

NEW DEVELOPMENTS IN FOREST GENETICS
RESEARCH PROGRAMS AROUND THE COUNTRY

by

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To the best of my knowledge, no other newly developed field of forest research has been as enthusiastically received as forest genetics. Widespread interest and support have provided working facilities and financial aid at a rapid rate. This enthusiastic acceptance brings both opportunity for expansion of the work and responsibility to organize the research effort so as to proceed toward the desired goals in an orderly manner. Orderly progress is secured when every study contributes to the attainment of some broad objective, when there is no duplication but sufficient replication of research, when each research worker knows what others are doing and when the results of research are made available as rapidly as possible. It may therefore be worthwhile to survey briefly the research in forest genetics now under way in the several major forest regions of the country, to discover any nation-wide tendencies that may be developing and their significance.

The following survey is necessarily general because records for a more detailed study are not available. I have merely attempted to determine the genera and species being studied in each region and the kinds of studies being conducted. The studies have been placed in a few very broad subject matter categories which could be revised and made more specific if the necessary information were available. The categories here used are:

1. Racial studies. This category includes all seed source or provenance studies and all studies of geographic variation of species, and the testing, with clones or seed progeny, of forms recognized through such studies.
2. Selections. The search for and selection of superior phenotypes and the testing of their progeny under a range of environmental conditions. The purpose is to obtain genotypes superior in growth rate, form, resistance to parasites or superior in other respects, for use as parent stock in breeding, or as a source of seed for large scale plantings.
3. Species hybridization. This may be for the general purpose of study of a genus, to determine species relationships and crossability and where heterosis may occur. Or it can be more specific in purpose, for the development of hybrids of practical value.

4. Racial hybridization. This is to develop superior forms within a species.
5. Studies of vegetative propagation. Forest geneticists recognize the value of vegetative propagation as a tool in research and in the development of seed orchards.
6. Studies of flower induction. The value of frequent and abundant seed crops is universally recognized by forest geneticists.
7. Fundamental studies. This includes studies of physiology, cytology, polyploidy, taxonomy and other subjects which provide basic knowledge for research in forest genetics or which may bring results of direct practical value.

Much information for this survey was obtained from Jonathan Wright's very valuable "Directory of Forest Genetics Education and Research in the United States and Canada." This was supplemented with later information which workers in the several forest regions were kind enough to send me. Altogether, these various sources give a general summary of current research throughout the country.

As we should expect, we find that in each forest region most of the forest genetics research is concentrated on the timber species of greatest local value. Thus in the Far West (the Rocky Mountain and Pacific Coast states) Douglas-fir and several species of pines are receiving the most attention. In the pines, ponderosa pine and its closely related species, the white pines and lodgepole pine are the principal subjects of study with some special work on Monterey pine and its closely related species. The white pine investigation is part of a national and international project for development of forms resistant to the white pine blister rust and possessing desirable growth characteristics, in which three of our forest regions and many workers in Canada are cooperating by exchange of information and experimental materials. The Far West's special interest in this study is the protection of western white pine and sugar pine. One pine study in the West, the general study of pine hybridization by the Institute of Forest Genetics at Placerville, California, applies to the entire genus and is not limited to the species of the region.

Studies of geographical variation of ponderosa pine and Douglas-fir which should yield valuable results are also under way in the West. It is believed that the tremendous variety of environmental conditions under which these species occur has given rise to numerous forms, variously called races or ecotypes, and that knowledge of these forms will be indispensable to the improvement of these species. Several studies of individual tree selection of Douglas-fir and of vegetative propagation and flower induction, in pines and Douglas-fir are also being conducted in this region.

When we direct our attention to the North Central region we find that three genera, the poplars, pines and spruces, are winning the race for attention by forest geneticists. In the pines, the three most important species, the red, white and jack pines, are receiving the most attention. As for the spruces, the indigenous black and white and the exotic Norway spruce are the subjects of research with several other exotic species being used in experimental species hybridization. In the poplars, the aspens seem to get the most attention, with practically every institution in the region that is conducting forest genetics research working on them. In this region, racial studies, species hybridization, individual tree selections and studies of vegetative propagation and flower induction are the most numerous. A number of studies under several of these categories are directed toward the development of forms resistant to diseases and insects. This region is participating in the study of white pine resistance to blister rust which I have mentioned, with the particular interest here in eastern white pine. Other studies pertain to resistance of poplars to canker diseases.

The Northeast region shows a somewhat different pattern in regard to the species being studied. As in the North Central region, pines and poplars are getting the most attention, but they are evidently followed by chestnut and maple. However, most of the work on chestnut consists of selections and testing of hybrids for resistance to chestnut blight, and much of it on maple pertains to sugar yield. Spruce, hemlock, ash, larch and birch are also being studied. Racial studies seem to be most numerous in the Northeast, followed by species hybridization, studies of vegetative propagation, flower induction and cytology.

I hesitate to make many comments concerning forest genetics research in the South before this audience. So I shall merely say that the records show that a very great proportion of your work is on your native species of pines, with some effort being expended on maple, chestnut and bald cypress. As to the types of studies you are conducting, racial studies seem to be most numerous, followed by individual tree selections, species hybridization and flower induction studies. A number of your studies pertain to disease resistance.

When we merge these regional summaries into national totals we find that work on the pines is in the lead throughout the nation. The poplars are second, followed by spruce, if we disregard the special work on chestnut and maple. The high rating of the poplars is due to their importance in the North Central and Northeast regions. They may, however, assume some future importance in the Pacific Northwest.

When we consider the number of commercially valuable pine species in the country, the numerous uses to which they are put and the fact that they constitute nearly one-fourth of the nation's forest growing stock, we will doubtless agree that our forest geneticists have done well to make them the principal subject of study.

There are two points concerning this national pattern of research which I think merit comment. When we consider the wide distribution of the spruces, true firs and hemlocks, their many uses and the fact that they constitute one-fifth of the nation's growing stock, I feel that they merit more attention than they are getting, Both by volume and area they represent a large and permanent part of our forest resources. Their improvement should pay big dividend*.

My second comment is that in our national pattern of forest genetics research the hardwoods, of which walnut, oak and cherry are examples, that have been in constant use by the American people throughout our history, and which we value so highly and use so much in our daily lives, simply do not appear to any appreciable extent in our present effort. Surely they merit it. I am not so rash as to propose that the softwood research program be curtailed to permit work on the hardwoods, but I do suggest and hope that an adequate portion of the future expansion of our national research effort be devoted to the hardwood species. For some time the Foundation has been hoping to receive a comprehensive and thoughtful plan for a program of forest genetics research on these species.

The nation-wide summary shows that racial studies head the list in every region. The others which are evidently considered of major importance are species hybridization, individual selections, vegetative propagation studies, racial hybridization, and flower induction studies. These are followed by such fundamental studies as cytology, taxonomy, physiology, polyploidy and wood technology, as they apply to forest genetics.

It seems logical to expect that our research in forest genetics will follow the two traditional avenue of plant genetics: first, the improvement of natural forms through selection and second, the development of new ones by hybridization, both intra- and interspecific. To this we should add the testing of natural polyploids and the formation of new ones, in a few forest tree genera. If our development is to follow these avenues we seem to be on safe ground with the principal lines of work which we have under way. The emphasis on racial studies and selection seems particularly fortunate in these early years of our work in forest genetics research. They will bring results of practical value and will provide the materials for breeding. Studies in vegetative propagation and flower induction seem necessary for the development of two powerful tools needed for research and seed orchard management, and it is well to start them early, Exploratory programs of species hybridization are invaluable in helping to determine species relationships within a genus, and in seeking hybrid vigor. But I suspect that the most fruitful work in this field will be done when we have accumulated much more knowledge of the species with which we are working than we now possess. Racial hybridization will doubtless increase as racial studies provide more requisite information.

Fundamental studies in taxonomy, cytology, physiology, polyploidy and wood technology as related to forest genetics are fewer in number than those discussed above, but their importance should not be overlooked. The fundamental knowledge that they provide is the basis upon which many

of the other studies must stand. Failure to provide for their continuation, and expansion will ultimately stunt the research in the fields generally considered to be of more practicability. We hope that workers in forest genetics a decade or more hence will not reproach us for not having prosecuted these basic studies more vigorously.

This summary of the present research program leads me to a brief discussion of the activities which the Forest Genetics Research Foundation proposes to conduct. Our program is set up under two general subject headings: grants for research and education, and what we are calling general assistance to research. The first heading is self-explanatory, and all that needs to be added is that we propose to make grants to research projects which will contribute significantly to the development of forest genetics. For educational purposes, we propose to make grants to carefully selected individuals possessing special qualifications for research who are in need of financial help to complete their advanced training. Much of this will be in preparation for the Ph.D. degree, but we may have occasion to assist in post-doctoral studies.

Our plans for general assistance to research are not yet final because we propose to be guided to a considerable degree in this activity by the suggestions of research workers throughout the country. There is, however, one initial undertaking which we propose to conduct in the near future. I stated earlier in this discussion that my summary of current research in forest genetics is of limited value because it is based upon partial information. To provide a more accurate and complete basis for planning our work and for the benefit of others who may need the information, we plan to conduct a survey which we hope will constitute a project inventory of forest genetics research in the United States. We shall ask every institution conducting such research for a brief statement on each study, including project title, a brief description of the study (probably 200 words) and the names of the individuals working on it. When this information is brought together it will be classified by subject matter categories established with the advice of forest geneticists, and by forest regions. We then plan to discuss the work in each region with a representative regional group which we hope in each case will be the regional forest tree improvement committee. Such a discussion should consider carefully the nature and scope of the research currently under way in the region and arrive at a mutually acceptable conclusion as to that new projects should be started, or what current projects strengthened, to round out most effectively the pattern of regional research. By this procedure we hope that the Foundation can establish guide lines for future activities based on accurate and detailed information, and developed cooperatively with, and to the satisfaction of the technical workers in each region.

This survey will necessarily be made by mail, and we shall ask for the support and assistance of each regional forest tree improvement committee in the undertaking. As soon as possible we also want to have a representative of the Foundation visit each institution conducting research in forest genetics.

My personal contact with forest genetics research workers in various parts of the country leads me to believe that in the course of this survey we shall receive enough practicable suggestions for the Foundation's general activities to keep us more than busy. Some suggestions that have thus far come to us are that we might assist in the publication of research results of general interest, and that we might assist in the publication of research results of general interest, and that we might sponsor meetings on special research topics, bringing together for several days a number of individuals having one primary interest for exchange of information and ideas. We invite comment on these proposals and your suggestions for other activities.