

Budding as a Silvicultural Technique

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Results of several budding tests at the Arnold Arboretum and Harvard Forest are set forth and their significance to forestry discussed.

ALTHOUGH budding and grafting have been long used by horticulturists as a means of reproducing genetically complex or sterile clones superior for their fruit or ornamental value, little consideration has been given to these techniques by foresters as a means of improving the unit value of forest stands. Forest geneticists in Denmark and Sweden have, however, sensed the practical value of these techniques in the establishment of their "seed plantations" or "seed orchards" in which groups of superior, progeny-tested mother trees are propagated by budding or grafting in isolated locations for the production of high quality seed (2, 3, 4, 5, 6, 7, 9).

Larsen and Magius (8) in Denmark and, doubtless, others have suggested that the technique of budding might provide a practical means of directly introducing genetically superior forms of trees into the forest. Although American foresters are characteristically reluctant to consider seriously such intensive schemes it seems likely that such a method may have some practical application in the hardwood forests and woodlots of the eastern states. By the utilization of wild seedlings as they occur *in situ* for rootstocks, the budding of fast-growing and otherwise desirable forms on them would prove vastly more economical of time and labor than, for instance, planting. In addition, successful budding requires no especial skill, the only tool and supplies required being a jackknife and pieces of rubber band or other material for use in binding the incision in the bark after insertion of the bud. Numerous publications such as the well-illustrated Special Circular No. 65 of the Ohio Agricultural Experiment Station (1) provide details of the commonly used shield or "T" method of budding.

Since very little is known about bud and rootstock compatibility in forest trees preliminary investigations into this problem were started at the Arnold Arboretum in August, 1946, under nursery conditions and during the current bud-

ding season at the Harvard Forest under forest conditions.

Results of the nursery work based on growth during the 1947 season indicate that an apparently high degree of compatibility exists between various species and hybrids of poplars. Flower and leaf buds of a species of willow were also successfully budded on a poplar rootstock. Normal development of catkins resulted in this case which suggests a practical hybridizing technique since it affords the possibility of bringing together flowers of desired parents on the same or different potted rootstocks in the greenhouse. Shoots from the willow leaf buds have shown vigorous, normal development on the poplar rootstock. Buds of a red x silver maple hybrid² were also successfully budded on four months old silver maple seedlings. Some failures were recorded in this case but it was very likely due to poor technique.

Studies of bud and rootstock compatibility at the Harvard Forest during the current season have been concerned primarily with the feasibility of making various budded combinations under field and forest conditions. Undisturbed wild seedlings or seedlings sprouts as they naturally occur in the woods have been used exclusively as rootstocks. Buds were, for the most part, obtained from local sources with little regard for their individual genetic superiority since immediate interest has been directed to intra- and inter-specific compatibility of bud and stock under forest conditions.

Since it is usually possible to determine whether buds have "taken" on the rootstock by examination after a period of ten days or two weeks, the following may be reported as promising combinations: sugar maple on red maple; diploid, tetraploid, and hexaploid white ash³ on diploid white ash; green ash and red ash on white ash; white oak on red oak; largetooth aspen on trembling aspen (and the reciprocal);

²Produced by H. J. Sax at the Arnold Arboretum in 1944.

³From the collections of J. W. Wright growing at the Harvard Forest.

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willow on aspens (and the reciprocals); yellow birch on grey birch. If such comparatively wide combinations prove compatible through observation of their subsequent growth it may safely be concluded that genetically superior forms may be budded on wild representatives of the same species with considerable promise of success.

The interspecific combinations noted above, especially the budding of sugar maple on red maple and yellow birch on grey birch, are of special silvicultural interest since they suggest a possible inexpensive direct method of improving stands of low unit value. Red maple, for instance, is notably ubiquitous in its site requirements and it therefore seems likely that by this method the local distribution of sugar maple could be extended to sites that this species could not normally occupy.

It must be recognized that conclusions regarding compatibility based on bud "take" during the same season in which the budding operation is done, or even successful establishment during the following season of growth must be made with caution. Budding and grafting work in other woody plants has emphasized the need for this caution since failure of bud or scion has been observed to occur suddenly in the second or third year. In addition, little is known about the dwarfing or other possibly undesirable effects

which may characterize certain forest tree rootstocks. Although final reports on the ultimate practical success of this technique as adapted to various forest tree genera under forest conditions must be reserved for some time, the present outlook is promising indeed.

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Dr. Brandis never let his pupils forget a great truth which most German foresters had never grasped—that in the long run Forestry cannot succeed unless the people who live in and near the forest are for it and not against it. That was the keynote of his work in India. And when the pinch came, the application of that same truth was what saved the National Forests in America.—Reprinted from *Breaking New Ground* by Gifford Pinchot through the courtesy of Harcourt, Brace and Company.