

BURIED—INARCHING

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With the exception of easily-rooted species, such as the poplars and cryptomeria, vegetative propagation of forest tree species is practical only where clonal material is advantageous in tree improvement and similar research programs. Only in recent years have vegetative propagation techniques—long familiar to horticulturalists—been applied to many of the coniferous forest trees. So far, grafting has been the most common method of propagation, since many conifers are very difficult to increase by cuttings.

In the Pacific Northwest, Douglas fir is receiving the most attention from research and tree improvement workers. This species has proven to be very easy to graft. However, with the older grafted seed orchards (some now 10 years old), losses due to incompatibility between stock and scion have been of serious magnitude. Recent studies by Dr. Copes gives us hope that grafting may become practical in the future.

However, another way to beat a problem is to avoid it. A clone can also be maintained by cuttings. Repeated trials have shown that cuttings from Douglas fir trees of cone-bearing age are extremely difficult to root, though there are some exceptions. In contrast, cuttings from seedlings or very young trees may root relatively well.

Without knowledge as to what the seedling possesses that enhances rooting, or what the mature tree may have as an inhibitor, the buried-inarch has been developed in an attempt to transfer root-initiating ability from the seedling to the mature tree cutting by forming a temporary union between the two. Romberg in 1942 reported (3) success with a similar technique on pecan. Kemmer in 1958 was using the buried-inarch with apples (2). Since then Jaynes has been successful with chestnuts (1), which have a rooting history very similar to that of Douglas fir.

The buried-inarch might be described as a cutting with the upper portion grafted to a seedling stock and the lower portion in soil or a rooting medium. One or more buds must be present on the upper portion of the cutting. Buds may not be necessary for rooting, but are essential for any future top growth. As a case for this point, one can cite the rooting of budless pine needle fascicles. Union with the stock is easily made by shaping the top of the cutting into a wedge and inserting this into an upward cleft cut into the side of the stock at the desired height. Other grafting techniques may work equally as well. The graft union is secured with conventional budding bands and sealed with grafting wax.

My first attempt to root Douglas fir through buried-inarching was in 1963 (4). Rooting success was about 30 per

cent. In 1966, 328 buried-inarches were made using 16 clones. Overall response again was about 30 per cent, though success within individual clones varied from 0 (one clone) to 70 per cent. In both trials high mortality of cuttings during the rooting period greatly affected the results. It is felt that with proper care these losses could be held to 10 per cent. This would increase rooting to about 40 per cent with no other improvements in technique.

The time of year the buried-inarching is done may be as important as it is with conventional cuttings. Though not all periods have been investigated, greatest response has been from January through March. Little rooting takes place before five months, with the peak of rooting occurring between six and eight months. Lifting of one trial after nine months appeared to be somewhat premature.

Hormone treatments of cuttings with commercial dusts of 0.3 and 0.8 per cent indolebutyric acid have shown no effect on root formation.

Several procedures were tried for making buried-inarches. The most convenient and practical was the use of 2-0 stock in gallon containers. A month or more prior to grafting, the stock was potted with positioning of stock well to one side to make room for a 3-inch peat pot set flush with the soil surface. In applying the buried-inarch the butt of the cutting is in the peat pot which is then covered with horticultural-grade vermiculite and wetted. Other rooting media may be as good, though peat moss in any concentrated amount will kill a Douglas fir cutting.

Size of cuttings was best between five and seven inches in length. With Douglas fir and some other species, care must be taken to make cuttings only from orthotropic growth. Success in rooting may be greater with cuttings from lower and more pendulous branches, but it may take many years for them to be freed from the branching habit of growth.

Greenhouse facilities are very desirable for this work. At Nisqually, Washington, buried-inarches made in mid-winter are moved into a lath house by May. Extra precaution is necessary to guard against drying conditions and wind movement of the buried-inarch.

In conclusion I feel that the technique described is economically practical for production of Douglas fir clones in tree improvement and research programs, though there is much room for improvement. Rooting percentages possibly can be increased through manipulation of heat, light, moisture, growth regulators, etc. The possibility exists of abbreviating the process by grafting scions from seedlings onto the mature-tree cutting.

LITERATURE CITED

- 1 Jaynes, R. A. 1961 Buried-inarch technique for rooting chestnut cuttings *Rept. Northern Nut Growers' Assoc.* 52: 37-39
- 2 Kemmer, E. 1958 Studienbeobachtungen an Kernobstgehölzen *Der Züchter* 28: 367-377

- 3 Romberg, L D 1942 Use of nurse seedlings in propagating the pecan from stem cuttings *Proc Amer Soc Hort Sci* 40 298-300
4 Wheat, J G 1964 Rooting of cuttings from mature Douglas fir *For Sci* 10 319-320

VOICE: At what stage do you cut off the rootstock?

JOE WHEAT: When I investigate the grafts in the fall — October and November. If the inarch is rooted, then I remove it; I don't bother to cut it. I just take them and tear them apart. It is removed then because it will have its own foliage by then and will have an active root system started. I would almost prefer to let the inarches go 12 months because I feel that there are some that were starting to root that I would not have lost if I had left them a little longer. I have to jump ahead a little bit because I want to get them out of the lath-house before winter and back into the greenhouse.

VOICE: Could you use two or three inarches on one rootstock?

JOE WHEAT: You could on some of the huskier ones. Actually I use two. I find I have better results with ordinary cuttings, or with these inarches, by using a sterile medium, something like clean masonry sand or vermiculite, rather than soil. They will root directly in soil but there is a larger initial loss, just as with ordinary cuttings, because of the pathogen problem in unsterilized, normal soil.

MODERATOR DOUGLASS: The next speaker, unfortunately, is absent today. Dr. Oscar Sziklai is in Europe attending the International Union of Forestry Research Organization. However, Dr. Phillip Haddock, University of British Columbia, has kindly agreed to give Dr. Sziklai's presentation on grafting techniques in forestry. Dr. Sziklai is associate professor at the University of British Columbia, teaching forest genetics.

GRAFTING TECHNIQUES IN FORESTRY

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Apomixis is a general term used for all types of asexual reproduction that replace or substitute for sexual methods. Agamospermy includes all types of apomictic reproduction in which embryos and seeds are formed by asexual means. In the case of vegetative reproduction, the propagules are not produced from seed but as a result of cell multiplication by mitotic division. Most plants have the capacity to reproduce vegetatively from roots, stems, branches and leaves; and even in a few cases, the propagules occur within the inflorescence as is the case in vivipary.

Layering, rooting and grafting, as different means of vegetative propagation, have been widely used in horticulture