PROCEDURES TO INCREASE TAKE IN BUDDING AND TOP-GRAFTING

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Despite the recent advances in cutting propagation procedures, there are some species of fruits, nuts and woody ornamentals where grafting and budding are the only practical means for multiplying clones, and others in which for various reasons budding and grafting will supplement cutting propagation My talk is based on work with nut trees and several fruits growing in the open. Several variations from the usual procedure, particularly in summer budding, have shown promise as means of getting more uniform take, with difficult materials or in seasons when ordinary budding practices have not been very successful Three that I wish to emphasize are (1) plate budding as a substitute for "T" budding, (2) plastic bud covers and (3) protective fungicide treatments for nursery-budded or topworked woody plants.

SOME ALTERNATIVES TO "T" BUDDING

The ordinary "T" or shield bud is standard nursery practice for summer propagation of roses, fruit trees of the rose family and many ornamental clones of hardwood species in other families, such as honeylocusts, elms and Norway maples. It works very well for a wide range of easily handled materials. But there are other budding methods that appear more generally effective with some species, and even with roses and common fruits. This is particularly true when growing conditions are not at optimum, due to season, degree of cambial activity, poor maturity of budwood, thickness of the stock bark, or unfavorable weather following budding. The inverted "T", which is standard for citrus tree propagation in Florida nurseries, seems always to work as well as the upright "T" for deciduous plants in the midwest, and often is better. The traditional reason assigned for this is better drainage around the bud This is of some importance, but I believe a major reason is the fact that the stock will form more abundant callus tissue above a horizontal incision than it will below it. The inserted bud therefore has a better chance to unite quickly, if there is an uninterrupted vascular connection between the surrounding stock bark and the active foliage and growing points of the upper stock.

A still more efficient connection between the bud and the upper stock bark is secured with a chip bud or a plate bud For most deciduous materials, except vines, I prefer the plate bud method developed by J F. Jones in Missouri about 1896, which is also called "dry budding" by some Canadian authors. It could be called a reduced chip bud, or a minimum graft Jones made the cuts on the budstick similar to the standard chip bud, except that it was removed with a thinner slice of wood under the eye of the bud. The cut on the stock doesn't extend deeper than the cambium layer, by preference, and all cutting is done with a grafting knife. The bud piece, when placed on the stock, has its sliced bark in contact with live bark of the stock throughout most of its inner face. Callus tissue growing either from the cambium prop-

er, or from the upper stock's inner bark tissues will be in position to give a prompt union with tissues of the bud piece. Jones, who developed this as a method for fall budding of cherries when the bark would not slip, left a lower bark flap on the stock. Some fruit and nut propagators now prefer to eliminate this flap Another variation, used by some with walnuts, pecans and other species tending to have "humped" buds, is to simply slice off a stock bud and a little surrounding bark, replacing this with one cut similarly from the budstick. The latter technique seems to be confined to early spring use.

I have compared, on the same topworked stock, "T" buds, inverted "T" buds and plate buds. With both persimmon and pear trees used in this direct comparison, the advantage usually lies with the plate bud, not only in giving a higher percentage of takes, but in giving a more vigorous initial scion growth from buds that have taken Another advantage, in the case of topworking, is that the plate bud can be set wherever wanted, in branches up to four or five years old, where the bark would be too thick to accomodate a "T" bud. I have used such older limbs for plate budding with mountainash, persimmon, pawpaw, cherry and apple, and in establishing pear and quince on old stocks of *Aronia melanocarpa*

Some species seem poorly adapted to either "T" budding or plate budding methods, at least in late spring or early summer when their bark slips very readily The walnut family is adapted to ring or patch budding in warm weather, provided we can use relatively small buds surrounded with thick bark (Dormant buds from older wood can be used for pecan and black walnut.) Chestnuts, probably in common with oaks and others of that family, are morphologically ill-adapted to budding. These, along with hackberries and some persimmons that have proved difficult to bud, can be propagated in both spring and summer by "girdle grafts," in which thin scions are bridged over a section of larger diameter stock where a ring of bark has been removed or inverted It is a fairly tedious but very effective method If patch buds or girdle grafts are used in hot weather, a sheet of plastic is better than wax for covering

PLASTIC BUD ENCLOSURES

Various plastic materials have been tried as bud and graft enclosures and bud ties during the past twelve years. Among the first were polyvinyl films, used by workers at the University of Miami in successfully budding mango on young seedling stocks In a 1957 publication from New South Wales, a clear elastic polyvinyl strip has been recommended as superior to the usual natural rubber propagating strip in tying buds of pecan, citrus and common pome and stone fruit nursery stock The latest arrival in America, which I have not yet tried, is the Speed-Easy Bud Tie distributed by the Conard-Pyle Co. It is a patented device invented in West Germany, which European nurserymen know as "Fleischhauer's O. S V." Now available in two sizes, it combines a rectangular translucent elastic film, to be stretched over an inserted bud, and a U shaped wire pin for fastening on the opposite side of the stock plant. Besides providing a labor saving method of bud tying wth a protective and moisture retaining shield, it is claimed for

this film that it disintegrates in the sun. The bud grows right through it, and labor is saved again, as it does not require a follow-up for removal like ordinary ties, whether raffia, string, rubber strips, or the more durable types of plastic films.

The ordinary plastic bag variety of polyethylene has already been used widely by American amateurs and some professional propagators, as a substitute for grafting wax in the topworking of fruit and nut trees. In southern localities or in hot weather, the plastic bag is combined with aluminum foil wrapping to shade the base of the graft, which is usually a bark graft in the case of nut trees L D. Romberg, of the U.S Pecan Field Station in Brownwood, Texas, published two methods for plastic application on grafts One was a complete enclosure of scion and the cut-back stock area just below the scion or scions. The alternate method exposed the scion's top bud through a slit in a corner of the tied-on bag Both methods are being used in the midwest with chestnuts, pecans, walnuts and fruit trees, including persimmon. O. S. Gray, an Arlington, Texas nurseryman who pioneered with plastic bags for grafting, now prefers to have the top bud outside the bag, but coated with shellac. With partial shading and polyethylene bag enclosures, it is possible to topwork graft with leafy green shoot scions in the summer or late spring. I have grafted in this manner, pome fruits, persimmon, mulberry, hickory and baldcypress, but was not successful in limited trials with peach grafts.

Polyethylene wraps or shields, in my experience, have given the best results of any material tried for the enclosure of summer buds of pecan, walnut and other difficult hardwood species, particularly when combined with the use of protective fungicides. A plastic ribbon can be used in place of the usual rubber budding strip on materials that are not too soft. More generally, a polyethylene patch is used in connection with a string or rubber tie. Although the clear type of plastic is satisfactory,I had more rapid and profuse callus formation last summer when walnut patch buds were covered with a black polyethylene film.

PROTECTIVE FUNGICIDE TREATMENTS

A number of midwestern nut propagators for several years have reported better takes of buds and grafts protected with the fungicide, ferbam I had nearly as good results on pecan, walnut and other materials this year where zineb was used, and a combination of ferbam and zineb seemed as good as ferbam alone, on polyethylene wrapped buds. Thiram has shown less benefit in increasing bud take, and captan, in earlier trials, sompletely inhibited bud unions on several nut and fruit species. In the 1958 tests, the fungicides were applied according to the method of August M. Gorenz, which he published in U. S. D. A. Circular 913 in 1953. Ferbam and other fungicides he tested as protectants in *Hevea* rubbertree budding were made up with 20% of the commercial wettable powder preparation in water (200 grams to a liter). The stick of budwood is wiped with a cloth moistened with the fungicidal preparation and allowed to dry before buds are removed. The budding area on the stock is similarly wiped before its bark is lifted to insert a bud. The films of fungicide remain to protect the bud and surrounding area against different fungus spores which might germinate to cause infection

in the wounded tissues. Gorenz suggested and observations with nut scions confirm, that budwood which is to be shipped should first have a fungicide treatment. The same thing is true with scions or budwood to be stored before use.

In some of my earlier trials, the dry wettable ferbam powder was lightly dusted on cut bud pieces, and some correspondents report good grafting results where scions are shaped, then dipped in ferbam powder before grafting, but probably more uniform results will be obtained with the concentrated mixture in water

Part of the benefit from ferbam and zineb applications on buds may derive from a stimulative effect on callus formation resulting from use of these chemicals. Both are dithiocarbamate compounds, and contain nitrogen which is at least slowly available as a plant nutrient. Where ferbam is sprayed on fruit trees it has been noted that leaves take on a greener appearance. A similar stimulative effect has been noted with cuttings of some herbaceous plant materials that had ferbam applied to their cut ends.

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MODERATOR WARNER. Thank you very much.

The next speaker is Mr. Zimmerman of Rutgers University, New Brunswick, New Jersey. I understand you are doing work under a fellowship Is that correct?

MR RICHARD ZIMMERMAN (Rutgers University, New Brunswick, New Jersey): Yes, and I would like to express my appreciation to the Metropolitan Nurserymen and the New Jersey Nurserymen's Association for sponsoring the work I have been able to do at Rutgers. This is the first chance I have had to come back to Ohio, which is my home state.

Mr. Zimmerman read his prepared paper entitled "Effects of Liquid Fertilizers on Rooting of Cuttings." (Applause)

EFFECTS OF LIQUID FERTILIZERS ON ROOTING OF CUTTINGS

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In the past twenty years, there have been scattered reports of the treatment of cuttings with various types of ferilizers in an effort to improve rooting. These attempts have covered a wide variety of plants, numerous types of fertilizers and several methods of application. In many of the trials, root and/or shoot growth was stimulated by the addition of fertilizer but in almost all cases, the cuttings also had to be treated with a chemical root-inducing compound for the effects to be noticeable.

A series of experiments was conducted with cuttings of several species of woody ornamental plants to determine the effect of fertilizer applications during the rooting period on the rooting, root growth and shoot growth of the cuttings.