FOREST GENETICS - THE U.S. CONTRIBUTION TO INTERNATIONAL FORESTRY - THE FEDERAL ROLE

Stanley L. Krugman1/

Abstract--Following World War II, the U.S. Government began a major program to reduce hunger and malnutrition in many countries. Their effort became known as the Food for Peace Program. Funds from this effort led to a special research program in over 50 countries. As part of this effort forest geneticists from both the U.S. and 30 countries initiated joint research in flowering physiology and vegetative propagation, seed orchard management, breeding, species introduction trials, and studies in quantitative genetics. Currently forest genetics studies are still underway in 5 countries supported by the Special Foreign Currency Research Program.

In the last 15 years, forestry has played a more important role in the foreign policy of the United States. Through such State Department agencies as Agency for International Development (AID), major forestry schemes have been developed. In support of these forestry development efforts, modest research and development programs have been initiated in forest genetics in over 35 countries. For the most part these have included the initiation of species tests and the training of foreign forest geneticists. These efforts are currently supported by Science and Technology agreements between the U.S. and the other nations.

The more active genetic programs that I am directly involved with include: those in Egypt--trees for windbreak and shelterbelts as well as roundwood; Spain--the establishment of a national genetics program; People's Republic of China--initiation of species tests and germplasm exchanges; Yugoslavia--joint studies in breeding; India--the development of fast-growing hybrids; and Pakistan--species tests for arid lands.

New exchanges are in the planning stages with Chile, France, and Australia.

As forestry becomes more important in our foreign aid programs, I see forest genetics as a major effort in support of these programs.

Additional. keywords: Foreign forestry, science and technology exchanges, germplasm exchanges.

1/ Director, Timber Management Research, USDA Forest Service, Washington, D.C.

INTRODUCTION

USDA Forest Service research has had a modest international role for over 80 years. Initially most of this international involvement was in the area of forest products and international trade. It was not until after World War II that Forest Service genetics and tree improvement activities became involved in the international scene.

The major stimulation for this activity was the Special Foreign Currency Research Program, better known as the Food for Peace Program, or the Public Law 480 Program. Following World War IT, the U.S. Government began a program to reduce worldwide hunger and malnutrition. Countries repayed the U.S. in their own currencies and most of the repayments remained in the host countries. These funds were then used to improve their quality of life, i.e., to build schools, roads, hospitals, and to support research. As part of this research effort forest geneticists and associated reseachers initiated joint research in over 30 countries. Studies included flowering physiology, vegetative propagation, seed orchard management, breeding, hybridization, population studies, tissue culture, and terpene analysis. Most of these studies were completed by the late 1960s as the funds were no longer available or devoted to other uses.

The completed studies in Columbia, Chile, Brazil, and Uruguay were involved with the evaluation of physiology of slash (Pinus elliottii, Engelm.) and loblolly pine (Pinus taeda L.). These studies included seed source studies in the individual countries as well as flowering physiology and tissue culture investigations. Studies in Columbia explored grafting using different root stock and scion combinations. Flowering was also carefully studied since flowering of these species become erratic in the tropics. Results have been published in both internal reports and scientific publications. In Columbia, one investigation was directed to the haploid culture of pines, mostly with sugar pine (Pinus lambertiana Dougl.).

Table 1 summarizes the countries and the number of major genetic or related studies that we have conducted. In this brief paper, I will attempt only to provide a summary of our activities, since time does not allow a more detailed discussion. However, much of the results of these earlier studies have been published, although often in foreign journals.

Table 1. Countries in which major forest, genetics and related projects were supported by PL-480 funding

Country	Number of Projects	Country	Number of Projects
Brazil	1	Pakistan	16
Chile	3	Peru	1
Columbia	2	Poland	15
Egypt	3	Spain	3
Finland	12	Sri Lanka	2
Greece	3	Taiwan	1
India	17	Tunisia	1
Israel	3	Uruguay	1
Italy	3	Yugoslavia	10
Korea	1		

Currently, PL-480 forestry research is only funded in India and Pakistan. The major active studies in Pakistan include superior selection studies of poplar clones, provenance trials with Himalayan blue pine (Pinus wallichiana A. B. Jacks), screening trees and woody shrubs for the arid zones, and the preparation of a monograph on Eucalyptus camaldulensis Dehn, E. microthea F.V.M. and E. tereticornis Sm. We are also supporting a number of related programs including management of improved poplar selections and a modest program of selecting species for windbreaks. In India, our major genetic studies deal with the tree improvement in Eucalyptus tereticornis.

In many of the developing countries, there is research underway in forest genetics but usually such research is rarely published. We have used Special Currency Funds to a limited extent to get these data organized and published. Such is the case with the above monograph on Eucalyptus from Pakistan.

Because of the frequency of requests for information on arid land species and because there is relatively little research in the U.S. in this area, we have encouraged considerable arid land research under the PL-480 program. For example, in Pakistan we are screening at nine sites 62 species from 22 genera under semi-arid conditions. The designs are simple but the results have been most promising. Such research most likely would not have been done by the more traditional methods of funding by the host countries. If the situation permits, I establish essentially similar studies in other countries in an effort to screen the same germplasm in as many environments as possible.

Our foreign programs have often taken us in strange directions. We are currently completing a PL-480 genetics program with Egypt. The main aim of this investigation was the identification and screening of tree species for windbreaks and shelterbelts. This has led to the development of a number of linear plantations and the establishment of a small private particle-board

plant. We have collected across North Africa and the middle East one of the finest collections of Eucalyptus camaldulensis, and recently completed a collection of Casuarina. In Egypt, we are also screening for tolerance to an array of soil conditions and already we have detected several promising seed sources of Eucalyptus camaldulensis for salt conditions. This modest project has demonstrated the feasibility of planting trees for an array of uses in the Egyptian western desert in conjunction with their agricultural projects.

BILATERAL AGREEMENTS

With the passing of the PL-480 programs, the U.S. has initiated bilateral research agreements with several countries. With Israel, we are currently conducting Eucalyptus propagation studies. With Yugoslavia, we are continuing a joint investigation on the incompatibility systems between European Black Pine (Pinus nigra Arnold) and Scots pine (Pinus sylvestris L.) and the means for mass production of this hybrid. in Poland, we have an excellent joint study on the genetic basis for forest tree resistance to toxic gases. Flowering physiology studies have been underway in Poland for over 15 years and one of these is still being supported. Like the PL-480 funding, funds for these projects are very limited, and we can expect fewer projects.

AID RELATED PROJECTS

In the last 15 years forestry has started to play a more important role in the foreign policy of the United States. Through such State Department agencies as the U.S. Agency for International Development (AID), major forestry schemes have been developed and funded. Many of these programs deal with reforestation and fuel wood production. In support of these activities, modest research and development programs have been initiated in forest genetics or tree ihiprovement in 35 countries. For the most part these projects have included germplasm collections, species tests, and seed production. In a few cases, the projects have involved training geneticists. Currently, we are screening approximately 210 species from 50 genera. In addition, we are assisting in the development of forest tree germplasm conservation programs in at least 15 countries. These efforts are currently requested and supported by various Science and Technology agreements between the U.S. and the other nations.

SCIENCE AND TECHNOLOGY EXCHANGES

In addition to the above projects, USDA, thru its Office of international Cooperation and Development (OICD), supports several scientific exchanges in forest genetics. Recently a 6-year research project with Spain was completed under this program. In the course of this project, 15 forest tree species and 192 seed sources were planted in 32 locations in northern Spain. Although the project has officially ended, we will continue our cooperation since these test plantings have yet to be evaluated.

We did conduct a major meeting in Spain on the science of species introductions which will he published later this year in several different languages.

The species now being tested in Spain are summarized in Table 2. The results of this type of investigation will have application outside of Spain.

Table 2. Major tree species being introduced into Spain under the OICD program

Species	Number of Seed Sources	Locations
Abies concolor (Gord. and Glend.) Lindl.	1	1
Libocedrus decurrens Torr.	1	1
Pinus contorta Engelm.	23	5
Pinus jeffreyi Grev. and Bulf.	4	2
Pinus ponderosa Laws	2	1
Prunus serotina Ehrh.	22	5
Pseudotsuga menziesii (Murb.) Franco	87	18
Sequoia sempervirens (D. Don) Endl.	5	3

Other Science and Technology genetic research projects have also been initiated in the past with several Eastern Bloc countries. Although the program with the USSR is officially over, we are still conducting annual exchanges of germplasm. From the USSR, we have obtained excellent collections of Scots pine and white elm (*Ulmus pumila* L.) as well as a large number of new collections of cold hardy material from eastern USSR. At this time, we have one active field study of U.S. species underway in the southern parts of the USSR where we have established six test locations.

During the last three years, we have also initiated a series of studies with the People's Republic of China. Our first major effort will he a loblolly and slash pine seed source studies in eastern China (Figure 1). Within the next two years, we are planning a *Paulownia* test of at least five species in the United States.

We have received small quantities of seed of 210 species representing 81 genera from China for distribution in the U.S. as well as to other countries; and this material has been provided to over 60 cooperators in the U.S. New cooperative programs are in the planning stages with Chile, France, West Germany, and Australia. With both Chile and Australia, we hope to develop better mechanisms for germplasm collections and exchanges. We have also exchanged scientists and plant material with France and have initiated several hardwood genetic studies with red oak, walnut, and black cherry.

CONCLUSION

As forestry becomes more important in our foreign aid program, I see a larger role for forest genetics. In most countries the main problems are associated with limited resource and major reforestation needs. There are many contributions that we as forest geneticists can make, and I hope that those of you who are interested will join us in these activities. We plan to continue to use these foreign research opportunities to further our knowledge of our own species as well as exotics. I feel strongly that when such programs are properly designed, we all benefit.

Figure 1. The Ever Happy Forest Farm in Zhejiang Province, The People's Republic of China. A slash pine plantation is in the foreground, with masson pine (Pinus massoniana Lamb.) on the ridgetops. In the valley rice is grown, and on the lower slopes there are tea plantations.