

SEED PROCUREMENT AND NURSERY MANAGEMENT
OF THE SOUTHERN PINES
IN THE PEOPLE'S REPUBLIC OF CHINA^{1/}

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Abstract.--The area south of latitude 34° N and east of longitude 115° in the People's Republic of China is receiving increased attention for plantation establishment of the southern pines. The Red and Yellow Earth group (south from the Yangtze River to the Tropic of Cancer) is best suited for Pinus elliottii var. elliottii and P. taeda, whereas the Red Earth group south of the Tropic of Cancer is best suited for P. caribaea.

Seeds of the southern pines are often obtained from abroad without assurance of adapted sources. Provenance trials of P. elliottii and P. taeda were installed at more than 15 locations. Early results for height growth show the best sources of P. taeda to be from the coast of South Carolina and Georgia; no definitive results are available for P. elliottii.

Bare-root seedling production is favored for the Red and Yellow Earth group (Semitropics), whereas containerized seedlings are best suited for the Red Earth group (Tropics). For bare-root seedlings, the nurseries are most often spaded, formed, seeded and tilled by hand implements. Polyethylene tubes of about 20 cm long, 8 cm diameter, and 0.3 mm wall thickness are favored for the containerized stock.

INTRODUCTION

Article 28 of The Forestry Act of The People's Republic of China, which was adopted in 1979, states: "Forestry departments at all levels must vigorously popularize fine-quality, fast-grown seedlings, establish seed-tree forests and seed gardens, cultivate good-quality and sturdy seedlings, and plant forests with only fine-quality seedlings." Interpreted literally, the message is to produce and use quality seedlings from seed production areas and seed orchards. It has specific application to plantation forestry, which encompasses the planting of southern pines inclusive of Pinus caribaea in southeast China (south of about 34° N latitude and east of longitude 115°E).

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The soils of this region are allocated into two great groups: (1) Red and Yellow Earth, which extends from about the Yangtze River to the Tropic of Cancer; and (2) Red Earth, which extends from the Tropic of Cancer southward to the South China Sea. Both are acid and nutrient-poor. On the upland sites where forestry will be practiced, the soils are degraded from agricultural cropping which has gone on for centuries. In addition to being marginally productive for agronomic crops, row-cropping is now prohibited on soils subject to severe erosion.

The most prevalent plantation species for the Red Earth group are Pinus caribaea var. caribaea and Eucalyptus exserta. The Red and Yellow Earth group is commonly planted with Cunninghamia lanceolata up to about 80 meters above sea level (ASL), Pinus elliottii var. elliottii between 80 and 300 meters ASL, and P. taeda between 300 and 800 meters ASL. Above 800 meters, the indigenous P. massoniana is favored.

ADMINISTRATION

The basic unit of rural production, administration, planning and a socialist community life is the People's Commune (FAO, 1982). It is subdivided into brigades which consist of 40 to 50 households and 50 to 400 hectares of land. Brigades are further divided into teams of 6 to 50 households, each of which contain 4 to 5 members. A hamlet or a subdivision of a larger village would comprise a team. Included within the area controlled by the commune would be varying amounts of forest land. The intensity of management of the forest land is determined by the objectives of the commune.

The functioning of communes is supervised by the county, the counties are grouped in prefectures (groups of counties within a state) which are responsive to the provinces (states), and the provinces are responsive to the federal ministries, of which forestry is one. The Minister of Forestry also administers the national forest system, the lands of which occur primarily in the northeastern and southwestern part of the country and on Hainan Island. The schools of forestry and forest research centers are also responsible to that office.

This administrative structure shows the complexity of forest administration in the People's Republic of China. Planting programs, inclusive of forest tree nurseries, occur at the brigade, commune, county, prefecture, city, province and federal levels. Some of the best plantation forestry exists on forest farms, which are city- and county-operated. The structure also creates difficulty in compiling forest statistics. For example, the 30 million hectares of forest which were supposedly planted between 1949 and 1979 (67% commercial forest) is thought to have been based on seedling production instead of area successfully planted. Some observers suspect that the figure is inflated and, in effect, includes areas planted several times following failure of the previously planted stand. If the suspicion is correct, the forest statistics of the People's Republic of China hold something in common with those in the United States and other countries of the world.

SEED PROCUREMENT

Regardless of the accuracy of the forest statistics, millions of southern pine seedlings are being produced annually in the People's Republic of China. In 1974, for example, five tonnes of P. elliotii and P. taeda seed were imported into the country through a Canadian intermediary (personal communication, Mr. Pan Chih-kang). Even though the seeds were ostensibly obtained from the southern United States, the source was unidentified. Even more pertinent, information on the desired source and species was lacking. Range-wide provenance tests of both species were commenced in 1981 and more complete tests containing 50 sources of P. taeda and 30 sources of P. elliotii were installed in 1983. Preliminary results from these trials, which include more than 15 installations in southern China, show the best height growth of P. taeda to come from sources of coastal South Carolina and Georgia. Source differences are not yet evident for P. elliotii (personal communication, Mr. Pan Chih-kang).

Tree improvement programs are of high priority for the southern pines in China. One program involving P. elliotii of unknown seed source exists from 1964 in Guangdong Province. The seed orchard of 38 clones and occupying 111 hectares was producing 112 kg/ha/yr of seed by 1981, a highly acceptable rate compared to southern pine seed orchards in the United States (Kellison, et al., 1982). Based upon open-pollinated progeny tests, the 20 best clones were chosen for establishment of a 67-hectare improved first-generation seed orchard.

The plantations from the huge 1974 seed importation are beginning to set seeds. This event has caused many organizations to manage the stands as seed production areas, and from which to select trees for clonal seed orchards. Inquiries are also being received about obtaining scion material from the best-performing clones in the southern United States in anticipation that those trees will also perform similarly in the People's Republic of China.

BARE-ROOT SEEDLING PRODUCTION

Forest tree nurseries for bare-root planting stock are most common to the subtropical region, whereas containerized seedlings are favored in the tropical region. The bare-root nurseries are often located on land formerly occupied by agronomic crops and range from less than 0.5 to more than 20 hectares. Except for the larger provincial or federal nurseries where plows, bed formers, and seeders might be available, most nurseries are spaded, formed, seeded, and tilled by hand implements. Fumigants are infrequently used, and irrigation, if used, consists of flooding from diversion ditches. Seeding is done without stratification in February or March; seedling lifting commences in late October of the same year or in February-March of the following year for outplanting, commensurate with the rainy season. Mycorrhizal inoculation is usually unnecessary because of Telephora, Pisolithus and other beneficial fungi on the indigenous pines such as P. massoniana and P. yunnanensis.

Soil tests of the nurseries producing bare-root southern pine seedlings are infrequently conducted, and life history plots do not exist. Soil fertility is often amended by the use of organic fertilizers, including animal dung and agriculture-crop residue. Superphosphate at about 250 kg/ha is frequently applied before seed sowing, and urea at varying amounts is added during the growing season. This regime plus repeated cropping without the use of cover crops often results in seedlings with foliar nutrient deficiency symptoms. Some of the deficiencies which exhibit chlorosis are likely the result of high alkalinity which renders the unavailability of iron. Other types of discoloration are symptomatic of potassium and magnesium deficiency.

In addition to soil chemical imbalances, part of the observed seedling nutrient deficiency could be caused by chemical imbalances in the irrigation water. Few of the nurseries have a deep-well water supply, and even fewer have a water chemical testing program. The result of these imbalances is seedling failure and poor quality of the surviving plants. One solution is to initiate a soil testing and amelioration program, but some of the nurseries are so small and in such poor condition that the best alternative would be to relocate the nursery.

Pests are likely to be similar to those found in nurseries in the southern United States because of the presence of both indigenous hard and soft pines in the People's Republic of China. Damping-off fungi (Fusarium spp.) is a common nursery and greenhouse problem, and fusiform rust (Cronartium spp.) has been reported on P. yunnanensis although no nursery infections have been reported. Fungicides are used to combat damping-off. A tip moth (Rhyacionia spp.) is a common pest of P. caribaea in southern China, and the turpentine beetle is a common pest on P. massoniana. It will be only a matter of time before these and other pests adapt to the introduced tree species.

I do not want to leave the impression that all bare-root nursery stock is of inferior quality. Some bare-root nurseries go to great length to produce quality stock. For example, the nursery of one forest farm visited in Jiangsu Province made maximum use of the short supply of quality seed by germinating the seed on flats and transplanting the seedlings on nursery beds at 5 x 10 cm in perfectly aligned rows. One has to remember that labor is more plentiful in China than are genetically improved seed or costly nursery equipment.

CONTAINERIZED SEEDLING PRODUCTION

A good proportion of the southern pine seedling production in China, perhaps 25%, is grown in containers. Other than being more labor-intensive and relying more on biodegradable or discardable containers, the system is similar to that found in the southern United States. Even then there is a preference for polyethylene tubes that are 16 - 20 cm long and 6 - 8 cm diameter and have a wall thickness of 0.3 mm. Ribbed tubes to prevent root spiraling and a constricted opening at the base to allow for air-pruning of the roots are desired.

The seeds are sown in flats for transplanting to the containers or sown directly in the containers upon collection in November. The seedlings develop for about 100 days until outplanting in February, in conjunction with the rainy season. Some of the limitations to producing a quality seedling (such as chemical imbalances in the rooting medium) are similar to those described for bare-root seedling production.

PLANTATION ESTABLISHMENT

After repeated failures, some forestry organizations are taking great care to assure a high planting survival. In good years the survival of containerized plants will average 95% and bare-root stock will average 80%; the values decline to 90 and 60% during droughty years. Site-preparation on many of the upland slopes of rugged terrain is intense, and control of weeds is prolonged until crown closure at about three years from planting. Failure, when it occurs for reasons other than environmental extremes, most often results from an inadequate lifting, storing and transporting system rather than from lack of planting and management care. The procedure would dictate planting or heeling-in the seedlings immediately after lifting, because of the lack of storage cold-rooms. Planted at 2 x 2 m to 3 x 3 m, the yields at about 40 years are 60 to 100% greater than those of P. massoniana, the indigenous conifer of greatest importance on upland sites in southern China (FAO, 1982).

LITERATURE CITED

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