FOREST TREE BREEDING STUDIES AT THE UNIVERSITY OF WISCONSIN-MADISON

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Red Pine

Annual variation in cone production of most conifer species is recognized as a problem in planning for seed procurement„ For example, large cone crops of red pine are expected every three to five years. For fifteen years , a survey was made of cone production over the northern half of Wisconsin. Cones were counted in the tops of eighty red pines at twenty-five locations, The counts showed a cycle of roughly three years, although only one bumper crop occurred during the period„ Monthly mean temperatures of weather stations nearest to each survey tree were used to determine whether weather variation was associated with variation in cone production. Analysis showed that mean April, July, August, and September temperature two years before cone maturity was fairly closely associated with the number of cones produced. By use of those weather variables much of the variation in cone production could be accounted for and cone crops probably can be predicted up to two years in advance, (1)

Our breeding approach in red pine is built around the assumption that although. this species has relatively little genetic variation, small gains in growth will be meaningful in Wisconsin because red pine is the principal, species for reforestation.

Forty-five acres of seedling seed orchards have been established from seed collections representing the entire state, Seed collection emphasized southern and central stands because seed from more southerly locations often shows greater growth potential where hardiness is not a problem,

As 3-0 nursery stock, seedlings of the best stands were 10% taller than stock from seed now used in the state nursery system. Seed from certain individual trees produced seedlings up to 30% taller than standard seed. If nursery performance is maintained in field plantings, removal of all but the tallest 10% of the seedlots would leave a seed orchard with an expected genetic potential for volume growth increases of 3-5%. (2)

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White Spruce

Large scale seed source tests have identified certain Ontario stands as producers of seed with high genetic growth potential over a wide range of environments. To estimate the economic significance of such research results, a cost-benefit analysis of simple tree improvement possibilities was calculated. For the analysis, costs of labor, seed, and investment at 5% compound interest were charged over the anticipated life of the improvement project,. Anticipated benefits were higher values per acre as the result of greater volume growth by the two million white spruce seedlings now planted annually in Wisconsin. The improvement options were:

(1) Purchase of seed in commercial quantities from Canadian cooperators (at $40 per pound);

) Purchase of scions with which to establish a grafted seed orchard for seed production; or,

(3) Purchase of enough seed to establish a seedling seed orchard.

The added cost of tree improvement would be balanced by the following gains in tree volume growth at current stumpage prices:

(1) Direct Seed Purchase - 4.2% growth increase

(2) Graft Orchard Establishment - 4.2% growth increase

(3) Seedling Seed Orchard Establishment - 2.4% growth increase

When compared to an expected improvement of 15% in height growth from (3) Canadian seed, the cost-benefit ratio was clearly in favor of obtaining improved seed, Cost-benefit analysis, in contrast to emphasis only on minimum cost, was suggested as a useful way of looking at nursery expenditures for seed.

Balsam Fir

Seed source variation of balsam fir has been analyzed in nursery and field experiments and will be comprehensibly summarized within the next year. Nursery studies showed that seed sources from Quebec and New Brunswick were generally taller than local sources in Wisconsin, By contrast mid-Spring frost damage was least on Lake States sources. Late flushing was characteristic of some but not all Lake States seedlots. Delay in flushing markedly reduced but did riot eliminate the probability of frost damage in Wisconsin, (4)

Elms

The loss of elms as one of our most valuable trees for amenity planting has prompted a search for genetic resistance to the Dutch elm disease Through testing of about 75, 000 trees some general patterns of variation have emerged. Many :individuals of American elm have shown a high degree of resistance to disease but attempts to transmit resistance either through seed or clonal propagation have been unsuccessful,. Emphasis now is on the use of Asian species to produce a tree which adequately substitutes for American elm in, ornamental qualities Hybrids between Siberian and the Japanese elm have shown high resistance and good ornamental traits One hybrid is to be released soon for commercial use Further hybridization directed toward development of elm seed orchards is in progress (5)

Reference

;1) Lester , DT. 1967 Variation. in cone production or red pine in relation to weather. Can. jour, Bot , 45: 1683-1691 (Red Pine)

;2) Lester, D T 1971 . Nursery performance of statewide red pine seed collections For, Res, Note 158, Univ4 of Wis-Mdr.. 6 p (Red Pine)

;3) Lester , T 1973, Minimal approaches to genetic improvement of growth rates in white spruced Joint Proc 10th Lake States and 7th Central State Forest Tree Improvement Conference, U.S D, A., For, Serv, Gen, Tech, Rept. NC-3 p 40-44 (White Spruce)

;4) Lester, D T 1970 Variation in seedling development of balsam fir associated with seed origin, Can. Jour, Bot 48 1093-1097, (Balsam Fir)

:5) Lester, D , and Smalley, E B 1973 , Interspecific hybridization, for commercial production of disease resistant elms , Proc, 9th Central States Forest Tree Improvement Conference (In Press) (Elms)