apart in 36 in. spaced rows. After three years the grafted maples are sold as 18 to 24 and 24 to 30 in. stock.

## QUESTION BOX

The Question Box Session was convened at 9.00 a.m. with Ralph Shugert and Joerg Leiss serving as moderators.

**MODERATOR LEISS:** What is the shelf life of a rooting compound, such as the various Hormex formulations, provided you keep them in a cool, dry place? Will they break down after a certain period of time?

**DICK WOLFF:** If it is kept cool and in the dark there should be no deterioration. I have had some cans for 6 and 7 years but finally threw them out because I was concerned, even though I was successful.

**PETER VERMEULEN:** We were approached by the maker of Hormodin who was working on labeling. During the course of the conversation we were advised that Hormodin had an excellent shelf life if kept cool, sealed, and out of the light.

**JOERG LEISS:** Does it make any difference in relation to heat buildup when using two layers of plastic, whether the clear or the opaque layer is to the inside?

**JIM CROSS.** Dick Bosley did a study years ago. The best combination in cool areas was white on the inside and clear on the outside for heat uptake.

PETER VERMEULEN: Bill Roberts, an agriculture engineer, indicated that it did not make any difference what the arrangement was.

JOERG LEISS: Question for Nina Basuk. At what time of the year did you start the etiolation process in your tests with the pines?

STUART NELSON: I cannot answer for Nina Basuk but we put it on when snow is still on the ground. We use black plastic but let the etiolated plants become green under indirect light obtained by simply removing the north side of the tent.

JUDY ZUK: The pines were placed, I believe, both inside and outside a greenhouse. With the outside tests the cover was applied before bud break. The greenhouse plants were forced into growth.

MODERATOR LEISS: What is the frequency of graft incompatibility with *Acer rubrum* grafts. At what age does it show up?

JOERG LEISS: It starts when you first take the grafts out of the grafting box, and can continue for maybe 30 years. Put a mechanical digger down and quite frequently the roots go one way and the tops the other, breaking at the graft union.

FRANK GOUIN. In Maryland nurseries we have seen approximately 10 to 12% incompatibility cases within the first 3 years after transplanting, and another 2 to 3% by the time the trees reach 3 in. caliper. It also shows in fall color. If you have strong fall color by August you can kiss it off. If you start with cuttings there is no problem. You can also tell breakage is going to happen if a "horses hoof" develops above the graft union.

MODERATOR SHUGERT: Is crown gall on woody perennials a wide-spread problem? What can be done to prevent this, or to clean up an infected area?

BEN SWANE: It is a problem all over the world. There is a product, "No Gall," which we soak seed in of plants, such as peach and apricot, before stratification. We also use it with our rose cuttings. In addition, we are very careful what we allow on our farm. We do not allow tractors or trucks from other farms to come on our land.

MODERATOR SHUGERT: Can viruses be transmitted through seed propagation?

JOERG LEISS: In some cases they can be and in others, not. *Malus* and *Pyrus* rootstocks are generally considered free of viruses if propagated by seed. *Prunus* seeds have to come from virus-indexed seed sources.

MODERATOR SHUGERT: Has anyone every used antidesiccants to control powdery mildew?

FRANK GOUIN: Yes, and it works. there was a paper in *HortScience* this past summer on this subject. I applied it in mid- to late August to crapemyrtle and to *Euonymus kiautschovica* and obtained excellent control. I applied Vapor Guard once at a 1 to 60 dilution.

JEORG LEISS: Can we obtain a selection of birch that is resistant to the bronze birch borer?

TOM PINNEY: We know that river, yellow, and sweet birch are resistant. White bark birch, 'Whitespire' is also resistant but it must not be confused with *Betula platyphylla* var. *japonica*, of which it is a cultivar.

MODERATOR LEISS: Is 'Whitespire' a registered cultivar of birch? Are you growing it from seed? If it is a named cultivar and you are growing it from seed, how can you expect the progeny to exhibit the same white bark and borer resistance as the parent — especially when birches are known to cross pollinate readily? How can you feel justified in calling the progeny 'Whitespire'?

TOM PINNEY: Yes, 'Whitespire' is trademarked, but it is not patented. We grow it from seed. All the testing was done at Wooster, Ohio, on seedlings. It is a very homozygous plant and has an official cultivar name. Do not get confused by what Deb McCown said. She has decided to take one of the three original parent plants at the University of Wisconsin and to micropropagate it. I guess they could patent that plant. So, if you want to obtain a start of the plant you can contact her or me. Hers will be tissue-cultured and mine will be seed-grown.

There are three plants at the Wisconsin Arboretum which are isolated and, after having grown over 1 million liners I can attest that less than ¼ of 1% are atypical. We are also setting up our seed orchard from the original three plants. Dr. Ed Hasselkus has control of the seed from the original plants.

DAVE DUGAN. We have a good white birch labeled *Betula maximowicziana* that came from the old Kohankie Nursery. The trees have shown no signs of borer damage yet.

TOM PINNEY: What Dave has is what they thought was *B. maximowicziana*. It also may be resistant to bronze birch borer. The true species was obtained from Japan by Dr. Kawase and was found to be susceptible to bronze birch borer. What Dave has is some hybrid or some other species. Birch is very prone to hybridization.

JOERG LEISS: Just a comment on hybridization of birch. I

do not believe that they cross pollinate, because they flower at different times. So a lot of the species are true, I feel.

RALPH SHUGERT: At the old Cole Nursery we had a monarch birch that came from a beautiful park in Philadelphia. After much study it was determined that it was not monarch birch. After visiting Hillier's garden and observing the plant, I can agree that monarch birch has gray bark.

MODERATOR LEISS. *Pieris floribunda* has always been a problem for us to grow successfully. We grow it from seed. Germination is no problem when you have fresh viable seed. However, our problems begin later in the seed flat and after they have been pricked off. They always end up diseased and grow poorly! Is there someone doing a good job growing this plant?

ED VAN HOF. The only thing I feel you have to worry about is excessive water after transplanting because *Pieris* does not grow well with poorly aerated roots.

MODERATOR LEISS: Has anyone crossed *Cornus florida* with *C. kousa* var. *chinensis*?

ELWIN ORTON. I have been successful in crossing plants of these two species in the woody ornamentals breeding program at Rutgers University. Some of the hybrids look very promising and we are patenting several of them prior to introduction. To the best of my knowledge, these are the first hybrids of these two species

MODERATOR LEISS. Could anyone identify a variegated cotoneaster we are growing? It is low spreading and compact in growth.

JOERG LEISS: If it looks like it has spider mites it is probably *Cotoneaster horizontalis* 'Variegatus'.

MODERATOR LEISS: Would anyone know where the 'Nearly Wild Rose' originated?

TOM PINNEY: It is a polyantha introduced in the 1950's and then lost to the trade. Dick Cross from Minnesota found it and put it back into production.

MODERATOR LEISS: What zone would be considered the northern limit for *Abies procera*?

PETER VERMEULEN: I would think Zone 4.

MODERATOR LEISS: Is *Daphne* 'Carol Mackie' variegated? Could it be *Daphne* 'Somerset Silveredge'?

JIM CROSS. I do not know the second cultivar 'Carol Mackie' originated as a sport of *D. × burkwoodii* in a garden in New Jersey. It has a silver edge. [It would, therefore, be named *D. × burkwoodii* 'Carol Mackie,' Bot. Ed.]

MODERATOR SHUGERT: A question for Bernard Fourrier. Please review your herbicide program. My notes say Devrinol 5 lb. Ai/A. When do you apply? Do you use any other herbicide?

BERNARD FOURRIER: We apply at the rate of 5 lb. Ai/A right after sticking the hardwood cuttings in the fall.

MODERATOR SHUGERT: Question for Wayne Lovelace. How many pounds of annual rye per acre do you use?

RALPH SHUGERT: Wayne says 6 to 8 lb. to make a thick sod

MODERATOR SHUGERT: Another question for Wayne Lovelace. Do you sow annual rye when you sow viburnum seed in June/July?

RALPH SHUGERT: Wayne says yes, but be careful with the use of crop oil in high temperatures.

FRANK GOUIN: Wayne has solved the late frost problem. He has delayed the germination of the seeds by 1 to 2 weeks; also, if there is late frost, it will sit on the grass. Don't apply above 65°F or you will get burn.

MIKE DODGE: Could you not use some other crop that would provide a good root system but would die with the onset of frost?

RALPH SHUGERT: No, because there would be no top growth for late spring frost protection.

BEN SWANE: Lots of work on minimum tillage for soil conservation work is going on around the world. One thing that pleases me about Wayne's paper is the fact that it is one application of minimum tillage. I predict that his work will not stop at its present state. I feel that, in the future, he will stratify his seeds out of the ground and use a fluid drill system for planting into the sod.

MODERATOR SHUGERT: Has anybody experienced plant damage with Fusilade application on growing plants?

RALPH SHUGERT: Fusilade, like many herbicides, is labeled for use by genus. It is labeled for use on *Euonymus*. So I applied it over the top of 10 quarter-mile rows of *E. alata* 'Compacta' (3 year plants). It knocked all the new growth and blasted leaves half way down the stem. I will tell you in the spring what bud damage we had. Ralph should have known better. I should have tested it. I am pleased with the results on *Taxus* for quack grass control. Also you cannot use oil with Fusilade but must use a nonionic surfactant.

CLAYTON FULLER. *Euonymus alata* 'Compacta' is not tolerant to a lot of the herbicides we are using today. Ronstar

even inhibits its growth a little. Dr. Ahern's work also showed damage with Fusilade.

ELTON SMITH: Azaleas and junipers are two additional plants in which care is needed when Poast and Fusilade are used. With azaleas we have had extensive leaf defoliation and growing tip injury. The two cultivars we have worked with are 'Hershey's Red' and 'Hino-pink'. In the other group, junipers, the blue color is changed to green. It occurs with both the oil and surfactant.

JIM JOHNSON. We also tried Poast and Fusilade on 'Hershey's Red' azalea but only had damage from Fusilade.

DALE MARONEK: We have experienced some injury from both compounds. We have found that it is important to make sure your crop is not going into stress when you put the products down. I did some trials with irrigation intervals and found that if the crop is stressed you can get injury.

WILL WITTEE: We were cleaning up some Bermuda grass in juniper plants with Fusilate plus X-77 as a surfactant and it turned 'Blue Rug' juniper brown in July and August.

MODERATOR LEISS. How do you propagate male ginkgo trees and then get them to grow?

BILL FLEMER: They can be rooted from softwood cuttings in late July or early August when treated with Hormodin 1 or 2. However, the rooted plants are very slow to start growth so we have finally given up on that method.

A quicker way is to bench graft them like apples. They are faster growing but still take a long time. The fastest method of all is to use seedling-grown plants, but you can not tell the sex. Ginkgos require high heat and nitrogen. Cool nights are not good for best growth.

JOERG LEISS: The fastest method we have found is field grafting. However, you must have a 3-year seedling so you are not that much ahead.

MODERATOR LEISS: Question for Murry Alward. Do you use bottom heat to push your hardwood cuttings to gather your softwood cuttings from them?

MURRY ALWARD: No. I have tried it but found no advantage for most items, but *Prunus × cistena* cuttings do benefit from bottom heat.

MODERATOR LEISS. Question for Bernard Fourrier. At what point do you remove the mulch from the hardwood cuttings in the spring and when are they covered?

BERNARD FOURRIER: We take the hay off as soon as we

can — in late April or early May. It is kind of a gamble with the frost.

MODERATOR LEISS: Can you propagate *Dicentra spectabilis* from summer cuttings? The leaves on our cuttings turn yellow and decay after a week or so. Is there a technique to prevent this?

JOERG LEISS: As soon as *Dicentra* develops a hollow stem it often fails to root. Therefore you need to take them as early as possible.

MURRY ALWARD: After it blooms, cut it back by ½ and you will get small shoots in the leaf axils. These shoots root with no problem.

MODERATOR LEISS: Any suggestions on the propagation of *Euphorbia epithymoides* (also known as *E. polychroma*)?

STEVE STILL: Seed.

JOERG LEISS: Tip cuttings can be taken as late as frost.

MODERATOR LEISS: Can anyone offer any suggestions on how to get good germination of *Eryngium alpinum* seed?

MIKE DODGE: We germinate it under mist with bottom heat.

JOERG LEISS: We sow our seeds in open beds and the seedlings just come up.

MODERATOR LEISS: Has any one accelerated germination of *Syringa reticulata* seed to earlier than August or September?

BERNARD FOURRIER: We found that after stratification for 2 months in peat/sand the seeds would germinate. After stratification we sow the seeds in flats in the greenhouse with 70°F bottom heat, or outside. The outside sown seeds germinate in the spring.

MODERATOR SHUGERT: How do you root *Pinus strobus* 'Nana' cuttings?

ARDA BERRYHILL: Most people are grafting it rather than using cuttings.

MODERATOR SHUGERT: For the past two summers we have experienced premature dormancy (July) in Exbury azaleas. Does anyone have an explanation for this problem?

ANNA KNUTTEL: The best way to grow them is to prune hard in the spring and fertilize a lot in the spring. After hot weather they do not grow very well. Stress induces dormancy.

MODERATOR SHUGERT: Does anyone have any suggestions about rooting lithospermum (*Lithodora*) cuttings?

BEN SWANE: Take short cuttings — less than ½ in. in length with a heel from the inside of the plant. No hormone is required and retain the bottom leaves. Do not overpot the cuttings and place in a quick draining soil with low fertility.

MODERATOR SHUGERT: What is the “loose” yew sold by Stuebaker Nursery?

DON STUDEBAKER: A selection of *Taxus cuspidata* ‘Columnaris’ that has a loose, upright growing habit and may have potential in shady areas.

MODERATOR SHUGERT: Question for Bill Flemer. Do you propagate your *Cornus kousa* var. *chinensis* from seed? If so, are the seedlings uniform?

BILL FLEMER: We have selected and established isolated blocks from previous seedlings. We look for broad, thick leaves and broad, thick bracts. So we do grow them from seed. It can also be propagated by cuttings but, like a number of the tree dogwoods from cuttings, we have had overwintering problems. I remember we had a block in our Allentown nursery about 9 years ago in which ⅔ were planted from seeds and ⅓ were from cuttings. Following a severe winter all the cutting plants died while all the seedlings plants lived. They were 4 to 5 feet tall at the time. The roots just died. We have had the same problem with *C. florida* ‘Rubra.’ The *C. kousa* var. *chinensis* grown from our isolation blocks are the way to go we feel.

## ROOT REGENERATION TECHNIQUES

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### INTRODUCTION

Woody plant establishment and growth are greatly affected by root loss which occurs during the transplanting process. The resulting stresses placed on the plant are a major source of problems in woody plant production and consumer usage of trees and shrubs. Root loss which occurs during digging, handling, storage and transplanting, results in reduced shoot growth for several years, branch dieback, or plant death. It also reduces the type and size of trees able to be moved and makes some species expensive to produce and unavailable in the landscape trade. The transplanting period and the first