REPORT FOR THE NORTHEASTERN FOREST EXPERIMENT STATION TO THE SECOND LAKE STATES FOREST TREE IMPROVEMENT CONFERENCE

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My presentation to you today is not, strictly speaking, a report on recent progress--unless the word "recent" can be interpreted to mean within the last 20 years° Because we have not previously had a representative at this conference, and at the suggestion of your program committee, I am going to give you a rather generalized review of past and present work of the Northeastern Station as it relates to forest tree improvement.

Our program got started in 1935 when the Station took over from the Oxford Paper Company the experimental work on hybrid poplars, Though the poplar studies continued to be an important part of the tree improvement program, studies were started immediately on other important forest trees in the Northeast.

Exploratory studies were made for 14 of the most common and most important genera° Five of these were later selected for more intensive study, based on their commercial importance to the region and on the possibility of rapid progress. The white pine group and spruce were selected among the softwoods; maple, birch, and ash among the hardwoods,.

As the program was expanded it developed along several lines: (1) hybridization and the mass production of hybrids, (2) racial tests, (3) individual tree selection, (4) the study of exotics, and (5) field testing.

HYBRIDIZATION

Until 2 or 3 years ago major emphasis in our species-hybridization program was on the determination of species crossability patterns° The poplar crossability pattern was the easiest to determine, It was found some 30 years ago that nearly all the species crossed with each other. The pattern was also easy to determine in maple, which is subdivided by the

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taxonomists into 13 sections, Crosses between sections usually failed, whereas crosses within sections usually succeeded.

Since there are a good many agencies working on pine genetics, we confined ourselves to the 5-needled white pines and to the series Sylvestres in the hard pines (Scotch pine, red pine, Austrian pine, etc.) because these groups include our important northeastern pines. Of 63 different species combinations attempted, 25 yielded identifiable hybrids. Except for sugar pine, almost all the white pines of the series Strobi cross with each other; a few crosses can also be made between the series Strobi and the series Flexiles (for example, limber pine x Himalayan white pine). With the exception of red pine, nearly all the hard pines in the series Sylvestres can be crossed with one or more other species.

The crossability pattern in the spruces eluded us for some times However, after trying 69 different species combinations (25 of them successful) we know more about the pattern. Most of the successes involved similar species with neighboring ranges, whereas most of the failures involved species with widely separated ranges.

Our oldest hybrids are the 30-year-old hybrid poplars in a seedling plantation in Maine. Many of the surviving hybrids are now 80 to 85 feet tall. We have made about 200 selections from these plantations and have established replicated clonal tests at several localities in the Northeast. These hybrids have also been sent to several organizations in the Lake States and Central States. By last year our tests in the Northeast had proceeded far enough to justify release for countrywide tests of 70 hybrid clones representing 23 different parent combinations (table 1). Two cuttings of each of four hybrids were sent to nearly 3,500 cooperators, mostly farmers and small landowners, throughout the country (fig. 1). These cooperators have agreed to provide information on survival and growth during the first 2 years, To make the most of the research possibilities from this distribution, each clone is being tested in as many regions as possible, and records of the identity of the clones sent to each cooperator have been kept.

Our oldest hybrids of other genera date from about 1940, Among them, two pine hybrids are outgrowing their parents. Others, such as paper birch x gray birch and red maple x silver maple, are intermediate in growth rates Some of the newer pine hybrids show definite promise of hybrid vigor, mass production possibilities, and probable weevil resistance.

The next step with the most promising of these species hybrids is to investigate their mass production possibilities and to test different tree x tree combinations. (Sometimes a successful cross is repeated 40 or 50 times in different years and with different trees.) It appears that we could mass produce the fast-growing Pinus ayacahuite x strobus and Austrian x Japanese red pine hybrids cheaply by the simple procedure of interplanting clones of the two species in special seed orchards, The fast-growing Japanese black x Japanese red pine hybrids could probably be mass produced cheaply by controlled pollination, On the other hand, we have not yet devised any scheme for the mass production of first generation maple hybrids; perhaps we can use the F2's.

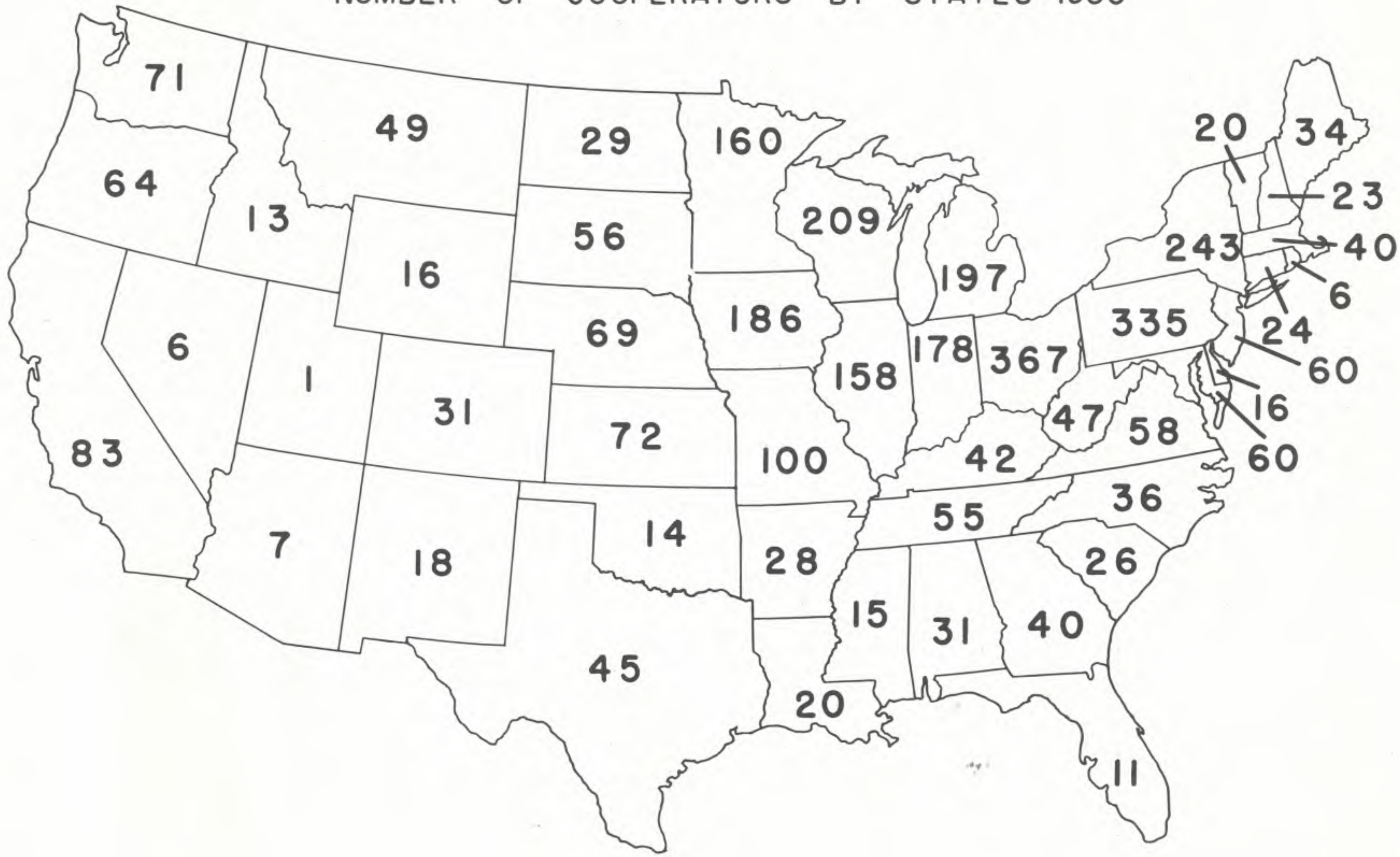
Table 1.--Parentage of hybrids distributed by the Northeastern Forest Experiment Station for nationwide tests

Hybrid	Number of clones	Hybrid	Number of clones
GROUP I		GROUP IV	
P. maximowiczii		P. nigra	
X P. trichocarpa	2	X P. laurifolia	3
X cv. 'berolinensis'	2	X cv. 'eugenei'	1
X cv. 'plantierensis'	2		
X P. caudina	1	P. nigra charkowiensis	
GROUP II		X P. caudina	6
		X cv. 'robusta'	1
		X P. deltoides	1
P. deltoides			
X P. caudina	12	P. sargentii	
X cv. 'Volga'	3	X cv. 'berolinensis rossica'	2
X cv. 'plantierensis'	3	X cv. 'italica'	1
		X P. simonii	1
P. angulata			
X P. deltoides	3	P. petrowskyana	
GROUP III		X P. caudina	1
		P. tacamahaca cl. candicans	
P. nigra		X cv. 'berolinensis'	3
X P. trichocarpa	2		
		P. rasumowskyana	
P. deltoides		X cv. 'plantierensis'	1
X P. trichocarpa	9		
P. angulata		Total	70
X P. trichocarpa	7		
P. nigra betulifolia			
X P. trichocarpa	3		

Figure 1.

COOPERATIVE HYBRID POPLAR TESTS

NUMBER OF COOPERATORS BY STATES—1955



RACIAL TESTS

The Northeastern Station has racial tests under way in red pine, white ash, and Norway spruce. We are starting a large test in eastern white pine in conjunction with the other eastern forest experiment stations and Canada. All the older tests have turned up important differences in growth rate and other characters associated with differences in origin. On the basis of early growth, the local races of native species did not always prove to be the best, For example, Maryland white ash planted in eastern Pennsylvania is growing much faster than native stock.

Scotch pine has a rather unsavory reputation in the Northeast because much of the early reforestation resulted in "typical" crooked growth. This summer, in cooperation with the State of New Hampshire, we measured a 15-year-old Scotch pine racial test (IUFRO)_ in southern New Hampshire and found that there are Scotch pines worth planting in the region. The trees of Latvian and Esthonian origin are fast growing and straight stemmed.

INDIVIDUAL TREE SELECTION

Individual tree selection studies are under way in two species, sugar maple (high sugar content) and eastern white pine (weevil resistance), but in general we have gone slow on individual tree selection work. One reason for this is that we do not wish to obligate ourselves to the years of selection, controlled pollination, clonal testing, and progeny testing that are necessary for the development of an improved strain until we are reasonably sure that there is no quicker way of obtaining our objective, For example, in Scotch pine timber growers in our region want straight boles and Christmas tree growers want blue color, and they want them now. For the present, at least, we believe that it is better to test the straight growing Latvian races and the blue Spanish races (followed in both cases by selection and breeding) than to make selections in a plantation of unknown origin.

EXOTICS

During the past few years we have been gathering growth information (from single specimens in arboreta or from small forestry plantings) on several hundred tree species that are not native in the Northeast. About 100 of these show definite promise for forestry and for future breeding work because of rapid growth, excellent form, or freedom from pests. During the next decade we hope to establish small forestry plantings of these promising species; we have already made a start on about 15 of them, There are very promising exotics in pine, spruce, fir, and some monotypic genera such as Ginkgo. The introduced species of spruce and fir frequently outgrow the natives. Norway and sycamore maples are among the most promising hardwood exotic species and are already reproducing naturally in areas where sugar maple does not grow, European sweet cherry is another

2/ International Union of Forest Research Organizations tree that has gone wild and is producing straighter sawlogs than the native black cherry in the Philadelphia area. On the other hand, exotic species of ash, oak, and hemlock have shown very little promise.

FIELD TESTS

Field testing for evaluation or genetic differences is the sine qua non of genetics research and must receive as much study as the actual selection and breeding, Perhaps we are making a fetish of careful design and planning, but the hybrid poplar clonal tests have clearly shown the desirability of keeping the plantation as uniform as possible by plowing and cultivation, the need for more replication than has generally been used in forest research, and the relative amounts of variation due to genetics and environment. For clear-cut genetic comparisons we favor experimental designs with many replications (up to 30) and with small plots containing only 1 to 4 trees. These small plot experiments sacrifice some information on stand performance and sometime pose a thinning problem. But such designs are more sensitive and more efficient because they provide more information for evaluation of genetic differences in relative growth rate, pest resistance, branch size, etc., at a lower cost which is within the limits of our genetics budget.

A project on which we are just getting started is known as the Michaux Quercetum. The Station and the Morris Arboretum are active participants, and financial assistance has come from a trust fund left with the American Philosophical Society. Some 80 species of American oaks and additional exotics hardy in this area will be planted in a series of arboreta. Acorns and herbarium specimens are now coming in. Nursery observations will be made to test the purity of the seed. The arboreta, which will contain only pure species, will help to end the confusion in names, and will eventually provide germ plasm for controlled hybridizations.