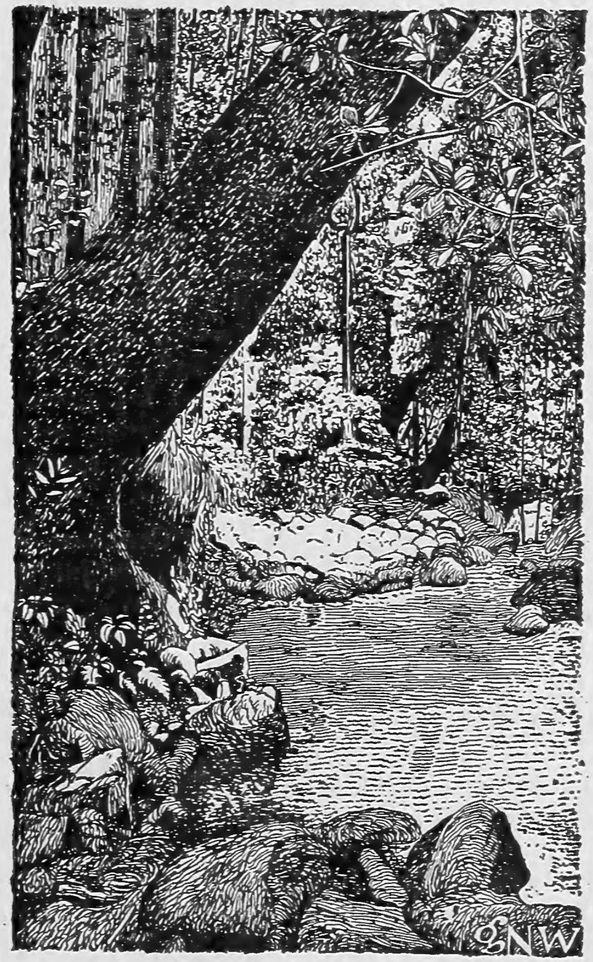
# Caribbean Forester





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FOREST SERVICE

TROPICAL FOREST RESEARCH CENTER
RIO PIEDRAS, PUERTO RICO

VOLUME 21 NOS. 1 AND 2

JANUARY - JUNE, 1960

# Caribbean Forester

El Caribbean Forester es una revista semestral gratuita publicada en Puerto Rico desde el año 1938 por el Centro Tropical de Investigaciones Forestales del Servicio Forestal del Departamento de Agricultura de los Estados Unidos. Esta publicación está dedicada a promover la mejor ordenación y utilización de los recursos forestales del trópico con especial énfasis a la región del Caribe.

Provee información a los que laboran en la dasonomía y ciencias afines sobre los problemas específicos que confrontan, las políticas forestales vigentes y el progreso del trabajo que se lleva a cabo para mejorar la ordenación y utilización de los recursos forestales tropicales. También sirve como medio informativo sobre los resultados y el progreso de los programas experimentales, en ordenación forestal tropical y utilización, que se llevan a cabo en el Centro de Investigaciones en Puerto Rico. También le brinda una oportunidad a otras personas interesadas en la dasonomía tropical para presentar el resultado de sus trabajos.

Se solicitan aportaciones de otras fuentes en el campo de la dasonomía tropical siempre que no estén considerándose para publicación en otras revistas. El manuscrito generalmente no debe exceder 20 páginas escritas a máquina a doble espacio, aunque ocasionalmente podría aceptarse un artículo más largo cuando tuviera un interés especial.

Los artículos deben someterse en la lengua vernácula del autor, deben incluir su título o posición que ocupa y un resumen corto. Deben estar escritos a máquina a doble espacio, solamente en un lado de la página, en papel blanco primera, tamaño 8½ por 11 pulgadas.

Las tablas deben numerarse consecutivamente, cada una en una hoja separada con su título. Las notas al pie usadas en las tablas deben escribirse a máquina como parte de la tabla y designarse por medio de números.

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Los manuscritos deben enviarse al Líder del Centro Tropical de Investigaciones Forestales, Río Piedras, Puerto Rico.

Las opiniones expresadas en esta revista no coinciden necesariamente con las del Servicio Forestal. Los artículos publicados en el Caribbean Forester pueden reproducirse siempre que se haga referencia a la fuente original.

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The Caribbean Forester is a free semi-annual technical journal published since 1938 in Puerto Rico by the Tropical Forest Research Center, Forest Service, U. S. Department of Agriculture. This publication is devoted to the development of improved management and utilization of tropical forest resources, with special interest in the Caribbean region.

Through the pages of the journal tropical foresters and workers in allied scientific fields are informed of specific problems of tropical forestry, policies in effect in various countries, and progress of work being carried out for the improvement of the management and utilization of forest resources. It furnishes a means of distribution of information on the progress and results of the experimental programs of the Tropical Research Center in Puerto Rico. In addition, it affords an opportunity for other workers in the field of tropical forestry to make available the results of their work.

Contributions for the journal are solicited. However, material submitted should not be under consideration for publication elsewhere. Manuscripts should not ordinarily exceed 20

(Continúa en la portada #3)

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# Caribbean Forester

## Contents

## Sumario

# 1959 Annual Report
# Tropical Forest Research Center

The year 1959 favored the Center with a full staff for the first time in many years, and correspondingly greater progress in forest research, demonstration, and assistance. Research was intensified on both the search for superior forest crops and the prolongation of the service life of forest products. Demonstrations of the results of research led to more and better forest plantings and prospective new wood uses and industries, both in Puerto Rico and in the Virgin Islands.

Early in the year the Center was saddened by the loss and later passing of F. Ralph Throop, the training officer who led the 1958 Tropical Forestry Training Course. He was replaced by Dr. F. Bruce Lamb, a forester with 20 years of tropical experience. Dr. Lamb served as training officer for the 1959 Training Course and has had the responsibility of training other students, maintaining the library, preparation of Center releases, and research on forest plantations in Latin America and on variations in mahogany.

The Section of Forest Management Research was taken over early in the year by Dr. Charles B. Briscoe, a former professor at Louisiana State University and with previous tropical forestry experience. With this appointment the six professional staff positions were filled.

Two agronomy students in the College of Agriculture of the University of Puerto Rico were employed during the summer as has been the practice in recent years. There is a good prospect that one of these will take professional training in an accredited forestry school on the Continent.

Training of personnel was intensified during the year, with all employees receiving some type of formalized training and five participating in technical training activities in the United States, the latter covering forest management research techniques, forest products research orientation, kiln drying, furniture manufacture, multiple-use forest administration, and accounting techniques.

Several of the facilities of the Center were improved materially during the year. The 26,321-acre Luquillo Experimental Forest is being enlarged by 1,557 acres through a land exchange which is nearing completion. Within the forest 6.7 miles of highway are being reconstructed and an additional 3.1 miles of new road are being surveyed for future construction to facilitate the use of the area.

Other new facilities include an air-conditioned laboratory and herbarium room providing much-needed protection for instruments and research equipment. A bolter saw and experimental kiln, together with the wood shop already at hand facilitate further development of new uses of little known sawtimber species. The non-pressure preservative treatment plant of the Center has been supplemented by an experimental pressure-treatment plant financed by the Commonwealth government. A mechanical post peeler was acquired to facilitate preservation research and for demonstration purposes. In the Virgin Islands the sawmill was subjected to extensive repairs and a small non-pressure preservative plant is nearing completion. A second post peeler has been put to work to supply the plant.

The Center library, containing some 7,000 selected titles on or related to tropical forestry, has been improved through subscription to the Centralized Title Service of the Commonwealth Forestry Bureau, providing prompt receipt of all titles of importance within the field. About half of the library material was reclassified and catalogued according to the Oxford system during the year. The mailing list for the Caribbean Forester and other Center publications, in spite of annual circulation to restrict it to currently interested recipients, stands at about 1,000, as large as it has ever been.

## FOREST MANAGEMENT RESEARCH

The new project leader, unfamiliar with Puerto Rico and the Virgin Islands, made a thorough review of the whole management research program. Some results of the review are evident in this report; others will take longer to become apparent. Fundamental studies will receive somewhat more attention in the future, but no major revision of the management program is planned.

At the beginning of the year there were 143 active studies. Eleven of these were closed during the year and eleven new studies were begun.

### DENDROLOGY

The manuscript for a semi-popular book "Arboles Comunes de Puerto Rico e Islas Vírgenes" has been completed. Publication by the University of Puerto Rico is expected in the near future.

### PHENOLOGY

For purposes of site description instruments were installed at four locations on the Luquillo Experimental Forest for the continuous measurement of temperature and humidity and for the weekly measurement of rainfall. Ten trees of five species have been located near each weather station for the first local weekly growth measurements and observations on the development of leaves, flowers, and fruits. Deciduous species under observation are bigleaf mahogany *(Swietenia macrophylla* King), teak *(Tectona grandis L.)*, and roble *(Tabebuia heterophylla* [D.C.] Britton). Evergreen species are tabonuco *(Dacryodes excelsa* Vahl), maría *(Calophyllum brasiliense* Camb.), yagrumo hembra *(Cecropia peltata L.)*, and yagrumo macho *(Didymopanax morototoni* [Aubl.] Dec. & Planch.). Mahogany, roble, and yagrumo hembra are present at all four stations; the remaining four species are found only at two. No conclusions are possible yet, but weekly diameter changes appear to be associated with rainfall, lagging about one week.

### VARIATION AND SELECTION

Four mahogany types, based on leaf size, have become apparent during past work: typical bigleaf *(Swietenia macrophylla)*, intermediate leaf from a bigleaf parent, typical small-leaf (*Swietenia mahagoni*), and intermediate leaf from a small-leaf parent. Seedlings of each type have been planted in replicated plots on St. Croix, Virgin Islands to determine whether patterns of growth and development are associated with a particular leaf type.

In addition, stands of typical bigleaf and typical small-leaf without the opposite species near enough to be probable source of cross fertilization have been located as seed sources for progeny testing. Results are expected to indicate whether the intermediate forms are interspecific hybrids or intraspecific variations.

### NATURAL REGENERATION

Two areas previously cutover were under observation to appraise the natural reproduction of yagrumo hembra. Three months after cutting, an area of about half an acre with 10 percent shade contained two seedlings and two sprout clumps, from a 6-inch and an 18-inch stump. The taller seedling was three feet; the tallest sprout eight feet. Another half-acre area with 50 percent shade had only one seedling and no sprouts. Observations as to site preferences of this species are continuing.

### SPECIES ADAPTABILITY

A continuing need in artificial regeneration is information as to the sites to which a promising species is adapted and as to what species are adapted to a site of special interest.

**True Pines**

Nearly a hundred attempts were made before any of the true pines were introduced successfully into Puerto Rico. The first was slash pine *(P. elliottii elliottii* Engelm.) on Nipe clay, inoculated with mycorrhizal material two years after planting. In late 1958 several thousand seedlings of slash and loblolly *(P. taeda L.)* pines already containing mycorrhizae, were flown in from the southern United States. They were planted on a variety of sites and subjected to differing degrees of care. The principal test was successful; mycorrhizae developed satisfactorily on all sites. Other indications at the end of the first twelve months:

1. Survival of both species absolutely required protection from overwhelming vines and grass.

2. Height growth of slash pine was significantly greater than of loblolly on sandy soils.

3. Survival percentage of loblolly pine was greater than of slash pine on all sites except one, where they were equal.

This year seed of *P. caribaea* Morelet collected at low elevation (less than 500 feet above sea level) in Cuba and higher elevation (above 2000 feet) in British Honduras were imported. Potted seedlings were inoculated in the nursery with mycorrhizal material from Maryland. Survival three months after planting was 95 percent for each species. The British Honduras seedlings averaged three times as tall as the Cuban; the latter, however, had a much better color on some of the more degraded sites. Therefore, mycorrhizae have now been successfully introduced in three ways: as inoculum applied to established seedlings in the field, as inoculum applied to very young seedlings in nursery beds, and on the roots of seedlings of planting size.

**Shallow Loam Area**

The plantings during 1958-1959 in the steep, drouthy, shallow loam area in the central mountains are mildly encouraging. The following figure for each species represents the average survival of 300 trees at six locations and in at least twelve plots, except *Cupressus*, which was planted at only three locations.

| Species | Survival Percentage 12/59 |
|---|---|
| *Didymopanax morototoni* (Aubl.) Dec. & Planch. | 7 |
| *Hernandia sonora* L. | 14 |
| *Castilla elastica* Cervantes | 21 |
| *Eucalyptus kirtoniana* F. Muell | 21 |
| *Erythrina poeppigiana* (Walp.) O. F. Cook | 24 |
| *Cecropia peltata* L. | 46 |
| *Casuarina equisetifolia* L. | 55 |
| *Cupressus lusitanica* Mill. | 60 |
| *Spondias mombin* L. | 68 |
| *Spathodea campanulata* Beauv. | 74 |
| All species | 39 |

*Spondias mombin L.* was first direct seeded; few seed germinated, and no seedlings survived the first dry season. The *Spondias* plots were then planted with seedlings in October, and have not, therefore, passed through a dry season.

**Other Species**

Yagrumo hembra *(Cecropia peltata)* planted on a deep clay in the eastern mountains has progressed satisfactorily. Sixteen months after planting, average height was only 3.2 feet on a badly degraded ridge, but ranged up to 15 feet on a lower slope. On the ridge, fertilized seedlings averaged 1.2 feet taller than unfertilized, a highly significant difference. Yagrumo hembra was also planted on sandy loam soils with the new pine plantings, at six locations.

Kauri *(Agathis robusta* [C. Moore] F. M. Bail.) was planted on deep clay at two locations in the eastern mountains. Survival after four months was 98 percent.

American sycamore *(Platanus occidentalis* L.) was planted with the kauri at one location and with the pines at six locations. Initial survival was 97 percent.

The granadillo *(Buchenavia capitata* [Vahl.] Eichl.) planted in 1951 on deep friable clay, at 600 feet, rainfall 100 inches, was completely eliminated in right-of-way clearing for a new highway. Height growth had averaged about two feet per year, and color and form were excellent. Diameters, however, averaged somewhat less than two inches at age eight.

Manjack *(Calyptracordia alba* [Jacq.] Britton) planted on the dry south coastal plain, rainfall 35 inches, in 1954 has developed satisfactorily as a live fence post and a source of posts. It also yields abundant fruit for wildlife. Although the form is bushy and survival was very low, growth was good; the trees averaging 15 feet and 3 to 4 inches d.b.h. at age five.

Avelluelo *(Colubrina arborescens* [Mill.] Sarg.) planted in 1948 on a steep, rather shallow soil at 3000 feet elevation has been disappointing after a very promising beginning. Although the trees are widely spaced with relatively little competing vegetation, growth has been almost completely lacking for the last four years, and the form is poor.

## GROWTH OF TREES AND STANDS

Growth records for approximately 24,000 trees were put on punch cards for analyzing by data processing machines as funds become available.

Routine measurements were made of a number of studies. Satinwood *(Zanthoxylum flavum* Vahl) planted in 1938 on the moist limestone hills, rainfall 80 inches, began with rather slow growth, which has gradually decreased. Dominant and codominant trees averaged 2.6 inches d.b.h. at 11 years and 3.9 inches at 21 years. In the first five years of this period mean basal area growth per tree was 0.034 square feet; in the second, it was only 0.012 square feet. At the current (1954 - 59) rate of growth dominants and codominants require an average of 100 years to grow six inches in diameter, a rate offering little hope of economical management. Plant competition can hardly be reduced; basal area per acre of satinwood is only 25 square feet and that of other woody stems in the plot is only 9 square feet.

Several adaptability studies have been closed successfully, and growth plots established.

Capá prieto *(Cordia alliodora* [Ruiz & Pav.] Oken.) in the eastern mountains on deep clay at 600 feet elevation with 120 inches rainfall averaged 4.7 inches d.b.h. with a maximum of 6.6, at age 10. Tree form was excellent, and the height of dominant and codominant stems averaged 55 feet.

Roble *(Tabebuia heterophylla* [DC] Britton) is one of the best species for reclaiming degraded crop and pasture lands and improving the site so that better species can be introduced. Wildings planted in severely eroded pasture in 1948 at 600 feet elevation, 120 inches of rainfall, averaged 5.1 inches d.b.h. at age 11; height of dominants and codominants was 47 feet, basal area per acre is 86 square feet.

Blue mahoe *(Hibiscus elatus* Sw.) at age 14 ranged up to 7.0 inches d.b.h. on lower slopes in the moist limestone hills near sea level with 60 inches of rainfall. Average d.b.h. was 5.4 inches. Form was excellent, and heights of dominants averaged 75 feet. On a narrow stream bottom at 2500 feet elevation in the central mountains, mahoe the same age had an average d.b.h. of 6.9 inches with a maximum of 13 inches.

Mexican cypress *(Cupressus lusitanica* Mill.) in the central mountains at 3200 feet elevation, with 100 inches of rainfall, averaged 8.5 inches d.b.h. at age 10. This species has given very erratic results and frequently suffers blowdowns, but at best it is very promising.

Primavera *(Cybistax donnell-smithii* [Rose] Seibert) has shown promise; at age eight in the moist limestone hills near sea level with 60 inches annual precipitation the average d.b.h. was 3.1 inches, and height of dominants averaged 41 feet. On a deep friable clay in the eastern mountains at 600 feet elevation with 120 inches precipitation primavera averaged 6.5 inches d.b.h. at age seven, with a maximum d.b.h. of 11 inches. Height of dominants averaged 72 feet. A nearby planting on a somewhat less degraded site averaged 8.1 inches d.b.h. at age eight. A third planting, also on a better site, averaged 11.0 inches d.b.h., with a maximum d.b.h. of 16.4 inches at age twelve.

### CHEMICAL ARBORICIDES

Various treatments begun in 1958 and reported previously failed to show results superior to the standard, 5 percent 2,4,5-T in continuous frills. A solution of 50 percent sodium arsenite in continuous frills killed 60 percent of the pomarrosa *(Eugenia jambos* L.), which has so far been resistant to 2,4,5-T; however, sprouting is abundant and final evaluation must be delayed until the ultimate fate of the sprouts is observed.

Application of soil sterilants will be tested in early 1960.

### PILOT MANAGEMENT

The pilot management study, covering 6,734 acres in the Luquillo Experimental Forest, has now completed its fourth year of operations, with 5,079 acres treated to date. A total of 1,598 acres were treated during 1959. Treatment consisted of removal or poisoning of unwanted trees. Only a small portion of the area was sufficiently accessible to treat through timber sales. The average stumpage yield was slightly less than $1.00 per acre. Poisoning, including marking and direct supervision, cost 10.3 man hours per acre. Labor, materials, and field supervision cost $6.92 per acre.

The establishment of more than 400 permanent plots within four compartments of this study was completed during the year and summary and analysis are under way. The weather stations mentioned earlier were established on these study compartments to determine climatic differences among them. Analysis of the plot data, not yet completed, indicates that the improvement cutting has reduced stand density and volume about half and has made a marked improvement in composition. A full report on the initial stands and treatment is to be published as soon as the analysis is complete.

### PLANTATIONS IN LATIN AMERICA

The numerous but scattered forest plantations established in Latin America have long been recognized as one of the best sources of information which might guide future planting in Puerto Rico and the Virgin Islands. Yet few of these plantations have been described in the literature in such a manner as to make it possible to appraise the results in terms which indicate their applicability elsewhere.

The Center began during the year a survey by correspondence to collect information of this character. A form was devised to provide detailed information on the history, environment, and productivity of each plantation. Forms were sent to some 125 forestry departments and foresters in Latin America, requesting cooperation in providing information regarding the more successful plantations. By the end of the year reports on 95 plantations had been received. These, plus 34 reports on local plantations, were published by the Center and distributed widely in both Spanish and English in response to a request from the Latin American Forestry Commission of FAO.

The reports received to date provide very incomplete coverage of the area. Efforts will continue to obtain additional information by correspondence, and, as opportunity permits, through direct observations in the more important plantations.

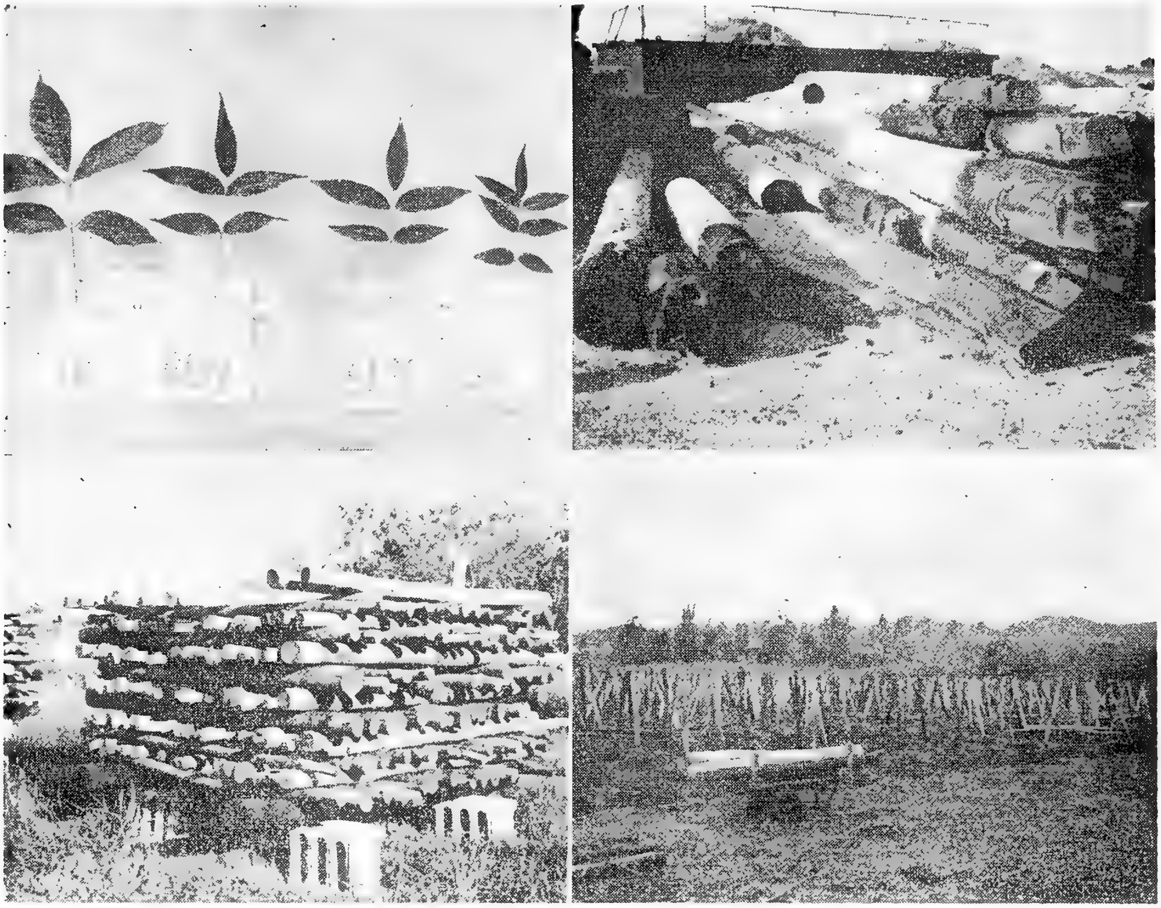

Figure 1. — Upper left. The four types of mahogany leaves, left to right: typical bigleaf (Swietenia macrophylla); intermediate leaf from a bigleaf mother-tree; intermediate leaf from a small-leaf mother-tree; and a typical small-leaf (S. mahagoni). Upper right. Treated southern pine piling of known history for the determination of creosote retention in relation to service life, in cooperation with the Forest Products Laboratory, Madison, Wis., and the American Wood Preservers' Association. Lower left. Fence posts set on concrete blocks and piled loosely for fast and uniform drying. Lower right. Setting fence posts for durability tests at Cambalache Forest; the 3000 6-foot posts in this plot were set 15 inches in the ground and 3 feet apart.

## FOREST UTILIZATION RESEARCH

Tests of preservative treatment and service life of fence posts occupied the Section most of the year, although sawmilling, air seasoning, and machining of local woods also received research attention.

Fence posts of 51 species plus the common bamboo *(Bambusa vulgaris* Schrad.) were treated with a five-percent solution of pentachlorophenol in diesel oil by cold soaking. An additional 22 species were treated by the hot-and-cold bath method. Ten species were treated with a 50-50 creosote-diesel oil solution by each method. Penetration and retention of preservative were determined for each of the 20 posts in each treatment. Results are not yet completely analyzed, but retention resulting from the hot-and-cold bath method is generally much superior to that from cold soaking. A complete report is in preparation.

Treated and untreated control posts from the study just described, a total of about 4700 posts, were set in two rural areas: on the Cambalache Forest, representative of the north coast dairy region, and on the Guavate

Forest, representative of the upland pasture region in the eastern mountains. Their service life will be determined by periodic reexaminations.

The double diffusion method of preservative treatment which was developed by the Forest Products Laboratory at Madison, Wisconsin and has proven successful under some conditions elsewhere, was tested by the Center on 30 of the most common fence post species, and the common bamboo. A primary advantage of this method over others is its applicability to green material immediately after felling.

For the double diffusion test freshly cut and peeled fence posts were subjected to two different treatments, as follows:

1. Full-length immersion for 72 hours in a 4 percent aqueous solution of sodium fluoride followed by an equal period in a 7 percent aqueous solution of copper sulfate.

2. Full-length immersion for 48 hours in a 10 percent aqueous solution of copper sulfate followed by an equal period in a 50-50 mixture of 13 percent aqueous solutions of sodium chromate and sodium arsenate.

The sodium solutions were prepared in a 4 by 4 by 8-foot metal tank, and a plywood vat of the same size was constructed for the copper sulfate solution. The chemicals were mixed in the vats with an air stream conveyed to the bottom by a lead pipe. A related test of the double diffusion method was made using barrels and drums for half-length treatment.

Since weight change is not characteristic of treatment by this process the absorption can be determined only by chemical analysis. Arrangements are being made to have this done. Preliminary observations on cross sections of immersed posts suggest that both treatments resulted in diffusion into the wood of most species.

Rapid deterioration of usual wood finishes exposed to the weather on signs led to a test of the natural finish for this purpose developed by the Forest Products Laboratory. This finish, described in Laboratory Publication No. 2096, was applied to woods of 50 species in a test exposure panel. At the end of the year, after six months exposure to full sunlight, the finish was in good condition.

The wood of palo colorado *(Cyrilla racemiflora L.)*, available in some quantity in mountain forests but of little utility to date primarily because of degrade in seasoning, was promoted by the Center for a local specialty use. As a result a manufacturer joined with the Center in testing the milling outturn of this species and its air-seasoning characteristics under restraint. A test run of 500 board feet sawed well on the bolter. Degrade during seasoning was not entirely eliminated, but its importance has not yet been determined.

## FOREST ADMINISTRATION

The Luquillo Experimental Forest, as the largest remaining block of natural forest in Puerto Rico and as the closest scenic area of high mountains to a metropolitan population recently found to exceed 400,000 people, is of importance for many purposes. In addition to its primary use as an area for forest research, it provides timber and other forest products for the local market, water for power and industrial and domestic needs in several communities, a nursery area for the production of planting stock for farm forestry plantings, a recreational area which locally is unique for week-end drivers, tourists, picnickers, and hikers; habitat for interesting, rare wildlife; sites for organization camps and summer homes; and outstanding peaks for radio transmission. These multiple uses are accommodated within this restricted area jointly wherever they are compatible and through area allotments elsewhere.

Land exchanges under negotiations, already described, will improve the Luquillo forest as an administrative unit, consolidating ownership, reducing the length of boundaries, and preventing developments on critical areas within the exterior boundaries which may not be in the public interest. One of these exchanges is to pass the Toro Negro Division of the Caribbean National Forest to the Commonwealth Government. It is hoped that these exchanges will be completed within a year.

Trespass, although a minor problem, is a continuous hazard along the 70 miles of boundary of the forest, part of which are adjacent to concentrations of rural population. Boundaries were systematically reposted during the year. Four cases of timber or grazing trespass arose, three of which have been settled satisfactorily without court action.

Mapping of the foot-trail system was undertaken, and the field work was nearly completed. This work is preliminary to the preparation of new base maps upon completion of pending land exchanges.

### TIMBER DISPOSAL

A total of 49 sales of forest products were made during the year. Included were 83,000 board feet of timber and small amounts of miscellaneous products such as bamboo, moss, and fruits, yielding revenues of $2,308. An additional $662 worth of forest products were provided free to 110 farmers in and near the forest. Of the payments received a total of $1,762 was reserved to pay part of the costs of sale area betterment.

### SPECIAL USES

Permits for 185 special uses within the forest (including the Toro Negro as well as the Luquillo) were active during the year. This represents a decline over the previous year due mainly to the elimination of cultivation within the Luquillo forest and the migration of parceleros to private lands. The largest group of permits (60) was for radio transmission. Forty-seven were for residences, 21 for cultivation, and 54 for miscellaneous uses and rights-of-way.

The largest expansion in public use of the Experimental Forest was for recreation. During the year a total of 265,000 persons visited the Forest, most of them to the La Mina Recreational Area. One youth organization camp was in operation and a second is being readied for use. Plans are being made for a new 3-mile road to serve a Navy radar facility on one of the peaks.

## FORESTRY ASSISTANCE IN PUERTO RICO

The Center continued its assistance to the Commonwealth Government and to private individuals concerned with forest production and utilization.

Assistance, both financial and technical, was given to the Commonwealth Government in its programs of production and distribution of forest tree planting stock and technical assistance to landowners in forestry. These programs were responsible for distributing 741,000 trees to farmers throughout Puerto Rico and for the establishment of 544 farm forests in an 8-municipality zone of concentration.

Technical liaison was maintained with the staff of the Commonwealth Division of Forests. A joint training session in timber stand improvement for both agencies was held in the Luquillo Experimental Forest and a demonstration of poisoning techniques was made in the Cambalache Experimental Forest.

In response to a request from the Governor of Puerto Rico a thorough analysis was made of the potential returns which could be expected from forestry and progress to date. A report was submitted with suggestions for a public forest policy; land classification; the protection, management, and utilization of forest lands; and for related public education in forest conservation.

Technical consultation was provided to the Puerto Rico Industrial Development Company to assist their promotion of wood-using industries. Subjects included were manufacture of table ornaments, furniture, and lamps; problems of shrinkage in shipment of products to the States; the establishment of local sawmills for both local and imported woods; the suitability of the local environment for plywood manufacture; the prospects for using wooden containers for shipment of fresh produce to the States; and the economic basis for a non-pressure fence post preservative treatment industry in Puerto Rico.

Additional direct technical assistance in the field of forest products utilization was undertaken. Included were the installation of a pilot pressure-treatment preservative plant for the Division of Forests, Fisheries and Wildlife of the Commonwealth; determination of the rate of moisture take-up in imported kiln-dried gunstocks; preparation of samples of several local wood species for knife handle manufacture; and the shipment of wood samples for testing for meat smoking by the owner of a new slaughter house being constructed in Puerto Rico.

Publicity displays, and demonstrations in the field of fence post preservation led to the installation of the first commercial facilities for non-pressure treatment. The plant, larger but designed after the pilot plant of the Center, was nearly completed by the end of the year. Two rural demonstrations of preservative treatment of fence posts were conducted in cooperation with the Division of Forests and the Agricultural Extension Service.

Samples from 13 marine piling from St. Thomas and San Juan harbors were collected for investigation by the Forest Products Laboratory and the American Wood Preservers Association as to the cause of early failure.

## FORESTRY ASSISTANCE IN THE VIRGIN ISLANDS

For the fifth year the Center administered for the Virgin Islands Corporation a forestry program concerned with forest planting, stand improvement, utilization of sawtimber, fence post preservation, and related activities. As in the past, the work in 1959 was concentrated on the island of St. Croix.

### FOREST PLANTING

Experience with planting stock of mahogany produced in plastic pots in 1958 led to a complete shift to this technique in 1959. During this year, 7,800 trees of Dominican mahogany and 4,000 trees of Honduras mahogany were produced. Two seeds were sown directly in alluvial soil in each pot. Germination was adequate to provide at least one seedling in nearly all pots.

Below-normal and poorly distributed rainfall in 1959 reduced the survival of late 1958 plantings and made inadvisable in 1959 the spring plantings which were successful during the previous year. Planting was not undertaken until October and November. Replanting of former plantations was done on 111 acres (12 sites) with 7,400 trees. New plantings, using 4,400 trees, were established on 26 acres (7 sites). About one-fifth of the new planting and one-third of the replanting were on public lands. Mahoganies planted on St. Croix during the past five years now total 66,000.

The planting technique, unchanged from previous years, involved clearing of strips 3 feet wide 25 feet apart in low brush. The trees were planted at 10-foot intervals within the strips. The cost of strip cutting was 4 man-days per acre and for planting an additional 1.6 man-days.

The seedlings are provided without charge to cooperating landowners. The absence of trained labor in the small local community has led to the provision, by the Program, of the service of planting and plantation maintenance, paid for by the landowner.

Teak *(Tectona grandis* L.) planting was continued on St. Croix, using 2,500 seedlings received from Puerto Rico. The future of this species on St. Croix has recently come into doubt because of its disappointing form and growth rate on certain sites. Existing plantations will continue under close observation and only a limited planting program is anticipated.

### FOREST IMPROVEMENT

The program has as one of its objectives the improvement of some 300 acres of dense mahogany forest, most of it privately owned. Pressure of other phases of the program have precluded emphasis on this to the present. However, on the 132-acre experimental forest at Estate Thomas this work has begun. During 1959 the acreage released from wolf trees and thinned increased from 15 to 27. A deterrent to more rapid progress has been the lack of a good market for the material removed. However, with the early prospect of preservative treatment of fence posts it was possible to fully utilize the sawtimber, roundwood and fuelwood. The success obtained in 1959 with chemical arboricides on worthless trees promises economies which will also make this practice more attractive to landowners.

### SAWTIMBER UTILIZATION

The existence on St. Croix of large old roadside and forest trees of Dominican mahogany with wood of high quality yet without commercial facilities for the efficient utilization of this wood led the Program to include the operation of a portable sawmill as a service function. Services offered at cost include logging, milling, and drying. During 1959 only 2,900 board feet were milled, but the dried lumber brought a price of fifty cents per board foot, and the slabs and chunks brought four cents per pound. The existence of manufactured lumber of high quality, small as the quantity may seem, attracted two artisans interested in the manufacture of specialty items ideally suited to the economy of St. Croix. Considerable interest developed from the discovery of "birdseye" figure in certain mahogany logs. Several trees with such figure have been located as possible sources of propagating material. Interest was also developed concerning thibet *(Albizia lebbek* [L.] Benth), another common local wood.

### WOOD PRESERVATION

The importance of pasture fences on St. Croix, the dwindling supply of fence posts, and the brief service life of most of those remaining led the Program to set-up a hot-and-cold bath preservative treating plant in 1959. Late in the year, when the plant was completed, a few posts were cut, peeled with a mechanical tight-chain peeler, dried, and treated experimentally. Using a 5 percent solution of pentachlorophenol in diesel oil retentions of more than 5 pounds per cubic foot were obtained 48 hours after heating. Further tests are in progress.

## FORESTRY TRAINING

The sixth tropical forestry short course was held in the spring of 1959. Sixteen trainees from nine countries attended. Details have been described in the Caribbean Forester 20 (1 & 2) 11-16, 1959. In addition to the regular course the Center was host to 55 man-days of other forestry trainees from foreign countries. These trainees were interested in a variety of subjects but chiefly forest products utilization. Some participated in preservative treatment tests.

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# An Approach to Mahogany Tree Improvement

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The expense of establishing and maintaining productive stands of forest trees makes it imperative that trees be established which will produce the most desirable type of wood in the shortest possible time. Tree improvement programs have been developed as a means of finding better methods of forest management. Widespread interest in the genetic approach to the problem of tree improvement has resulted in the accumulation of a considerable body of knowledge on the subject. However, tree improvement studies have been confined largely to temperate zone forest trees. Little work has been done with tropical species.

Mahogany[1] a tree of tropical America is now well enough known to justify tree improvement studies. Experience with managing mahogany in both plantations and natural forests indicate that trees of the genus *Swietenia* Jacq, could play an important role in the maintenance of forest land in a productive state in tropical regions of the world (16). Observations by ecologists and foresters indicate the presence of a wide ecological amplitude in the plant material available in this genus (15). Observation of the variability of this group has resulted in the present interest in the possibilities of tree improvement.

The purpose of this article is to call attention to some aspects of the problem and invite cooperation in developing a program of adequate scope to attain reasonable progress. An evaluation of the potential improvement to be achieved working with the wide range of plant material available entails an experimental program of such magnitude and long duration that the cooperation of technicians from several organizations and many fields of specialization will be required.

1/ The U. S. Forest Service recognizes the use of the name mahogany only for the various species of the genus SWIETENIA.

## TREE IMPROVEMENT

Based on information available, it seems reasonable to expect that tree improvement work with mahogany will be as productive of beneficial results as it has been with other forest trees. The success or gain from forest tree improvement work by the application of genetic principles depends on the inherent variability of the experimental plant material (15). The process of selection for improvement within a species can only be effective within the range of genetic or heritable variation found. For the sake of clarity a discussion of what constitutes a species may be worthwhile before considering the genetic aspects of the natural variation found in the three recognized species of mahogany.

The species concept has developed from one based strictly on morphology to one that now includes the hypothesis of evolutionary relationships along with geographical and cytogenetic criteria (3). Emerson (9) defines a species as "an evolved (and probably evolving), genetically distinctive, reproductively isolated, natural population. Occasional hybrids between two species do not invalidate the species concept." Biologically a species is generally recognized as a very large pop-

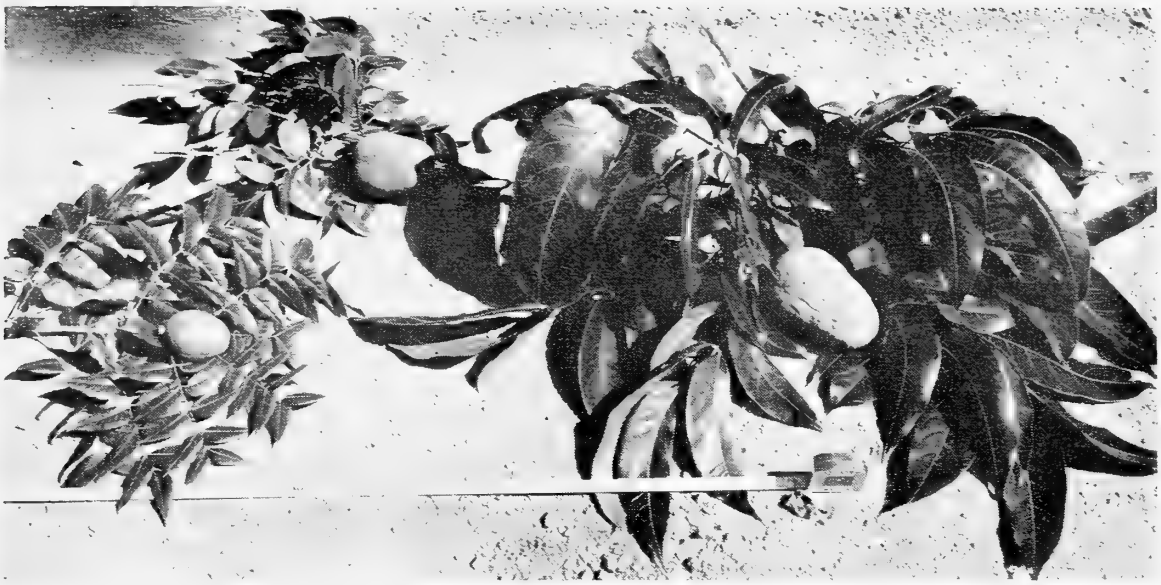

**Figure 1. — Variation in mahogany leaves and fruit from mixed population, from left to right: typical small-leaf (Swietenia mahagoni), intermediate (S. mahagoni x macrophylla?), and typical bigleaf (S. macrophylla).**

ulation, as a rule consisting of thousands of biotypes arranged in a pattern of local populations, ecotypes, and geographic sub-species. Most widespread forest tree species appear to be composed of geographical clines or moderately distinct geographic ecotypes (35).

A species population to a geneticist, according to Darlington (6) usually consists of hundreds to thousands of genotypes, and all fertilizations except those between members of the same genotype result in hybrids. To the ecologist and geographer, species consist of local races, ecotypes and geographical subspecies . Intraspecific hybrids are recognized between such groups, but lesser differences are not considered. The taxonomist is concerned with interspecific hybrids when he encounters occasional individuals ($F_1$) and swarms of back crosses (3).

**NATURAL VARIATION**

The three recognized species of mahogany[2] are relatively isolated from each other geographically in their natural distributions. Each species in turn is divided into subgroups of interbreeding populations by partial or complete discontinuities in distribution. Considerable differences within each species have been reported from different parts of their respective ranges (21). In addition to wide variation in the leaves, flowers, and fruit of a particular species, there are also differences in the structure and other characteristics of the wood. This variation has been largely attributed to differences in rate of growth due to environmental conditions. However, species which have been broken up into many separate breeding populations, among which there is little or no interchange of genes, increase in variety within the species. Natural selection results in the subdivision of species into adapted biotype groups which correspond to different habitats (3, 11, 20). The genetic variability within species enables the sum of the species biotypes to have considerable geographical range and ecological tolerance. Genetic plasticity is the basis for survival in an uncertain world of environmental change

2/ Swietenia mahagoni Jacq., S. humilis Zucc., S. macrophylla King.

(4). The range of differences between groups or populations depends on many factors including the extent of environmental differences, genetic recombination and mutation. Recombination and mutation cause variation within populations while natural selection and genetic drift cause variation between populations (7).

The genetic significance of the reported variation in mahogany species apparently has not been investigated. It remains to be determined whether the observed diversity can be correlated with botanical subspecies, ecotypes, races or forms. The recognized differences, however, give an indication of the possible gain to be achieved through a tree improvement program based on genetic principles.

**Swietenia macrophylla**

There are several fairly large gaps in the distribution of this species over its wide range from Latitude 23°N near Tampico, Mexico south to the headwaters of the Paraguay River at Latitude 18°S in Bolivia and Brazil. Differences in the appearance, density, texture and technical properties of mahogany wood are shown throughout this extensive range. Trees grown in dry or well-drained, rocky soils tend to produce hard compact wood, while many of the trees occurring in more or less permanently moist locations produce comparatively soft, straight grained wood lacking in figure (21, 25).

In British Honduras local variation in the technical properties of mahogany occurs between the wood from trees grown on different sites (22). The wood from the "poorer types of forest" (successional) is much redder and harder than that found in the climax type forest, which tends to be free-grained and cedar-like in color and properties. Lundell (18) described the form growing in British Honduras in "poorer type of forest" (broken ridge) as a species distinct from *S. macrophylla* basing the separation on morphological differences in the leaves and flowers.

According to Gleason (10), the woodsmen working with Krukoff in the Amazon reported the existence of two distinct varieties of mahogany with recognizable differences in the fruit and leaf characteristics. Krukoff, however, was not able to verify this variation in the field. Three varieties are recognized in Bolivia (1).

Perera (23) reports that in Ceylon as in India, where mahogany has been introduced, there appear to be two varieties of Honduras or bigleaf mahogany *(S. macrophylla)* growing side by side. One has smooth bark and soft wood. The other has bark that is conspicuously fissured, often flaking off in vertical strips which have a tendency to roll upward. The latter type has slower growth with wood of deeper color than the former.

Trees producing wood of unusual quality were reported to the author by Slater[3] as occurring in Honduras on the Rio Ylanga, a tributary of the Río Aguan, on the Prudot property called "Ganzal". The trees were relatively small in size, containing fine grained, dense wood with a deep pink color. This wood was not typical of that produced from trees in the general area of the Rio Aguan.

The species *S. candollei* Pittier from Venezuela, *S. tessamannii* Harms from Peru, *S. krukovii* Gleason & Panshin from Brazil, and *S. belisensis* Lundell from British Honduras may show variations in comparison with *S. macrophylla* King. However, many authorities now agree with Standley (29) who does not recognize them as distinct species, but only forms of the latter species.

**Swietenia humilis**

This species occurs largely on the Pacific coastal plain of Central America from Sinaloa, Mexico (Lat. 24°N) to Guanacaste, Costa Rica (Lat. 10°N). In its typical form this is a small tree 10 meters tall with leaves and

3/ George M. Slater, Inter American Institute of Agricultural Sciences, Turrialba, Costa Rica.

fruit considerably smaller than those of *S. macrophylla.* Another species has been described from this area, *S. cirrhata* Blake, with characters nearer those of *S. macrophylla.* It is considered by Standley (28) to be only a form of *S. humilis.*

The distribution of this species is marginal to or overlaps that of *S. macrophylla* on the Isthmus of Tehuantepec, Mexico, in Guatemala and also in southern Nicaragua. Observations in plantations in Honduras and Cuba indicate these two species merge (16).

**Swietenia mahagoni**

West Indies or small-leaf mahogany occurs naturally in the Greater Antilles of Hispaniola, Jamaica, Cuba, in the Bahamas and the southern tip of Florida.

In Jamaica this species has been described as thriving on many soil types, but as being variable in its grain and wood texture from one area to another. That which grows on rocky ground is small in diameter, but proportionally of closer grain, heavier weight and more beautifully veined than wood produced on low, rich, moist lands (2). The tree of this latter type is larger in dimensions, the wood lighter, more porous, and paler in color. In Cuba different types of mahogany wood are recognized, that coming from the port of Santiago being the hardest and darkest in color. Wood coming from Hispaniola has been considered the highest in quality, and little variation has been reported (25).

## EVOLUTIONARY RELATIONSHIPS

From the findings of plant geographers it may be inferred that *Swietenia macrophylla*, because of its wide distribution, is the oldest species, from which the other two species have evolved (3, 27, 37). Schuchert (27) states that neotropical life forms from South America moved into Central America via the Isthmus of Panama and on to Mexico and North America after Miocene time. The introduction of South American tropical flora into the Antilles took place via Central America so long ago that plants have evolved into local species of which *S. mahagoni* is probably an example. Speciation is usually a population-periphery phenomenon which gains expression through the migration that allows isolation and selection according to Cain (3). Closely related species that have developed because of geographical isolation may be found to be fully cross-fertile if isolation is overcome through migration, or either purposely or inadvertently by man's activities. Two related species, once sufficiently isolated to have developed distinct genetic characters, may, if they meet, lose their identity through hybridization. The interaction of genes from different species may result in characters not revealed by either species.

The various species of mahogany have been planted in close proximity in many parts of the tropical regions of the world, but indications of hybridization have been reported only recently (14, 31, 32, 33).

Mahogany is not native to Puerto Rico and the Lesser Antilles. However, *S. mahagoni* was introduced to many of these islands soon after it became an important item in the colonial lumber trade. There is a record of this species cultivated in gardens in St. Croix as early as 1793 (34). It was introduced to the area around Ponce, Puerto Rico by Rivas[4] before 1860. Stehle (32) states that *S. mahagoni* was reported in Guadeloupe in 1892 and in Martinique in 1897. Stahl introduced this species from Santo Domingo into several areas of Puerto Rico including Aguadilla, Toa Alta and Bayamón around 1896 (13).

The introduction of *S. macrophylla* to these islands apparently did not occur until about the beginning of the 20th century. On Martinique in 1905 the Agricultural Service established 5 hectares of this species in clear-

4/ Carlos Purcell, Univ. of Puerto Rico Extension Service. 1960 correspondence.

ings, using seed presumably brought from the botanical garden at St. Pierre (5, 32). There is a record of the introduction of this species to the Agricultural Experiment Station in Mayaguez, Puerto Rico from British Honduras in 1904[5] and from Venezuela in 1918[6]. The trees of this species found on the Lavallee and Davis Bay Estates in St. Croix were apparently introduced early in the 20th century also.

In many locations where *S. macrophylla* was established it was in close proximity to the earlier introductions of *S. mahagoni*. During the 1930's in both Puerto Rico and Martinique it was observed that plants obtained from local grown seed of *S. macrophylla* were extremely variable in their leaf size and growth characteristics. Marrero[7] noted the wide variation in the morphological characteristics of nursery stock being used on the University of Puerto Rico campus at Rio Piedras in 1935-36. This variation can still be observed in the trees that have developed on the University campus. Stehle (30, 31) reports that the so called mahogany hybrid was observed as early as 1939 in Martinique.

More recent observations in Puerto Rico, St. Croix and Martinique indicate that the occurrence of an intermediate form between bigleaf mahogany *(S. macrophylla)* and small-leaf mahogany *(S. mahagoni)* is quite common in the progeny of these two species when the parent trees of the two are in close proximity. (See Fig. 1) The author is not aware of any controlled cross pollination or other cytogenetic studies being carried out to test the occurrence of hybridization between these two species. However, considerable circumstancial evidence is accumulating to indicate that hybrids with both species as mother trees are showing up. It is also probable that $F_2$ generation hybrids occur by this time.

5/ Ann. Rept. P. R. Agri. Expt. Sta. Mayaguez 1904 p. 395.

6/ Introduction Record Agr. Expt. Sta. Mayaguez 1918.

7/ José Marrero, Tropical Forest Research Center, Río Piedras, P. R., Personal communication.

## IMPROVEMENT PROGRAM

In plant breeding success depends on the ability to discern fundamental differences of importance in the plant material available and to select and increase the more desirable types (12). Forest tree breeding is still in a relatively early stage of development if compared with the fields of agriculture and horticulture. Methods to be used should take into account work in these fields that have produced worthwhile results with other species. New approaches to the problems should be sought along with the necessary adaptation and modification of established procedures.

### Species Evaluation

The first problem in the genetic improvement of forest species is assessment of the genetic status of the species as it occurs in nature (24). The full extent of the natural variability of the species under study should be surveyed.

Segregation and evaluation of the racial components of the three mahogany species is essential to the selection of superior individuals for further study. Provenance tests carried out under a variety of site conditions with adequate replication for statistical analysis will be required to classify ecotypes within the species. Categories should be established on the basic of phenology, morphology, habit of growth, rate of growth, resistance to insect attack and disease attack. Seed sources for such tests should be carefully evaluated phenotypically whenever possible since the parent tree represents an expression of the interaction of the genetic potential of the individual within the existing site condition or environment (19, 30).

### Superior Tree Selection

The first steps in selection are usually based on the general outward appearance (phenotype) of individual trees within a species or ecotype. The characters usually considered are comparative rate of growth, stem form, branching habit, resistance to disease and insects, amount of seed produced and specific gravity of the wood. A rapid rate of growth is desirable, other factors being equal. The stem should be round and straight, with little taper. Bark characteristics sometimes give an indication of wood quality. Branching habit includes the angle from the trunk, size of branches, occurrence of forking, and crown shape. An angle near 90° is preferred, slender branches are desirable (not more than ¼ the stem diameter at point of occurrence), the absence of forking is essential, and a narrow crown is preferred. Disease and insect resistance are important and large volume of seed production desirable.

Phenotypic selection, however, is only one step in the process of tree improvement. Clonal and progeny tests using cuttings and one-parent and two-parent controlled seed should be set up to test and compare superior trees that have been selected. Work of this nature is needed to establish the range of variation for traits of economic importance, and to determine the proportion contributed by environmental as opposed to genetic factors (7). The degree and rate of improvement depends to a large extent on the heritability of the characters responsible for quality (19, 26).

A review of tests made with open pollinated seed of both superior and inferior trees shows that many of the traits important to foresters in establishing, managing and harvesting forest stands are heritable (7,26). Among the characters reported by Schreiner (26) to be susceptible to genetic improvement in forest trees are: stem form, branching habit, wood density, anatomical characteristics, chemical composition and dimensional stability.

Along with progeny testing, diagnostic criteria should be sought as a basis for evaluation and selection. Biochemical and physical tests should be developed that can be applied at various stages of tree growth. Diagnostic methods of selection in the juvenile stages are important in working with forest trees because of the length of the life cycle. Tests for tannin content in the bark, specific gravity of the wood, and other physical tests may prove helpful in judging young mahogany trees. Observations in Puerto Rico and St. Croix indicate that the so called mahogany hybrid can be selected out in the nursery on the basis of growth rate and morphology.

In Puerto Rico phenological observations have been started and work has been undertaken to identify mahogany trees or stands where the source of seed can be determined as a basis for selection and studies of variation. Stands of *S. mahagoni* have been established in the past with seed from Haiti and Santo Domingo, and recent introductions include seed from Jamaica and Florida. Seed of *S. macrophylla* from Venezuela, Panama, and Peru has been used to establish plantations, and introductions from other sources are planned. Recent introductions of *S. humilis* from El Salvador and Guatemala have been made and additional material from other locations will be added for provenance studies.

One-parent progeny tests have been started by planting seed from isolated populations of both bigleaf and small-leaf mahogany mother trees along with seed of mixed populations and seed from trees of the intermediate type. A preliminary comparison of five month old seedlings indicates that small-leaf mahogany seed from unmixed populations produces all small-leaf progeny, bigleaf seed from a bigleaf seed tree in an unmixed population produces only bigleaf progeny. Seed from both small-leaf parents and bigleaf parents in mixed populations produces a high proportion of intermediate forms. Seed from the intermediate type, so-called hybrid, produces an array of all three types indicating $F_2$ generation hybrids. The seedlings from these progeny tests will be observed at different stages of their development in the future and the findings published.

**Controlled Pollination**

The most significant results in improvement programs working with planted stands will probably come according to Wright et al. (35, 36), from programs where every parent involved is carefully selected and progeny-tested, and where controlled pollinations play a major role.

Before controlled pollination studies can be undertaken with mahogany, a considerable amount of cytological and phenological study will be required to establish the details of the reproductive process of the species involved. It is not known for instance the extent of self and cross pollination that takes place in mahogany. The technique of controlled pollination may be difficult because the perfect flowers are small with the stamens born in a narrow stamen tube just below the stigma. It will be difficult to eliminate the anthers in order to prevent self pollination without destroying the flowers. The mahogany flowers occur in many flowered panicles and generally only one flower of the inflorescense produces a fruit. Rao (24) reports that controlled pollination efforts with this type of inflorescense have been very disappointing because of the loss of flowers and consequent low production of fruit. The possible gain through hybridization however, makes it important to develop methods of controlled cross pollination. Mergen (19) states that evidence obtained from interspecific hybridization has shown that desirable traits of two or more species can be combined in one individual. In addition the interaction of genes from different species may result in characters not revealed by either species (3, 12).

Preliminary observation of the intermediate form between small-leaf and bigleaf mahogany found in Puerto Rico, Saint Croix, and Martinique indicate the possibility of producing a tree with the vigorous growth of the bigleaf mahogany and the desirable wood characteristics of small-leaf mahogany (14, 32). The exact status of hybridization between *S. macrophylla* and *S. mahagoni*, and whether or not *S. humilis* can be brought into the complex with advantage remain to be determined.

In view of the possible difficulties in controlled cross pollination with mahogany, other means of producing and testing hybrids should be sought. Comparative studies of chromosome numbers may provide a basis for determination of genetic relationships within the genus (8). A comparison of the morphology of the progeny from mixed and unmixed populations of known origin of the various species may also provide clues as indicated by progeny test described earlier. While more specific data on hybridization is being developed it seems worthwhile to establish isolated mixed plantings of selected individuals of bigleaf and small-leaf mahogany to produce material for testing. This step has been taken by Cuevas[8] at the forest nursery at Chetumal, Quintana Roo, Mexico, but no offspring have yet been produced. Similar plantings should be started in other areas, using ecotypes of the three recognized species of mahogany. Tests of intraspecific hybridization are also needed.

**Desirable Types of Wood**

In the mahogany trade soft, light colored, coarse-textured wood has always sold at a discount, while a premium has been paid for firm, straight grained wood with fine texture. At various times during the 300 years that mahogany has been an item in the world lumber trade various special types of figured wood have sold at a premium. However, the demand for special figures has changed with changing tastes in the use of wood.

A tree improvement program is at best a long term affair, and should take into account long term trends in wood utilization. From

8/ Armando Cuevas López, Coordinador Forestal del Sureste, Agencia General de Agricultura, Chetumal, Quintana Roo, Mexico. Personal communication.

past experience it appears that forest plantation and management programs that include the use of mahogany should establish means, through tree improvement techniques, to avoid propagating trees that produce soft, open textured wood. The aim should be to produce fast growing, well formed trees that contain wood of potentially high value. Findings in the field of forest genetics indicate that this objective is attainable through the organized and coordinated effort of trained technicians.

### SUMMARY

Mahogany, as a potentially important element in tropical forestry programs, should be investigated to find the most desirable material available. In its natural environment covering a considerable range of site conditions, mahogany shows significant variation in its morphological characteristics including the wood produced.

Tree improvement programs based on genetic principles provide methods of selecting and producing planting stock that will produce wood with the required properties in the shortest time. To initiate a program with mahogany a survey of the natural variability of the three recognized species should be made. Work should then be undertaken to evaluate and segregate the best racial material available. Finally interspecific and intraspecific hybrids may be tested to determine whether the best of the natural plant material can be further improved.

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# Raw Material Prospects for the Colombian Paper Industry

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**U. S. Operations Mission to Colombia**

Colombian tropical hardwoods are being used for the first time in the manufacture of paper. In July 1959, the firm Cartón de Colombia in Cali began experimenting with local tropical hardwoods for this purpose. They will be followed soon by the firm Celulosa Pulpapel in Barrancabermeja. This is only the beginning of the utilization of Colombia's forest resources for paper as a substitute for high-priced imported pulp.

The first major paper plant started production in Colombia in 1944. Numerous small plants followed and have been producing various grades of paper. These have been made principally from imported long-fibered pulp, waste paper and some bagasse. Raw materials from Colombia forests, which cover 50 per cent of the country's total area of 1,138,000 square kilometers have not been used.

The Agricultural Service (STACA), a cooperative entity of the Colombian Ministry of Agriculture and the U. S. Operations Mission to Colombia (Point IV), has actively supported efforts to utilize local raw material such as wood in developing the pulp industry in Colombia. Technical assistance has been given in making pulpwood resource surveys of various forest areas[1].

The source of pulp for paper consumption will continue to come from waste paper, bagasse, imported long-fibered pulp and Colombian hardwoods (short fibered pulp).

In 1960 approximately 8,000 tons of pulp will be produced from Colombian hardwoods. By 1965 this production should have reached 27,500 tons, an increase of approximately 3½ times.

## NEEDS OF THE INDUSTRY

The increased use and development of local pulp resources for the Colombian paper industry require:

1. Continued testing of hardwoods for pulping and paper making characteristics.
2. Managing the tropical forest for production of pulpable species.
3. Local production of long-fibered coniferous pulp.

### Hardwood Testing

The use of tropical hardwoods, while sure to increase, necessitates considerable experimentation before standard pulp for some types of paper and board can be produced. Also, production costs must be competitive with those of other local materials such as bagasse and waste paper.

1/ U. S. Technical assistance to Colombia in the field of forestry goes back to 1954 when the first cooperative watershed management project was established in Medellin, Antioquia. Similar projects were subsequently established in Cali (Valle) and Neusa (Cundinamarca) for introduction of forest protection, management and utilization practices, and training of Colombian personnel.

A major field of assistance is the development of programs, policies and practices for the National Forest Service established in 1958. Technical personnel trained by the cooperative program (STACA) were selected for the key positions in the new service.

Training of professional and sub-professional forestry personnel is another important phase of the cooperative program. STACA has provided a total of 16 scholarships for undergraduate training in Colombia and has employed 67 students for on-the-job training during vacations. Eleven short courses have been given for practical training of forestry personnel in the STACA cooperative projects.

The firm Cartón de Colombia intends to establish a small laboratory at the plant in Cali for testing various woods for pulping characteristics. This will be the first of its kind in Colombia and will save much time and money in making it possible to do the testing in the country.

Preliminary tests made outside the country indicate that Sajo *(Campnosperma panamensis)* has desirable pulping and paper making characteristics. The pure stands of Sajo, containing an estimated 90 to 100 tons of pulp per hectare, extend further south on the Pacific Coastal area of Cauca and Nariño states.

The Sajo forest appears to be a promising resource, though at present, shipping costs to Buenaventura make this raw material more expensive than woods from Buenaventura.

Preliminary tests on Cativo *(Prioria copaifera)* made at the Madison Laboratory also indicate that it might serve the pulp industry. This species grows in pure stands in the Río Atrato drainage. It is now exported for veneer and lumber.

In the meantime, this company continues to experiment with making paper and board on a commercial scale with various tropical hardwoods. They are able to use some quantities of tropical hardwoods since they are making a number of different grades of paper which require different strength properties. For instance, in some types they are able to use large percentages of tropical hardwood pulp while in others none at all.

One interesting point is the reluctance of some consumers to accept paper made of tropical hardwoods because it differs in color and texture from that now used even though the paper has the same strength characteristics. Changing the consumer's habits is a slow process. It may take some time to overcome a customer's objection to a difference in color or texture.

**Newsprint**

The use of hardwoods in the manufacture of newsprint is rapidly becoming a technical and economic probability. Hardwoods are currently being used to some degree by three newsprint mills in the United States. Considerable experimentation has been done in the Lake States with hardwoods for commercial manufacture of newsprint.

The experiments conducted with Colombian woods at the Forest Products Laboratory in Madison, Wisconsin, show some advantage for newsprint, according to G. H. Chidester, Chief of the Pulp and Paper Division. Some of the species produced a good quality groundwood pulp which could either be used in blends with long-fibered pulps or with long fiber and cold soda pulp.

The best combination obtained to date in the Lake States area is a combination of 60 per cent aspen groundwood, 15 percent cold soda pulp from mixed hardwoods (which Cartón de Colombia is producing), and 25 per cent long-fibered pulp.

**Management of Tropical Hardwood Forests**

It is in the field of tropical silviculture for pulpwood production where technical assistance from the Colombian government could be of great help to industry. However, little scientific information is available to serve as a guide for this work. Cooperative studies should be set up as soon as possible to develop forest management procedures suitable for the type of forest found in Colombia.

Cartón de Colombia has undertaken the enormous job of expanding into a pulp producing operation by obtaining a 15,000 hectare forest concession.

The eventual silviculture applied to their Buenaventura concession for the production of pulpwood will probably have to be a compromise between species that can be regenerated after initial cuts and species that have good pulping qualities.

**Local Production of Long-Fibered Coniferous Pulp**

In 1959 Colombia imported about four million U. S. dollars worth of long-fibered pulp. This is consumed principally by two companies, Cartón de Colombia and Celanese Corporation. More companies which are at present planning to establish plants, such as Papeles Colombiana of the Canadian Kruger organization, will import long-fibered pulp for their needs.

Coniferous plantations should be the answer to this ever increasing demand. Colombia is in an excellent position for developing coniferous plantations. There is a ready market for every piece of pine pulpwood that is produced. Cartón de Colombia alone estimates that they can use the growth of 50,000 hectares of pine. The climatic zones for good pine growth exist, and preliminary data are available on the growing of various pine species in Colombia.

New Zealand is an outstanding example of the successful building of a new industry — pulp and paper — on the growth of exotic pine plantations which provide a source of long-fibered pulp. Their forest industry ranks fourth in importance today in that country.

Establishment of exotic pine plantations in Colombia is a project that deserves full governmental support. It involves selection of areas within the climatic zones favorable to pine development, selection of species, and establishment of large plantations. These plantations could be established by individual companies, by the government, (national, state or municipal) and by large and small land owners. The latter presents a challenge to forest extension programs in convincing people to put idle or worn-out land to produce short rotation pulpwood.

With the establishment of numerous experimental plots for adaptability studies, STACA has made the first step in the introduction and election of species in different altitudinal and climatic zones. Species like Florida slash pine *(Pinus elliottii)* and a mexican pine *(Pinus patula)* have had exceptional growth (14 feet and 12 feet height respectively in 2 and 3 years).

The pulp and paper industry probably has possibilities for faster development and showing greater economic benefits than any other forest products field in Colombia.

# El Crecimiento de los Eucaliptos en Regiones Semi-Húmedas y Semi-Aridas

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El uso del eucalipto en los programas de reforestación en el mundo está aumentando continuamente. Este hecho indica la importancia de evaluar la información disponible sobre plantaciones ya establecidas como base para programas de reforestación en el futuro.

Las observaciones presentadas aquí, resultados del establecimiento de 1500 hectáreas de plantaciones de varias especies de *Eucalyptus* y la ordenación de 3000 hectáreas de plantaciones de *Eucalyptus globulus*, se basan en 15 años de experiencia en las Minas de Río Tinto y Almonte, Provincias de Huelva, España, y de observaciones sobre plantaciones de varias especies de *Eucalyptus* en El Salvador, América Central. Esperamos que la información sea de valor para dasónomos trabajando bajo condiciones similares.

## PLANTACIONES DE ALMONTE

Un estudio preliminar hecho en 1928-29 de pequeñas plantaciones ya establecidas en la región dió una indicación de la productividad en escala más grande. Medidas tomadas indicaron crecimientos anuales como siguen: *Eucalyptus camaldulensis* - 17 a 28 metros cúbicos por hectárea por año. *Eucalyptus globulus* - 21 a 47 metros cúbicos por hectárea por año.

Ya en aquel tiempo se consideró que estas plantaciones se encontraron en terrenos especialmente fértiles y en circunstancias favorables. Por esta razón se adoptó para los cálculos un crecimiento medio anual de 20 metros cúbicos por hectárea por año. Veremos más abajo que en plantaciones extensas el crecimiento es aún muy inferior a este número.

### Ambiente

El suelo es arenoso, profundo y suelto de origen diluvial y aluvial. La falda freática se encuentra a una profundidad de 1 a 4 metros.

Principales especies de la vegetación espontánea:*Helianthemum halimifolium* Willd., *Rosmarinus officinalis* L., *Halimium libanotis* Lang., *Ulex parviflorus* Purr., *Lavendula pedunculata* Cav., *Chamaerops humilis* L.

Datos sobre el clima consisten de temperatura media anual 16.9°C., pluviosidad media anual 658 mm., mínimo absoluto de la temperatura -10°C., máximo absoluto de la temperatura 49°C., sequía casi total en julio y agosto y sequía más o menos pronunciada en mayo, junio y septiembre.

### Preparación del Terreno

Después de un año de agricultura se limpió el terreno de los arbustos que aún quedaban, como el *Ulex parviflorus* y el *Chamaerops humilis* y se hicieron los hoyos de una profundidad de 60 centímetros y a distancias de 4 x 4 metros. Se usaron plantas de 5 a 6 meses de edad en otoño o plantas de 8 a 9 meses en la primavera, criadas en almácigas y plantadas en el terreno a raíz desnuda. Más tarde se usaron plantas criadas en macetas de barro y latas de conserva. Las plantas de macetas dieron los mejores resultados y desde 1936 se usaron solamente estas plantas. La semilla se obtuvo del Sr. Vilmorin Andrieux en Paris y era de origen australiano. Un kilo de esta semilla de *Eucalyptus globulus* daba unas 40,000 plantas.

**Plantaciones**

Las plantas fueron puestas en el terreno en hoyos de 60 centímetros y a una buena profundidad, muchas veces hasta 25 centímetros desde la superficie. Después de haberse hecho la siembra se araba el terreno hasta una profundidad de 15 centímetros en dos direcciones. Las fallas se repusieron tan pronto como se observaron. En varias ocasiones era necesario enderezar las plantas caídas por el viento. Se aró el terreno durante algunos años, hasta alcanzar la densidad suficiente de las copas de los árboles para la conservación y protección de las plantaciones.

**Aprovechamiento**

El plan original era utilizar la madera para una fábrica de celulosa pero dicho plan no llegó a ejecutarse. El volumen insuficiente de la madera y la segunda guerra mundial hicieron imposible el proyecto. Desde 1940 se utilizó la madera para palos de minas, carbón vegetal, madera para tablas de minas y embalaje, palos de telégrafo y teléfono, palos de construcción, traviesas de ferrocarril, y para celulosa para una fábrica en el Norte de España. Las hojas de las podas y de las cortas se utilizaron para la extracción de aceite esencial.

**Rendimiento**

Las tablas 1 y 2 demuestran la producción de las plantaciones durante el primer y segundo turno.

*Tabla 1. — Producción de la plantación de* Eucalyptus globulus *durante el primer turno*

| Calidad del Sitio | Edad | DAP Medio cm | Altura Media m. | Vol. por hect. $m^3$ | Crec. $m^3$ | Crec. Anual Medio/hect. $m^3$ | Arboles por hect. |
|---|---|---|---|---|---|---|---|
| I | 7 | 15.0 | 16 | 58 | 20 | 8.3 | 482 |
| | 8 | 16.8 | 18 | 78 | 20 | 9.8 | 472 |
| | 9 | 18.2 | 20 | 98 | 20 | 10.9 | 462 |
| | 10 | 19.7 | 21 | 118 | 20 | 11.8 | 452 |
| | 11 | 20.9 | 23 | 138 | 20 | 12.5 | 442 |
| | 12 | 22.0 | 24 | 158 | 16 | 13.2 | 432 |
| | 13 | – | – | 174 | 12 | 13.4 | – |
| | 14 | – | – | 186 | 11 | 13.3 | – |
| | 15 | – | – | 197 | 8 | 13.1 | – |
| II | 7 | 14.8 | 15 | 41 | 15 | 5.9 | 395 |
| | 8 | 16.4 | 17 | 55 | 15 | 6.0 | 393 |
| | 9 | 17.7 | 18 | 70 | 15 | 7.8 | 391 |
| | 10 | 19.0 | 20 | 85 | 15 | 8.5 | 387 |
| | 11 | 20.1 | 21 | 100 | 15 | 9.1 | 387 |
| | 12 | 21.0 | 22 | 115 | 11 | 9.6 | 385 |
| | 13 | – | – | 126 | 10 | 9.7 | – |
| | 14 | – | – | 136 | 8 | 9.7 | – |
| | 15 | – | – | 144 | 6 | 9.6 | – |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| III | 7 | 14.5 | 14 | 31 | 11 | 4.4 | 337 |
| | 8 | 16.0 | 16 | 42 | 11 | 5.2 | 337 |
| | 9 | 17.3 | 17 | 53 | 12 | 5.9 | 337 |
| | 10 | 18.3 | 18 | 65 | 11 | 5.5 | 337 |
| | 11 | 19.2 | 19 | 76 | 11 | 6.9 | 337 |
| | 12 | 20.0 | 20 | 87 | 10 | 7.3 | 337 |
| | 13 | – | – | 97 | 8 | 7.5 | – |
| | 14 | – | – | 105 | 7 | 7.5 | – |
| | 15 | – | – | 112 | 6 | 7.5 | – |
| IV | 7 | 14.3 | 13 | 23 | 7 | 3.3 | 268 |
| | 8 | 15.6 | 15 | 30 | 7 | 4.0 | 268 |
| | 9 | 16.8 | 16 | 37 | 7 | 4.1 | 268 |
| | 10 | 17.6 | 17 | 44 | 8 | 4.4 | 268 |
| | 11 | 18.3 | 18 | 52 | 8 | 4.7 | 268 |
| | 12 | 18.9 | 19 | 60 | 7 | 5.0 | 268 |
| | 13 | – | – | 67 | 6 | 5.2 | – |
| | 14 | – | – | 73 | 5 | 5.2 | – |
| | 15 | – | – | 78 | 4 | 5.2 | – |
| V | 7 | 14.0 | 12 | 17 | 5 | 2.4 | 224 |
| | 8 | 15.2 | 14 | 22 | 5 | 2.8 | 224 |
| | 9 | 16.3 | 15 | 27 | 5 | 3.0 | 224 |
| | 10 | 16.9 | 16 | 32 | 5 | 3.2 | 224 |
| | 11 | 17.5 | 17 | 37 | 5 | 3.4 | 224 |
| | 12 | 17.9 | 18 | 42 | 5 | 3.5 | 224 |
| | 13 | – | – | 47 | 5 | 3.6 | – |
| | 14 | – | – | 53 | 5 | 3.8 | – |
| | 15 | – | – | 58 | 4 | 3.9 | |

*Tabla 2. — Producción durante el segundo turno*

| Calidad del Sitio | Edad | DAP Medio cm | Altura Media m | Vol. por hect. $m^3$ | Crec. $m^3$ | Crec. Anual Medio/hect. $m^3$ | Arboles por Hect. |
|---|---|---|---|---|---|---|---|
| I | 3 | 9.2 | 11 | 4 | 3.3 | 1.3 | 136 |
| | 4 | 9.7 | 12 | 18 | 14 | 4.5 | 507 |
| | 5 | 10.2 | 13 | 33 | 15 | 6.6 | 775 |
| | 6 | 11.1 | 13 | 48 | 15 | 8.0 | 825 |
| | 7 | 13.5 | 17 | 63 | 15 | 9.0 | 648 |
| | 8 | 15.2 | 21 | 78 | 15 | 9.8 | 510 |
| II | 3 | 8.9 | 10 | 3 | 2.4 | 1.0 | 119 |
| | 4 | 9.3 | 11 | 14 | 11 | 3.5 | 468 |
| | 5 | 9.7 | 12 | 25 | 11 | 5.0 | 704 |
| | 6 | 10.6 | 14 | 37 | 12 | 6.2 | 751 |
| | 7 | 12.5 | 16 | 49 | 12 | 7.0 | 623 |
| | 8 | 14.0 | 19 | 61 | 12 | 7.6 | 521 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| III | 3 | 8.6 | 10 | 2 | 1.6 | 0.7 | 85 |
| | 4 | 8.9 | 11 | 10 | 8 | 2.5 | 361 |
| | 5 | 9.3 | 12 | 18 | 8 | 3.6 | 552 |
| | 6 | 10.0 | 13 | 26 | 8 | 4.7 | 633 |
| | 7 | 11.5 | 15 | 35 | 9 | 5.0 | 561 |
| | 8 | 12.7 | 17 | 44 | 9 | 5.5 | 509 |
| IV | 3 | 8.3 | 9 | 1.5 | 1.2 | 0.5 | 77 |
| | 4 | 8.5 | 10 | 6 | 4.5 | 1.5 | 263 |
| | 5 | 9.0 | 11 | 10 | 4 | 2.0 | 355 |
| | 6 | 9.5 | 12 | 15 | 5 | 2.5 | 440 |
| | 7 | 10.5 | 13 | 20 | 5 | 2.9 | 447 |
| | 8 | 11.4 | 15 | 26 | 6 | 3.2 | 421 |
| V | 3 | 8.0 | 8 | 1 | 0.9 | 0.3 | 62 |
| | 4 | 8.2 | 9 | 2 | 1.0 | 0.5 | 105 |
| | 5 | 8.7 | 10 | 3 | 1 | 0.6 | 125 |
| | 6 | 9.0 | 11 | 5 | 2 | 0.8 | 177 |
| | 7 | 9.4 | 12 | 7 | 2 | 1.0 | 208 |
| | 8 | 10.1 | 13 | 9 | 2 | 1.1 | 216 |

Estos números se han obtenido por mediciones de 102 líneas experimentales durante los años 1932-1947. El número de árboles de las calidades I y II del primer turno disminuye como consecuencia de la entresaca de árboles perdidos por sequía, vientos y heladas. En las calidades III, IV y V el número queda constante porque las pérdidas ocurren más temprano y sin aprovechamiento posible. En el segundo turno aumenta el número de fustes como consecuencia del hecho que un número cada vez mayor de fustes llegan al diámetro mínimo de 7 centímetros.

Estas tablas de producción tienen solamente un valor local y representan un promedio general de las plantaciones de esta región. En la práctica, el tiempo, la frecuencia de las labores de conservación y las podas pueden causar variaciones que son mucho más importantes que con especies de crecimiento más lento. Las variaciones del crecimiento con estas circunstancias se pueden apreciar de manera global en la Tabla 3.

*Tabla 3. — Crecimiento de* E. globulus *en relación con precipitación y tratamiento*

| Año | Area Hect. | Crecimiento Corriente Por Hect. $m^3$ | Precipitación Anual mm. | Preparación del Terreno | Podas |
|---|---|---|---|---|---|
| 1940 | 2649 | 5.75 | 679 | normal | normales |
| 1941 | 2825 | 6.80 | 776 | " | " |
| 1942 | 2967 | 6.84 | 853 | insuficiente | intensas |
| 1943 | 3022 | 7.02 | 540 | " | " |
| 1944 | 3022 | 7.10 | 362 | " | " |
| 1945 | 3022 | 6.07 | $+350$ | " | " |
| 1946 | 2965 | 3.48 | $\mp 500$ | " | " |
| 1947 | 2965 | 3.58 | $\mp 700$ | " | " |
| 1948 | 2965 | 2.96 | $\mp 600$ | " | " |

En los años 1946-1948 se observan las consecuencias de los años secos de 1943-1946 y las labores insuficientes.. Los efectos de la poda en el caso de una poda normal son minimales. En el caso de una poda intensa se puede observar algunas diferencias durante medio año después de la poda, pero el crecimiento rápido de la copa restablece el crecimiento en poco tiempo. La poda de un rodal de eucaliptos se puede comparar con la entresaca en rodales de otras especies, disminuye algo el consumo de la humedad del suelo por la disminución del volumen total de las hojas y así se puede tal vez salvar algunos árboles que de otra forma se hubiesen secado en la temporada seca.

Otro efecto de los años secos y de las labores insuficientes es la disminución del peso específico de la madera. Así el rendimiento del carbón por metro cúbico de madera en los años 1940-1945 era 140 kilogramos y en los años 1945-1948 solamente 90 kilogramos. Un estéreo de leña seca pesaba 600 kilogramos en las orillas de los arroyos y 450 kilogramos en el terreno más alto y seco.

En las tablas locales de Almonte es también notable el hecho que el número mayor de árboles por hectárea, o sea la mayor densidad, se encuentra en las calidades mejores, mientras las calidades inferiores tienen un número menos de árboles por hectárea. Esto es contrario a otras tablas de producción existentes y demuestra en mi opinión que el bosque de eucalipto en Almonte tiene caracteres de "bosque de sábana" de las zonas climáticas semi-áridas. Las plantas se sembraron a distancias de 4 x 4 metros y así resultaron 625 árboles por hectárea. Después del replante de las fallas siempre quedan algunas pérdidas en el orden de 5 a 15%. Estas pérdidas continuaron en los años sucesivos, especialmente cada fin de verano, hasta el momento en que la densidad del bosque llegaba a una cierta estabilidad.

El número de árboles por hectárea es también variable dentro de amplios límites como demuestra la siguiente relación:

| | | | | |
|---|---|---|---|---|
| 1a | Calidad | 300 a 525 | Promedio | 432 |
| 2a | ” | 225 a 525 | ” | 385 |
| 3a | ” | 200 a 500 | ” | 337 |
| 4a | ” | 200 a 500 | ” | 268 |
| 5a | ” | 200 a 475 | ” | 224 |

Existen bosques que con solo 300 árboles por hectárea, o sea con fallas de más de 50%, pueden todavía llegar a pertenecer a la primera calidad de producción. Durante toda la vida del bosque y especialmente en ocasión de las cortas se siguen perdiendo árboles porque siempre hay un porcentaje de árboles cortados que no brotan. Aunque siempre es preferible un mayor número de árboles por hectárea, estas pérdidas no son tan graves como parecen a primera vista. Esto se puede demostrar con el siguiente ejemplo de un bosque de 3 hectáreas plantado en 1903, cortado por primera vez en 1927 y medido en 1941. Este bosque tenía 177 árboles por hectárea, que representa una pérdida del 71% del número original de plantas. El número de fustes era 730 (4 por cada planta como promedio), el diámetro medio 25 centímetros, la altura media 28 metros y el volumen 409 metros cúbicos por hectárea. En varios claros de este bosque se encontraron ejemplares de *Pinus pinea* nacidos espontáneamente.

La influencia de la sequía, calor y del frío sobre el crecimiento del *Eucalyptus globulus* se puede ver en la siguiente relación del área basimétrica medida a una altura de 1.30 metros incluyendo 30 árboles escogidos medidos el día 15 de cada mes:

*Tabla 4. — Crecimiento de* E. globulus *en relación con la precipitación y la temperatura*

| Mes | Area Basimétrica de 30 Arboles $m^2$ | Aumento $cm^2$ | Precipitación del mes mm. | Temperatura media del mes ºC |
|---|---|---|---|---|
| Nov. '38 | -- | -- | 22 | 15.8 |
| Dic. '38 | 1.5775 | -- | 123 | 10.8 |
| Enero '39 | 1.5884 | 79 | 58 | 11.3 |
| Feb. '39 | 1.6045 | 191 | 67 | 11.2 |
| Marzo | 1.6429 | 384 | 36 | 12.6 |
| Abril | 1.6745 | 316 | 65 | 14.0 |
| Mayo | 1.7136 | 391 | 16 | 17.5 |
| Junio | 1.7421 | 285 | 56 | 21.2 |
| Julio | 1.7485 | 64 | 0 | 25.6 |
| Agosto | 1.7499 | 14 | 0 | 23.2 |
| Sept. | 1.7842 | 343 | 24 | 21.8 |
| Octubre | 1.8362 | 520 | 370 | 17.7 |
| Noviembre | 1.8818 | 456 | 114 | 13.2 |
| Dic. '39 | 1.8909 | 91 | 253 | 10.3 |
| Enero '40 | 1.9084 | 175 | 189 | 10.9 |
| Feb. '40 | 1.9393 | 309 | 52 | 12.4 |
| Marzo | 1.9505 | 112 | 76 | 15.3 |
| Abril | 1.9959 | 454 | 30 | 15.8 |
| Mayo | 2.0228 | 269 | 24 | 17.4 |
| Junio | 2.0421 | 193 | 4 | 20.3 |
| Julio | 2.0540 | 119 | 0 | 23.3 |
| Agosto | 2.0902 | 362 | 1 | 24.9 |
| Sept. | 2.0810 | - 92 | 88 | 21.3 |
| Octubre | 2.1292 | 482 | 132 | 16.1 |
| Nov. '40 | 2.1655 | 363 | - | - |

Se nota una disminución del crecimiento en diciembre y enero por el frío y otra en julio y agosto por la sequía. En el año 1940 después de un invierno muy húmedo la disminución apenas es notable. La temperatura influye también en forma indirecta por su efecto sobre la evaporación; así algunas fuentes secas en agosto empiezan a dar agua en septiembre antes de las lluvias.

Para ver si podían encontrarse especies más resistentes a la sequía y al frío o especies de crecimiento mayor se hicieron experimentos con otras especies. En el arboretum de Almonte se experimentó con 172 especies, la mayor parte eucaliptos, pinos y acacias. Luego se plantaron pequeños rodales de algunas de las mejores especies.

Las siguientes especies se distinguieron: *Eucalyptus botryoides.* — Crecimiento igual al del *E. globulus* y además tiene la ventaja de ser más resistente en terrenos menos profundos y sueltos. No produce aceite esencial como el *E. globulus.*

*Eucalyptus viminalis.* — Crecimiento igual o superior al *E. globulus*, y más resistentes a las heladas. No produce aceite esencial.

*Eucalyptus macarthuri.* — Crecimiento mayor que el *E. globulus* y resistente a las heladas y a la sequía. Recomendado en la literatura para terrenos difíciles.

*Eucalyptus saligna.* — Crecimiento algo inferior al *E. globulus*, pero produce fustes muy derechos. Sensible a las heladas y a la sequía.

*Eucalyptus nitens.* — Crecimiento bueno.

*Eucalyptus robusta.* — Crecimiento bueno a las orillas de los arroyos, en terrenos inferiores.

*Eucalyptus camaldulensis.* — Crecimiento en terreno fresco y compacto 25 metros cúbicos por año por hectárea. Donde falta la frescura del suelo el crecimiento es mucho más inferior al del *E. globulus*.

*Eucalyptus maideni.* — Crecimiento y aspecto casi igual al *E. globulus*. Esta especie tal vez puede producir más aceite esencial que el *E. globulus*.

*Eucalyptus melliodora.* — Crecimiento lento, buena salud, muy resistente a la sequía.

*Eucalyptus algeriensis.* — Crecimiento aún mayor que *E. camaldulensis* en terrenos frescos. Carácter y aspecto muy similar al *E. camaldulensis*.

*Eucalyptus hemiphloia.* — Crecimiento bueno.

*Eucalyptus rudis.* — Crecimiento algo inferior al *E. camaldulensis* en terrenos frescos. En el carácter se parece mucho al *E. camaldulensis*.

*Eucalyptus rubida.* — Crecimiento bueno.

*Eucalyptus acmenioides.* — Crecimiento bueno.

En la Tabla 5 se presenta una comparación del crecimiento de *E. globulus* con varias especies plantadas en pequeños rodales.

*Tabla 5. — Comparación de crecimiento de varias especies de Eucalyptus*

| Especie | Terreno | Indice |
|---|---|---|
| *Eucalyptus globulus* | — | 100 |
| *E. robusta* | insuficiente frescura | 57 |
| *E. camaldulensis* | " " | 59 y 62 |
| *E. camaldulensis* | fresco | 113 |
| *E. botryoides* | alguna frescura | 90 y 141 |
| *E. maideni* | normal (falda freática 4 metros) | 103 y 117 |
| *E. hemiphloia* | normal | 121 |
| *E. macarthuri* | normal | 194 |
| *E. saligna* | normal | 87 |
| *E. rudis* | fresco | 81 |

De estos crecimientos no se pueden sacar conclusiones definitivas para plantaciones extensas. En los rodales pequeños es muy frecuente la extensión de las raíces hasta grandes distancias fuera del rodal, y también es probable que la plantación se hizo en terreno de fertilidad superior al promedio del *Eucalyptus globulus*. Sin embargo parece probable, que en terrenos algo difíciles pero frescos se deben preferir *E. camaldulensis*, *E. algeriensis*, *E. botryoides* y *E. macarthuri* y tal vez en terreno normal también *E. macarthuri*, *E. botryoides*, *E. hemiphloia* o *E. maideni*.

## PLANTACIONES DE MINAS DE RIO TINTO

Las plantaciones de Eucalyptus en esta zona son nuevas en comparación con las de Almonte.

### Ambiente

La mayor parte del terreno está compuesta de pizarras, mientras que en lugares aislados ocurren pórfidos y diabasas. El terreno es quebrado con laderas hasta 45° y más. Los lugares frescos, aptos para la plantación de eucaliptos se encuentran en las laderas norte y en los valles y pequeñas llanuras, siempre y cuando el terreno tenga suficiente profundidad.

La vegetación natural consiste de *Quercus ilex* L., *Quercus suber* L., *Pistacia terebinthus* L., *Erica australis* L., *Erica arborea* L., *Phillyrea angustifolia* L., *Viburnum tinus* L., *Cistus ladaniferus* L., *Cistus salviaefolius* L., *Cistus monspeliensis L.*, (en pórfidos), *Lavendula pedunculata* Cav., *Rosmarinos officinalis* L.

Los datos sobre el clima consisten de temperatura media 18°C., precipitación media anual de 716 mm. durante 1887-1936, 770 mm. durante 1937-1946, y 812 mm. durante 1946-1953. El aumento de la precipitación es a consecuencia de la aforestación de 3500 hectáreas con *Pinus pinea* y con *Pinus pinaster* en 1914 y 1915. Mínimo absoluto de la temperatura es -3°C., mientras que en los valles y laderas al norte deben ocurrir temperaturas hasta -10°C., máximo absoluto es 43°C.

### Preparación del Terreno

Después de algunos experimentos con otros métodos, se demostró que la mejor preparación consiste del arranque de todos los arbustos, amontonamiento de los arbustos arrancados en hileras horizontales para evitar la erosión de las laderas y la preparación de hoyos de 50 x 50 x 50 centímetros de tamaño a distancias de 3 x 3 metros.

### Plantaciones

Se usaron plantas de almácigas con raíz desnuda para evitar los costos elevados que causa el transporte de las plantas en macetas en terreno montañoso. A pesar de los buenos resultados obtenidos en muchas ocasiones usando plantas a raíz desnuda, más tarde se usaron plantas criadas en macetas de barro, debido a la necesidad frecuente de efectuar resiembras cuando el tiempo seco causó pérdidas elevadas entre las plantas a raíz desnuda.

Donde las laderas lo permitieron se labró el terreno con arado durante varios años. En muchos lugares no fué posible entrar con arado y aquí fué necesario repetir el arranque de los arbustos cada dos años. En los pocos lugares donde existía vegetación abundante de *Quercus coccifera o Myrtus communis* era casi imposible la exterminación de los arbustos por la cantidad de raíces que brotan después del arranque.

La preparación del suelo es sumamente importante en este clima relativamente seco. Un suelo labrado evita la competencia de los arbustos y hierbas y conserva la humedad. Esto se puede ver demostrado, cuando se labra un terreno parcialmente y después de uno o dos meses se labra nuevamente en dirección contraria. Todas las fajas labradas con anterioridad tienen humedad mientras las fajas no aradas son secas. Una tierra suelta tiene también mejor ventilación, calefacción y desarrollo de las bacterias y luego recoge mejor el agua de la lluvia. Lo ideal sería una labor con grada de discos después de cada lluvia para evitar la formación de una costra en la superficie.

Estas medidas de cultivo y el arranque de los arbustos sobre todo son operaciones costosas y por lo tanto es deseable estudiar la posibilidad que ofrecen otras soluciones. Las siguientes pueden ser soluciones posibles:

1. La plantación o la siembra de otras especies forestales entre los eucaliptos, para obtener una densidad mayor, es difícil de formar. Con este fin se hicieron experimentos con *Acacia longifolia*, *Pinus pinea*, *Pinus pinaster*, *Quercus lusitanica* y *Quercus suber*.

Los mejores resultados se han obtenido con *Quercus lusitanica* y *Quercus suber*, dos especies espontáneas de la región. Se formaron buenos rodales con un piso superior de eucaliptos y un piso inferior de *Quercus*. El *Pinus pinaster* no crece bien entre los eucaliptos, mientras que con *Acacia longifolia* y *Pinus pinea* no se conocen aún los resultados. Entre las acacias tal vez sería preferible escoger las especies, que corresponden a los tipos climáticos homólogos de Australia, en nuestro caso la *Acacia pycnantha*. En zonas de clima más húmedo tal vez no será posible llevar un piso inferior porque los eucaliptos dejarán insuficiente luz.

2. Exterminación de los arbustos y de las hierbas, que invaden el eucaliptal por medio de productos químicos como 2,4,5T; 2,4D o M.C.P.A. Los primeros experimentos con estos productos resultaron demasiado caros, comparados con la exterminación a mano. Sin embargo es muy posible que otros métodos de reparto con máquinas motorizadas o variaciones en las substancias humedificantes de los productos pueden dar resultados satisfactorios. En Suecia estos productos son usados en gran escala para eliminar las plantas dañinas para los rodales de abeto rojo, como son el chopo y el abedul.

3. Elección al arrancar los arbustos. Es probable que entre los arbustos que crecen espontáneos en el bosque se encuentren algunas especies menos dañinas, por ejemplo los arbustos de pequeñas dimensiones u otras de raíces profundas. Se pueden dejar crecer estos arbustos o plantas mientras se arrancan los más dañinos. No se han hecho experimentos con este método pero vale la pena probarlo.

**Rendimiento**

Algunos rodales plantados en los años 1929 y 1930 corresponden a la primera calidad de la tabla de producción de Almonte y se puede estimar un crecimiento medio anual de 13 metros cúbicos por año por hectárea. Otros rodales de esta edad eran muy inferiores y se pueden estimar en un crecimiento medio anual de 1 o 2 metros cúbicos por año por hectárea. Después del estudio de estas plantaciones viejas se decidió solamente proceder a la repoblación forestal de terrenos escogidos.

Para el presupuesto se estimó el crecimiento medio en 4 metros cúbicos por año por hectárea. Después de alguna experiencia se aumentó esta estimación a 5 metros cúbicos con la condición de efectuar limpiezas frecuentes de la maleza y la hierba.

No se dispone aún de números suficientes sobre la producción de madera. Algunas mediciones en las plantaciones de antes del 1950 han indicado que los mejores rodales corresponden aproximadamente a la primera calidad de la tabla de Almonte mientras otras corresponden a las calidades 4 y 5 de esta tabla. Esto depende también de la diferencia de especies, porque generalmente en Minas de Río Tinto se plantó primero el *E. globulus* y luego fueron replantadas las fallas con *E. camaldulensis*, *E. botryoides*, *E. rudis* y *E. tereticornis*. Estas especies tienen en el principio un crecimiento más lento. Se puede temer que en varios casos también tendrán un crecimiento lento más tarde, cuando llegan a una edad mayor, porque las parcelas de *E. camaldulensis* plantadas en 1939 tenían en 1954 a la edad de 25 años volumenes de solo 25 a 50 metros cúbicos por hectárea.

Las especies más resistentes en suelos pobres de poca profundidad y en los terrenos de gran frescura al lado de los arroyos son: *E. camaldulensis*, *E. rudis*, *E. tereticornis* y *E. botryoides*. Las especies más resistentes a las heladas en laderas norte son: *E viminalis* y *E. maideni*. Las más resistentes a la sequia son: *E. sideroxylon*, *E. melliodora*. Estas especies tienen buena salud, pero un crecimiento muy lento.

### PLANTACIONES EN EL SALVADOR, AMERICA CENTRAL

Las plantaciones experimentales en El Salvador no son extensas pero los datos reunidos son suficientes para una orientación.

#### Ambiente

La precipitación anual en la mayor parte del país es entre 1600 y 2000 milímetros, la temperatura media anual entre 27°C. al nivel del mar hasta 15°C. a 2000 metros sobre el nivel del mar.

La experiencia con varias especies de eucalypto en esta zona indica que es necesario un terreno de por lo menos una profundidad mediana y no demasiado arcilloso.

#### Plantaciones

Probablemente en zonas tropicales la necesidad de labrar la tierra es más importante aún que en la zona del Mediterráneo. La copa del eucalipto suele dejar pasar mucha luz y así se forma un piso inferior de maleza de arbustos y hierba que compite por la humedad del suelo y frena al crecimiento de los árboles. La pobre sobrevivencia de algunas especies es posiblemente debida a esta causa.

En El Salvador los fustes se suelen limpiar solos y no es necesario la poda. Al contrario sería deseable que las copas fuesen más grandes. No conozco la causa de la pequeñez de las copas pero sospecho que en la larga temporada seca no hay suficiente humedad en la tierra para mantener frondosa toda la copa. Una buena y contínua labor de la tierra tal vez sería el remedio. El inconveniente del monocultivo también existe. Se pueden ensayar mezclas con *Leucaena* u otras especies como subpiso, pero es posible que esto reste crecimiento al eucalypto en la temporada seca en los suelos de poca y mediana profundidad que abundan en El Salvador.

#### Rendimiento

No se deben tener esperanzas exageradas del crecimiento en plantaciones comerciales. Esto es igual de cierto que en la zona del Mediterráneo. El crecimiento en zonas tropicales será mayor, pero si se calcula un crecimiento de 82 metros cúbicos por hectárea por año para 15 ejemplares de *E. kirtoniana* en un camino, no se puede calcular con más de 20 a 25 metros para plantaciones comerciales en tierras de mediana calidad. Los turnos pueden ser bastante más cortos que en el Mediterráneo. Posiblemente se alcanzan buenas producciones con turnos de 5 a 10 años.

A continuación se indican especies notables en El Salvador:

*Eucalyptus kirtoniana.* — Se han plantado algunos ejemplares en 1956 en un lado de un camino en la Estación Experimental de San Andrés. La edad es ahora 4 años. El espaciamiento es de 3 metros. La sobrevivencia es 90%. Los diámetros van de 15 centímetros hasta 31 centímetros. La altura es 18 metros. Si con estos datos se calcula un volumen por hectárea y un crecimiento medio anual se obtienen números demasiado favorables para cálculos de plantaciones comerciales, ya que los árboles tienen espacio libre a ambos lados. Así el volumen de 330 metros cúbicos por hectárea y el crecimiento medio anual de 82 metros cúbicos solamente indican una posibilidad de alta producción, pero en plantaciones comerciales no se puede contar con más de 20 a 25 metros cúbicos de crecimiento en tierras de profundidad mediana.

*E. citriodora.* — Es de crecimiento parecido y además tiene fustes muy derechos. Existen solamente ejemplares aislados.

*E. saligna.* — También crece muy bien en plantaciones de caminos.

*E. alba.* — También es de crecimiento bueno, aunque la forma del fuste es algo inferior sin llegar a ser mala.

*E. tereticornis.* — Una pequeña plantación tiene 5 años, un espaciamiento de 3 metros, una sobrevivencia de 100%. Los fustes tienen mala forma y brotes adventicios. Los diámetros son de 7 a 18 centímetros y la altura 14 metros.

*E. eximia.* — Una pequeña plantación tiene 5 años, un espaciamiento de 3 metros, una sobrevivencia de 15%. Los fustes son bien formados y las copas saludables. Hay flujo de savia por rajaduras en la corteza. Los diámetros son 18 a 25 centímetros y la altura 17 metros.

*E. siderophloia.* — Una pequeña plantación tiene 5 años, un espaciamiento de 3 metros y una sobrevivencia de 80%. Los diámetros son de 18 a 26 centímetros y la altura 19 metros.

*E. robusta.* — Una pequeña plantación tiene 5 años, un espaciamiento de 3 metros y una sobrevivencia de 50%. Los diámetros son de 11 a 13 centímetros y la altura 9 metros.

*E. macrorrhyncha.* — La edad es de 5 años, el espaciamiento 3 metros y la sobrevivencia 75%. Los diámetros son de 15 a 21 centímetros y la altura 28 metros.

Hay varias otras especies de eucalipto cuyo crecimiento es inferior y cuyos nombres se han perdido. Se puede sacar la conclusión que las especies prometedoras son *E. kirtoniana, E. citriodora, E. saligna* y *E. siderophloia.* Hay que tener en cuenta que el terreno para todas estas especies es fértil, de buena profundidad y frescura.

Si consideramos el clima de El Salvador, con una precipitación anual de 1600 a 2000 milímetros en la mayor parte del país, una temperatura media anual de 27°C. al nivel del mar, 21°C. a 1000 metros de elevación y 15°C. a 2000 metros de elevación, y un período seco de 5 a 7 meses, podemos elegir teóricamente las especies de eucalipto que se adaptan a cada una de las tres zonas.

*Especies de zonas tropicales.* — Con un promedio anual de 25°C. temperatura son solamente las siguientes especies: *E. alba,* es original de las Islas Flores y Timos en Indonesia en elevaciones inferiores y medianas; *E. naudiniana* = *E. deglupta,* original de Filipinas (Mindanao), Indonesia (Celebes, Molucas), Nueva Britania, Nueva Irlanda y probablemente Nueva Guinea, en elevaciones de 0 a 1000 metros, crecimiento en ensayos en Indonesia 34 metros cúbicos por año por hectárea. *E. decaisneana,* es original de Malaya e Indonesia, en elevaciones de 500 metros en adelante. *E.kirtoniana,* desconozco el origen, pero por su buen crecimiento en una elevación de 400 metros en El Salvador, hay que suponer que es también una especie de zonas tropicales, *E. kirtoniana* = *E. patentinervis.*

*Especies de zonas subtropicales.* — En Australia con temperaturas de invierno de 10/15°C. y de verano de 25/28°C. o un promedio de 20°C. aproximadamente se adaptarán a una zona subtropical de 800 a 1600 metros más o menos. Son casi todas originales de Queensland, Australia como *E. paniculata, E. grandis, E. saligna, E. acmenioides, E. citriodora, E. siderophloia* y *E. maculata.* Varias de estas especies como *E. saligna, E. citriodora* y *E. siderophloia* han dado ya buen resultado en El Salvador en elevaciones de unos 400 metros en tierras buenas .

*Especies de zonas frías.* — En lugares de alrededor de 2000 metros de elevación con 15°C. temperatura media anual, que en El Salvador son relativamente escasas, entran en consideración todas las especies importantes que crecen también en la zona del Mediterráneo y originales de Tasmania, Victoria y N. S. Wales en Australia como *E. globulus, E. camaldulensis, E. botryoides, E. viminalis* y *E. maideni.*

## CONCLUSIONES

La experiencia de Almonte y de Minas de Río Tinto sirve como base para las siguientes conclusiones:

La diferencia entre el estudio preliminar basado en mediciones de rodales pequeños y la práctica de plantaciones extensas es siempre grande. Los rodales pequeños se encuentran casi siempre en lugares de excelente fertilidad y con frecuencia pueden extender sus raíces a grandes distancias fuera del rodal y también la conservación es más intensa. En plantaciones extensas no es posible escoger los terrenos con muchos escrúpulos porque así se haría una plantación dividida en pequeñas parcelas y figuras poco prácticas. Normalmente se dejan atrás los lugares muy pobres con arena suelta o agua estancada y suelo duro, pero aún así el promedio de la fertilidad permanece muy inferior a la fertilidad de suelos en rodales pequeños.

Las observaciones del crecimiento medio de la Tabla de Almonte podría llevar a la conclusión que el turno de máxima producción sería 14 o 15 años y el turno financiero quizás 12 años. Sin embargo es necesario tener precaución con tales conclusiones porque la disminución después de 15 años pudiera ser causada por años secos o por labor insuficiente y no por el propio carácter del eucalipto en este clima. Para un cálculo exacto del turno se necesitaría un período de observación más largo.

Cuando tratamos de averiguar cual es el tipo de vegetación normal correspondiente a la temperatura y la precipitación anual, encontramos como normal un "bosque de sábana". En estas circunstancias sería equivocado esperar un número elevado de árboles por hectárea y un crecimiento de la cantidad de 20 a 30 metros cúbicos por año por hectárea. Estos crecimientos pueden ocurrir localmente en sitios frescos, pero una plantación de eucalipto de gran extensión provoca ciertamente un descenso de la falda freática y escasez de agua especialmente en los largos períodos de sequía.

Con medidas de conservación como la labor del suelo y la poda de los árboles se pueden obtener mejoras notables de las condiciones generales, pero en mi opinión habría que repetir estas operaciones durante toda la vida de la plantación y no solamente en los primeros años.

En las zonas climáticas y en los suelos similares de otros países, se pueden esperar más o menos los mismos crecimientos. Las conclusiones de España tienen valor también para otros lugares del Mundo, especialmente en los países mediterráneos. Algunas comparaciones se han reunido en la Tabla 6.

*Tabla 6. — Comparación de temperatura y precipitación en varios lugares*

| Lugar | Temperatura media anual | Precipitación media anual |
|---|---|---|
| Almonte, Suroeste de España llanura | 16.9°C. | 658 mm. |
| Minas de Río Tinto, Suroeste de España, montaña | 18.0°C. | 770 mm. |
| Pontevedra Noroeste de España | 13.9°C. | 1397 mm. |
| Salamanca, Interior de España | 12.3°C. | 284 mm. |
| Alicante, Este de España | 17.8°C. | 440 mm. |
| Albury, Interior de Australia | 17.0°C. | 500 - 750 mm. |
| Manfredonia, Italia | - | 400 mm. |

Por regla general las zonas climáticas de Australia, donde crecen los eucaliptos más importantes como el *Eucalyptus globulus* (Tasmania), *Eucalyptus viminalis* (Tasmania, Queensland, N.S. Wales, Victoria), *E. maideni, E. botryoides, E. marginata, E. resinifera, E. macarthuri, E. maculata* Hook, *E. regnans, E. saligna, E. gigantea*, etc. son de temperatura media más baja que en los países del Mediterráneo y muchas veces con mayor cantidad de lluvia.

En la región australiana de Albury, donde existe un clima homólogo con el clima de Almonte se encuentran: *E. sideroxylon, E. melliodora, E. hemiphloia, E. macrocarpa, E. albens, E. bridgesiana* y *E. camaldulensis* en las orillas de ríos y arroyos. En los terrenos pobres crece el *Callitris glauca*, especie comparable con el *Pinus pinea* del Mediterráneo.

En El Salvador no se reunen las condiciones para el cultivo exitoso de plantaciones comerciales de eucalipto. Las especies más prometedoras son *E. kirtoniana, E. citriodora, E. saligna* y *E. siderophloia*. Hay que tomar en cuenta que estas especies necesitan terreno fértil de buena profundidad.

No hay grandes extensiones de tierras de mediana fertilidad y hay todavía abundancia en el mercado de otras maderas de mejor calidad. En el resto de Centro América es aún posible, que se encuentren terrenos adecuados pero solo grandes minas o industrias pueden aprovechar la producción. En casos especiales como en provincias pobres en madera y densamente pobladas el eucalipto puede suministrar en poco tiempo palos de construcción para casas de campesinos. El Instituto de Colonización Rural de El Salvador probablemente plantará en los próximos años unas 25 a 50 hectáreas de eucaliptos en su finca Metalío cerca de Acajutla.

**RESUMEN**

Recapitulando se pueden dar las siguientes reglas generales para el cultivo del *Eucalyptus* en zonas secas:

1. Primera condición para el éxito es la elección de terrenos de suficiente frescura y fertilidad.

2. Las labores con grada o arado son muy beneficiosas y casi siempre necesarias

3. En bosques de llanura la poda sin exageración es beneficiosa. En montaña las podas provocan un crecimiento mayor de los arbustos dañinos.

4. Turnos de 15 a 25 años y en los terrenos favorables de 10 a 15 años son probablemente los mejores y más ventajosos.

5. No se deben tener esperanzas exageradas del crecimiento en grandes extensiones. Esto puede dar lugar a graves errores en el caso del aprovechamiento industrial y también para las contribuciones territoriales rústicas.

6. Un punto débil en el cultivo del eucalipto será siempre la tendencia del suelo a empobrecer por el monocultivo y el aprovechamiento intensivo en algunos casos inclusive las hojas. El cambio de especie después de 3 o 4 cortas y la mezcla con especies de *Quercus*, *Acacia* etc. pueden ser posibles soluciones. También se puede pensar en abonos.

# Service Life of Some Puerto Rican Post Species Tested With Ten Percent Pentachlorophenol by Cold Soaking

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Preservative treatment of posts by cold soaking in pentachlorophenol was first undertaken experimentally in Puerto Rico in 1951. This study originally contemplated the determination of the depth and mechanics of penetration of the preservative into the wood of 65 common species. Before completion, however, the size of the study was reduced, and the extra posts appeared adequate for a preliminary service test. This report describes the condition of the posts after 8 years of exposure.

The study included 263 posts 2 to 4 inches in diameter by 4 feet in length, and representing 57 species. The number of posts per species varied from one to ten, with no controls. The posts were peeled and dried about a year before treatment. Treatment was by immersion for 120 hours in a 10 percent solution of pentachlorophenol in Diesel oil at about 75°F.

The long period of seasoning of these posts before treatment may have resulted in unusually high retention of the preservative and subsequent service life. The posts were not only drier than would be normal under commercial practice, but many of them were perforated by powderpost beetles. Particularly susceptible to insect attack were *Albizia lebbek, Inga laurina, I. vera, Laguncularia racemosa, Andira inermis, Leucaena glauca,* and *Ficus laevigata.*

Two exposure sites were selected. In the Cambalache Experimental Forest, at sea level, the mean temperature is about 78°F. and the precipitation averages 60 inches annually. Soil is sandy and well drained. In the Toro Negro Forest, at 2700 feet elevation, the mean temperature is about 70° F. and the precipitation averages about 110 inches annually. The soil is a heavy clay which is frequently saturated. Posts were tested on the site closest to the habitat of the trees. A few generally distributed species were set at both sites. The posts were treated in late 1951 and set at Toro Negro in February 1952 and at Cambalache two months later.

The condition of these posts 8 years after setting is described in Tables 1 and 2. In these tables species with less than three posts have been omitted. The species are listed in apparent ascending order of service life. The expected service life of species still serviceable has been estimated from the normality curves developed by MacLean[1]. Decay was responsible for all of the failures and most of the deterioration. Two posts at Cambalache had slight termite attack along with decay.

The service life of these posts probably varies with three interrelated factors: The inherent durability of the wood, the proportion of heartwood, and the amount of preservative retained. The first two of these

1/MacLean, J.D. 1951. Percentage renewals and average life of railing ties. U. S. Forest Products Laboratory. Report No. R886. 7pp factors may not vary greatly. Most post species tested untreated in other studies under these conditions are serviceable for no more than 24 months. Most of these posts had little or no heartwood, although no measurements of this were made.

For seven of the species it was possible to compare results to date at the two sites. Only two of these species have deteriorated sufficiently in both sites to permit estimation of probable service life. For *Cordia sulcata* it is 9.7 years at Cambalache and 10.9 years at Toro Negro. For *Ficus laevigata* it is 10.5 years at both places.

Assuming an average service life untreated, of 2 years, these data indicate that cold soaking for 5 days in 10 percent pentachlorophenol can add from 3 to 10 years to their effective use.

*Table 1. — Condition of fence posts treated with 10 percent pentachlorophenol by cold soaking for 120 hours and exposed for 8 years at Cambalache*

| Species | Estimated service life | Condition at 8 yrs. | | Posts in test | Preservative absorption |
|---|---|---|---|---|---|
| | | Decayed | Unserviceable[1] | | |
| | yr. | % | % | No. | lbs/cu. ft |
| *Sideroxylon foetidissimum* Jacq. | 5.3[2] | | 100 | 3 | 3.8 |
| *Coccoloba diversifolia* Jacq. | 7.7[2] | 33 | 67 | 3 | 2.9 |
| *Bursera simaruba* (L.) Sarg. | 8.5 | 38 | 50 | 8 | 15.1 |
| *Avicennia germinans* (L.) Stearn | 9.0 | 56 | 44 | 9 | 3.4 |
| *Andira inermis* (W. Wright) H.B.K. | 9.1 | 60 | 40 | 5 | 6.2 |
| *Cordia sulcata* DC. | 9.7 | 67 | 33 | 3 | 6.9 |
| *Miconia prasina* (Sw.) DC. | 9.7 | 67 | 33 | 3 | 2.1 |
| *Cassia siamea* Lam. | 9.9 | 70 | 30 | 10 | 4.3 |
| *Chrysophyllum oliviforme* L. | 9.9 | 60 | 10 | 10 | 4.6 |
| *Ficus laevigata* Vahl. | 10.5 | 75 | 25 | 4 | 4.0 |
| *Didymopanax morototoni* (Aubl.) Dec. & Pl. | 10.9 | 80 | 20 | 5 | 8.7 |
| *Tabebuia heterophylla* (DC.) Brit. | 10.9 | 20 | 20 | 5 | 5.0 |
| *Albizia lebbek* (L.) Benth. | 12.1 | 44 | 12 | 9 | 7.3 |
| *Sideroxylon portoricense* Urban | - | 100 | 0 | 3 | 4.6 |
| *Colubrina arborescens* (Mill.) Sarg. | - | 100 | 0 | 3 | 3.5 |
| *Citharexylum fruticosum* L. | - | 100 | 0 | 3 | 1.6 |
| *Inga laurina* (Sw.) Willd. | - | 75 | 0 | 4 | 6.2 |
| *Casearia arborea* (L.C.Rich.) | - | 80 | 0 | 5 | 4.4 |
| *Laguncularia racemosa* (L.) Gartn. | - | 43 | 0 | 7 | 12.2 |
| *Leucaena glauca* (L.) Benth. | - | 80 | 0 | 10 | 8.9 |
| *Guazuma ulmifolia* Lam. | - | 40 | 0 | 10 | 7.9 |

1/ Sound posts not included therefore sum of decayed and unserviceable does not equal 100%.

2/ Actual service life.

*Table 2. — Condition of fence posts treated with 10 percent pentachlorophenol by cold soaking for 120 hours and exposed for 8 years at Toro Negro*

| Species | Estimated service life | Condition at 8 yrs. Decayed | Unservi-ceable | Posts in test | Preservative absorption |
|---|---|---|---|---|---|
| | yr. | % | % | No. | lbs/cu. ft |
| *Ficus laevigata* Vahl. | 10.5 | 50 | 25 | 4 | 5.6 |
| *Cordia sulcata* DC. | 10.9 | 0 | 20 | 5 | 8.0 |
| *Trema micrantha* (L.) Blume | 12.1 | 76 | 12 | 4 | 6.7 |
| *Eucalyptus kirtoniana* F. Muell. | - | 67 | 0 | 3 | 7.2 |
| *Eucalyptus robusta* J. E. Smith | - | 33 | 0 | 3 | 6.5 |
| *Sloanea berteriana* Choisy | - | 0 | 0 | 3 | 7.9 |
| *Didymopanax morototoni* (Aubl.) Dec. & Pl. | - | 50 | 0 | 4 | 9.7 |
| *Calophyllum brasiliense* Camb. | - | 0 | 0 | 4 | 7.0 |
| *Andira inermis* (W.Wright) H.B.K. | - | 100 | 0 | 5 | 5.7 |
| *Inga laurina* (Sw.) Willd. | - | 40 | 0 | 5 | 7.6 |
| *Tabebuia heterophylla* (DC.) Brit. | - | 0 | 0 | 5 | 5.7 |
| *Casearia arborea* (L.C. Rich.) | - | 67 | 0 | 6 | 5.0 |
| *Ormosia krugii* Urban | - | 50 | 0 | 10 | 5.4 |
| *Inga vera* Willd. | - | 30 | 0 | 10 | 3.1 |
| *Micropholis chrysophylloides* Pierre | - | 0 | 0 | 10 | 7.2 |

# The Acidity of Selected Puerto Rican Woods

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Acidity and alkalinity have long been recognized as important factors in practically all branches of research and industrial work. Sugar manufacturers, electroplaters, paper manufacturers, sanitary engineers, agriculturists, bacteriologists, and workers in many other fields have studied the effects of these reaction conditions. They have found that the stability of various materials, the corrosion of metals,[1] the absorption of dyes by fabrics and clays, the growth of various bacteria,[2] and the yield and quality of products in numerous industrial processes all depend on maintaining definite values of acidity or alkalinity.

No research has been done previously to determine the reaction of the woods of Puerto Rico. The purpose of this project was to measure the pH values of some of the more common local woods.

The work was done as a science project while the author was a student at the Robinson High School in Santurce, Puerto Rico.

## EXPERIMENTAL PROCEDURE

The degree of acidity or alkalinity of a solution is expressed by the pH scale. The units on this scale are called pH values. pH is defined as the negative logarithm (to the base 10) of the hydrogen ion concentration. On the pH scale a value of pH 7.0 represents neutrality. A normal solution of a strong acid has a hydrogen ion concentration of 1 so that its pH is O, while a normal solution of strong alkali, having a hydroxyl ion concentration of 1 has a pH value of 14. pH values less than 7 represent acid solution and those greater than 7 represent alkaline solution.

The principle of making pH measurements is based on the fact that various indicators change color when they are acted upon by solutions of different acidities or alkalinities.

In order to make accurate pH determinations it is necessary to employ sensitive indicators with distinct color changes. In this work a series of La Motte[3] pH indicators (5 percent solution) was used (see Table 1). The indicators started at a pH value of 2.6 and range upwards to pH 8.4. Each indicator has a distinct color change over its active pH range. Bromphenol blue, for example, extends from yellow at pH 3.0 through various shades of yellowish green to blue at pH 4.6. This range of pH values was used because wood in general is slightly acid. In using these indicators a measured quantity of the indicator solution is mixed with a measured quantity of the solution to be tested. The color of the indicator is measured by matching against known color standards.[4]

1/ Gray, V.R. 1958. The acidity of wood. Timber Development Assoc. Ltd. London. 14 p., 9 refs. Mimeo. unpub.

2/ Hartley, C., Davidson, R.W., and Crandal, B.S. 1959. Wet-wood, bacteria, and increased pH in trees. Beltsville Forest Disease Lab. 98 refs., Unpub.

3/ La Motte Chemical Products Company. The ABC of pH control. Chestertown, Maryland. 17p.

4/ Clark, W.M.D. 1928 The determination of hydrogen ions, color chart of indicators. William & Wilkins Co. Baltimore. 2 p

*Table 1. — Indications used to determine pH of wood*

| Indicator | pH range | Color change |
|---|---|---|
| La Motte yellow | 2.6 - 4.2 | Red - yellow |
| Bromphenol blue | 3.0 - 4.6 | Yellow - blue |
| Bromcresol green | 3.8 - 5.4 | Yellow - blue |
| Methyl red | 4.4 - 6.0 | Red - yellow |
| Clorphenol red | 5.2 - 6.8 | Yellow - red |
| Bromcresol purple | 5.2 - 6.8 | Yellow - red |
| Brothymol blue | 6.0 - 7.6 | Yellow - red |
| Phenol red | 6.8 - 8.4 | Yellow - red |

A total of 28 species of wood cut 5 years previously, and 7 species freshly cut were used in the study. The former specimens of wood were cut from mature trees, and included either sapwood, heartwood, or both, while the latter 7 specimens were selected from post-sized trees and included sapwood only. The surface of each specimen was sanded lightly to facilitate more accurate readings, and then marked into eight divisions, one division for each pH indicator. The indicator dyes were painted on the wood, and the pH determined after about 15 minutes when each indicator reacted with the wood. Since the indicators overlap in their pH values, it was possible to determine the pH of a wood from two to four separate indicators.

It should be emphasized that the number of specimens of wood of each species tested was inadequate to show more than approximate pH values for each wood.

**RESULTS**

The results of the pH readings of 28 Puerto Rican woods are shown in Table 2. All woods had an acid reaction. Mango *(Mangifera indica* L.) had the lowest pH with a reading of 3.4 and jaguey *(Ficus laevigata* Vahl) the highest with a pH of 5.6. Most woods, however, were in the pH range of 4.4 to 5.0. The pH values for the woods of the 7 post-size trees are shown in Table 3. These specimens were sapwood only. The heartwood of comparable woods had generally a somewhat lower pH than the sapwood.

**CONCLUSIONS**

Both the sapwood and the heartwood of all species examined were acid in reaction. Additional work is needed, however, to determine more fully the differences between sapwood and heartwood, and the pH ranges within a family, genus, or species. The effects of acidity upon wood quality, are not completely known, but pH may possibly be used to determine superior or inferior wood within a species.

*Table 2. — The pH values of 28 Puerto Rican woods cut from mature trees about 5 years previous to study*

| Common name | Scientific name | Sapwood or[1] heartwood | pH value |
|---|---|---|---|
| Mango | *Mangifera indica* L. | sapwood | 3.4 |
| Caracolillo | *Homalium racemosum* Jacq. | heartwood | 4.0 |
| Tabonuco | *Dacryodes excelsa* Vahl. | sapwood | 4.0 |
| | *Matayba domingensis* (DS.) Radlk. | heartwood | 4.2 |
| Laurel avispillo | *Nectandra coriacea* (Sw.) Griseb. | sapwood | 4.2 |
| Ausubo | *Manilkara bidentata* (A. DC.) Chev. | heartwood | 4.2 |
| Roble | *Tabebuia heterophylla* (DC.) Brit. | sapwood | 4.2 |
| Yagrumo macho | *Didymopanax morototoni* (Aubl.) Dec. & Pl. | sapwood | 4.4 |
| Nemocá | *Ocotea spathulata* Mez | sapwood | 4.4 |
| Nuez moscada | *Ocotea moschata (Meissn.)* Mez | sapwood | 4.4 |
| Manzanillo | *Sapium laurocerasus* Desf. | sapwood | 4.4 |
| Panapén | *Artocarpus altilis* (Parkinson) Fosberg | sap & heart | 4.4 |
| Aguacatillo | *Meliosma herbertii* Rolfe | sapwood | 4.4 |
| Maricao | *Byrsonima coriaceum* (Sw.) DC. | heartwood | 4.4 |
| Masa | *Tetragastris balsamifera* (Sw.) | sapwood | 4.4 |
| Algarrobo | *Hymenaea courbaril* L. | sapwood | 4.6 |
| Caoba hondureña | *Swietenia macrophylla* King | heartwood | 4.6 |
| Laurel Sabino | *Magnolia splendens* Urban | heartwood | 4.6 |
| Caimitillo | *Micropholis chrysophylloides* Pierre | heartwood | 4.6 |
| Laurel geo | *Ocotea leucoxylon* (Sw.) | sapwood | 4.6 |
| Guayacán | *Guaiacum officinale* L. | sap & heart | 4.6 |
| Laurel prieto | *Nectandra membranaceae* (Sw.) Griseb. | sapwood | 4.6 |
| Higüerillo | *Vitex divaricata* Sw. | sap & heart | 4.8 |
| Palo de matos | *Ormosia krugii* Urban | sapwood | 4.8 |
| Yagrumo hembra | *Cecropia peltata* L. | sapwood | 5.2 |
| Mago | *Hernandia sonora* L. | sapwood | 5.2 |
| Ceiba | *Ceiba pentandra* (L.) | sapwood | 5.4 |
| Jagüey | *Ficus laevigata* Vahl. | sapwood | 5.6 |

has no known heartwood.
1/ After the wood dried, it was sometimes difficult to determine the type of wood. Some wood such as yagrumo hembra

*Table 3. — The pH values of the sapwood of seven Puerto Rican species cut freshly from post-size trees*

| Common name | Scientific name | pH of tree A | B | C | D | Average pH value |
|---|---|---|---|---|---|---|
| Roble | *Tabebuia heterophylla* (DC.) Brit. | 4.4 | 4.4 | 4.4 | 4.6 | 4.4 |
| Caoba hondureña | *Swietenia macrophylla* King | 4.6 | 4.8 | 4.8 | 4.6 | 4.7 |
| Laurel avispillo | *Nectandra coriacea* (Sw.) Griseb. | 4.8 | 5.2 | 4.8 | 4.6 | 4.8 |
| Guaraguao | *Guarea trichilioides* L. | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Caoba dominicana | *Swietenia mahagoni* Jacq. | 5.0 | 5.0 | 5.0 | 4.8 | 5.0 |
| Caimitillo | *Micropholis chrysophylloides* Pierre | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Espino rubial | *Zanthoxylum martinicense* (Lam.) DC. | 5.4 | 5.4 | 5.2 | 5.2 | 5.3 |

# Experimental Design and Analysis in Forest Research

By J. N. R. Jeffers
Almqvist and Wiksell, Stockholm
172 pp., 1959

**Review**

This excellent book has been prepared under the auspices of the International Union of Forest Research Organizations. As noted in the introduction it is intended to give a description of the more important designs and analyses used in forest research, and to explain when and why they are used. It is quite obviously written for the beginner, and even for the pre-beginner, in the field of statistics.

As such it is very well done. The examples are easy to follow for anyone with even a faint memory of college algebra, and it is a refreshing change for someone moderately familiar with the statistics literature to be able to dip into the middle of a new book without having to thumb frantically forward and backward to solve still another system of symbolic notation.

In view of the audience to which this book is directed, perhaps the least satisfactory section is that on Miscellaneous Aspects of the Design of Experiments, and in this section the most unsatisfactory discussion is that of Randomization, which is covered in one very brief paragraph. Here also is found one of the relatively few typographical errors. Since misconceptions concerning the techniques and necessity of randomization are so common and since faultless and efficient randomization is often difficult even for the initiate, a fuller discussion would certainly be justified in any future revisions of this work.

Another complaint which may be justifiably levelled at this book, when its intended audience is considered, is the lack of emphasis on the more important statements. For example, in the discussion of regression analysis, page 116, the last four lines in a 19-line paragraph are as follows:

> "By plotting the basal areas and their corresponding volumes in Figure 61, the regression line can be drawn in on the dot-diagram. The line evidently gives a satisfactory fit through the dots on the diagram. No line should be extended beyond the range of points for which it was calculated."

The first two sentences refer to the particular example being discussed. The final sentence is a cardinal rule of regression analysis of data and certainly merits special emphasis so that the uninformed reader may realize the importance and significance of the statement.

An excellent illustration of the fact that
"Small habits well pursued, betimes,
May oft attain the dignity of crimes."
is the continual references of the author to sections elsewhere in the book, especially the frequent references to the appendixes, without the citation of the corresponding page numbers.

These are, however, minor criticisms of a work of great value. The book can hardly fail to arouse interest and increase understanding in anyone who takes time to study it. Few workers in the field of forest research will fail to benefit by reading it at least once, and most will return again and again to refresh their minds on the details that slip away while field work is being brought up to date and office work is inexorably falling behind.

Experimental Design and Analysis in Forest Research is probably the best single book available to the beginner.

C. B. Briscoe

# Recent Observations on Forestry in Tropical America

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During recent months members of the Tropical Forest Research Center staff have travelled to many of the countries of the Caribbean area. The purposes of these trips have been to see trees, forests, and silvicultural and utilization practices that might be useful in Puerto Rico, to collect data on forest plantations for the Latin American Forestry Commission of FAO, and to obtain information of value to the forestry training program of the Center, set up to serve this area through the cooperation of the International Cooperation Administration. Forest management work and plantations were studied in the Yucatán Península of Mexico, Central America, Colombia and Ecuador, the lower Amazon Valley of Brazil, Surinam, British Guiana, Trinidad, St. Lucia, Martinique, and Jamaica. Forest utilization was observed in Trinidad, British Guiana, and Surinam.

## Mexico

Observations in Mexico were confined to Yucatán, Campeche, and Quintana Roo. At Colonia Yucatán interest has been shown in forest management since the development of the plywood plant in 1946. Studies have been made of natural regeneration, direct seeding, and planting Spanish-cedar (*Cedrela odorata* L.). The forest contained an unusually high concentration of commercial-size cedar trees (9 per hectare) probably as a result of past Maya cultivation. Natural regeneration of cedar after cutting was found to be unsatisfactory. Planting in recent clearings has failed primarily because of insolation and shoot borer *(Hypsipyla grandella* Zeller) attack. Failures have also resulted in planting in lines opened up in selectively cut forest because of shade and competition. However, plantings made in lines cut in low second-growth vegetation look promising. Recent direct seeding trials in abandoned logging roads and cleared strips in the forest also appear successful.

Mahogany is not native to this area of northern Yucatán but it is growing vigorously where planted in lines cleared through second-growth vegetation. It has failed where planted in the open or under selectively cut forest.

In Campeche experimental plantings of cedar and mahogany were seen at the Agricultural Experiment Station of Cayal and in the area of Escancega. Interesting direct seeding experiments are underway in the Branson area near Escancega, under a high shelterwood and in cleared lines in second-growth vegetation. Where seedlings were planted in cleared lines through selectively cut forest the success appeared to be associated with the density of the forest cover. Good survival and vigorous growth of planted trees in the area called Tormento appeared to be a result of light upper canopy cover allowing for abundant light in the understory. At kilometer 20 on the Escancega-Chetumal road the planting appeared much less successful due to heavier shade in the lower canopy levels.

Mahogany plantation success appeared to be correlated with shade conditions also in the area of Laguna San Felipe in Quintana Roo Territory. Forest inventories carried out by the Quintana Roo Forest Department in this region are of real interest because of the complete enumeration made of mahogany of all sizes.

At the Chetumal forest nursery bigleaf, or Honduras, mahogany *(Swietenia macrophylla* King) has been planted in mixture with small-leaf, or West Indies, mahogany *(S. mahagoni* Jacq.) to determine whether cross pollination and hybridization take place. The progeny of these trees will be of interest.

**British Honduras**

Projects of special interest as yet unreported except in the Annual Reports of the Forestry Department are the pine forest management program at Augustine and the hardwood forest management program in the Chiquibul area. Forest inventories have been made and the rate of cutting is adjusted to the capacity of the forests to produce on a continuous and permanent basis. Studies of reproduction, tree growth, and methods and effects of fire control have been set up in both areas to gather information to guide forest management.

A more recent development is the announcement of the offering for bids of a long-term forest management license for the Cockscomb Basin area. The area includes 180 square miles of tropical forest with a total volume of 378,790,000 board feet of mixed tropical hardwood timber. To obtain and hold the license an operator must fulfill certain conditions, such as the establishment of a local woodworking industry and the maintenance of a productive forest. If these conditions are met the right to exploit the forest may be held by the licensee in perpetuity.

This important prospective development in the general effort to establish permanent woodworking industries based on the utilization of mixed tropical forests will be watched with great interest.

**Guatemala**

In the highlands of Guatemala the tree most extensively established in plantations is cypress (*Cupressus lusitanica* Mill.). This tree has been planted with some success on sites varying from the subtropical dry forest at 1500 meters elevation all the way to the tropical montane wet forest at 3000 meters. Logs of commercial size are being cut from a 64-year-old plantation near Antigua. Data is not yet available to predict the productivity of cypress plantations on various sites, but there is little doubt that this will be an important species in the development of forestry programs in the Caribbean area where sites are similar to those on which the tree is found in Guatemala.

From the tropical zone of the Pacific slope several recent shipments of primavera logs *(Cybistax donnell-smithii* [*Rose*] Seibert), called "palo blanco" locally, have revived interest in this wood. The logs came from plantations approximately 30 years old and were reported to have produced veneer of excellent quality. This tree is widely planted in the lower part of the coffee zone in Guatemala but no longer exists in commercial quantities in the natural forest. In this same area promising young teak *(Tectona grandis* L.) and mahogany plantations should provide valuable information for future forest management projects.

The distribution of the Pacific-coast type mahogany *(Swietenia humilis* Zucc.) was found to extend to the Atlantic slopes of Guatemala in the Departments of Progreso, Chiquimula, and Zacapa. Seed was collected for comparative studies in Puerto Rico.

**Honduras**

Probably the most extensive experimental reforestation in Central America has been that of the United Fruit Company. In Honduras teak is the species planted on the largest scale, more than 2000 acres. Plantations up to 15 years of age at various spacings clearly show that a minimum of care is needed to obtain an adequate yield of first class products. Plantations with wide initial spacing (15 x

15 feet and 10 x 20 feet) tend to produce trees with short boles and excessive branching. Younger plantings spaced at 6 x 6 feet have, because they were not thinned, produced excessively tall thin trunks that will now be difficult to manage.

Trial plantings of more than 20 tropical species have been made, some of which could become important plantation species in the Caribbean area. On well drained sites *Eucalyptus naudiniana* F. Muell (Syn.: *E. deglupta* Blume) has made exceptional height and diameter growth in the tropical moist forest and in the wetter margins of the tropical dry forest. Limba *(Terminalia superba* Engl. & Diels) has grown more than one inch in diameter per year in the early stages of development on well drained sites in the tropical moist and tropical dry forests. Long, straight boles with rapid self pruning of lower branches are characteristic. *Terminalia ivoriensis* A. Chev. has shown similar growth characteristics on a small scale in the tropical moist forest. Individual trees of *Khaya ivoriensis* A. Chev. and *Entandrophragma rederi* Harms have shown remarkable development and deserve more extensive trials.

#### Nicaragua

A program of land classification under way in Nicaragua should point up the importance of forestry in obtaining a product of economic importance from non-agricultural land. In northern Nicaragua pine stands have been mapped. A program of fire control is under way to increase pine reproduction. Complete elimination of fire will probably be found not to be possible nor necessary.

On the Río Escondido important experimental plantings of teak and bigleaf mahogany are found on the lands of the El Recreo Experiment Station and of the Cukra Development Company.

#### Costa Rica

In the highlands of Costa Rica plantations of *Eucalyptus globulus* Labill, *Cupressus lusitanica*, and *Alnus jorullensis* H.B.K. present outstanding examples of what can be expected from forest plantations in lower montane wet and montane wet forests. An introduction of nogal *(Juglans* sp.) from Nicaragua shows remarkable development near San José with diameters up to 20 inches and heights to 90 feet in 18 years.

On the tropical lowlands of the Pacific coast well developed plantations of teak are found on United Fruit Company divisions of Quepos and Golfito.

#### Panamá

At Puerto Armuelles the Chiriquí Land Company has established 1,500 acres of teak plantations that show excellent development. Smaller plantations of Spanish-cedar and mahogany show less spectacular results but will provide important information on these trees if protected until the end of one rotation. The Summit Gardens in the Canal Zone of Panamá has been an important center for the distribution of forest tree seed both native and exotic, but there are no forest plantations of interest on this area. It is unfortunate that a part of the 35 square miles within the Canal Zone has not been dedicated to at least small demonstration projects in forest management. No other productive use is made of this land.

Land classification and watershed management studies in Panamá will no doubt provide a basis for natural resource development that depends to a considerable extent on the forests, one of the country's most important natural resources.

#### Colombia

The domestic paper industry in Colombia is important and is growing rapidly. An experimental program of establishing plantations of exotic conifers is directed toward reducing imports of long-fiber pulp needed for the local paper industry.

Outstanding *Eucalyptus globulus* plantations are found in abundance in the highland savanna country around Bogotá, most of them on private land. Many plantations need improved management if maximum production is to be achieved. The need for thinning operations are particularly obvious in some locations.

**Ecuador**

Ecuador probably has more extensive plantations of eucalyptus than any other Latin American country except Brazil. *E. globulus* plantations are found under a variety of site conditions, a wide range of age classes, and with many types of treatment.

In the Department of Guayas plantations of tropical species of *Ceiba, Prosopis, Swietenia, Cedrela* and *Tectona* have been established on a small scale.

**Jamaica**

Jamaica is especially interesting to a visiting forester from Puerto Rico because of the very close similarity of sites and conditions. In addition a great deal of forestry work has been done, too much to be examined thoroughly in one short visit.

The central plateau, in the Christiana-Gourie area, is about 3000 feet[1] above sea level. The soils vary from friable clay loam to very heavy clays. The underlying limestone presents outcrops occasionally, especially on steep slopes, and is responsible for the sinkholes which are so common in the Gourie plantation area.

Mahoe *(Hibiscus elatus* Sw.) planted about 1950 has developed very well in the bottoms of the sinkholes, but vigor decreases rapidly with distance up the slope. Wood grown here is thought to be denser and stronger than that grown on the better sites, and a sample collected had a specific gravity of 0.49 compared to 0.36 for a sample collected in the eastern mountains.

*Eucalyptus* species and patula pine *(Pinus patula* Schl. & Cham.) planted about the same time on the upper slopes and ridges have been disappointing. Since 1954 many of these areas have been re-planted with Honduras pine (*P. hondurensis* Loock), which has been much more promising to date.

Santa María *(Calophyllum brasiliense antillanum* [Britton] Standl.) planted in this area made a slow start but has improved tremendously since replacement pine has begun to afford it some shade and site protection. There are tentative plans for direct seeding Santa María under established pine plantations for a second crop.

The difficulty of obtaining seed has severely limited the acreage of Antillean pine *(P. occidentalis* Sw.) which has been planted, but the few plantations established show perhaps the most promise of any species planted in this region.

The cockpit country, because of its rugged local relief, contains most of the virgin and near-virgin forest left in Jamaica. Among other interesting species is goldspoon *(Antirrhoea jamaicensis* [Gr.] Urb.) which is reported to attain a dbh (diameter breast high) of 24 inches and produce a clear, straight bole of more than 35 feet on steep rocky slopes where most associate species are worthless brush.

Most of the plantations established are mahoe; the growth and form, especially in the bottoms and lower slopes of the glades, are excellent.

Of the small-leaf mahogany seen on the northwest coast about half had typical leaves and half had an intermediate leaf form appreciably larger. This, combined with the

1/ Elevations, rainfall, soil and other background information given is often based on informed estimates or extracted from mental files and is subject to a certain amount of error.

**Figure 1. — Pines in Jamaica. Upper left. Honduras pine (Pinus hondurensis), 6 years old, Gourie Plantation. Upper right. Patula pine (P. patula), 10 years old, Gourie Plantation. Lower left. Radiata pine (P. radiata), foreground, and Honduras pine, 3 and 2 years old, respectively, Resort. Lower right. Uyam pine (P. merkusii), 6 years old, Belle Vue.**

widespreading branches and short bole, indicates that these trees, previously considered to be naturally established from native parents, may well have been planted.

The arboretum near Moneague in the eastern mountains has several species of interest: Antillean pine is as promising here as it is on the central plateau, averaging 1 inches dbh and 35 feet tall at age 6. Honduras pine 5 years old is up to 6 inches dbh and 40 feet tall; this year it is producing its first fruit. *Eucalyptus patentinervis* R. T. Baker (Syn.: E. *kirtoniana* F. Muell.), at age 6, is up to 11 inches dbh and 60 feet tall. *Melia compositae* Willd. averages about 6 inches with a maximum of 14 inches at age 5.

Near Resort, goldspoon and *Terminalia latifolia* Sw., are off to a good start. Honduras pine has shown much better initial survival and growth than Monterrey pine (*P. radiata* Don.). Underplanted Spanish-cedar has made an excellent start, but has not yet reached merchantable size. This area contains many acres of excellent mahoe, including some outstanding glade stands. Even on upper slopes in this area mahoe plantations 15 years old are up to 8 inches dbh and with 32 feet of clear bole.

Near Bell Vue, Masson Pine *(P. massoniana* Lambert) is growing adequately at about 4500 feet elevation but produces a rather knotty bole. Uyam pine *(P. merkusii* Jungh.) at 5200 feet has a periodic annual increment of 6 feet in height and one inch in dbh. Because of the near-constant winds on this exposed ridge, many stems are deformed, but a great many are as straight as could be desired. *Eucalyptus patentinervis* on moist, well-drained soil in a protected swale has a periodic annual increment of 10 feet in height and nearly 2 inches in dbh. The same species on a nearby ridge is quite inferior. Mahoe has not developed satisfactorily in this area except where underplanted *Eucalyptus* has outgrown it and now affords protection.

Of special interest to a forester from the southern United States is the longleaf pine *(P. palustris* Mill.) growing at Cinchona above 4000 feet elevation, whereas its native site seldom approaches 400 feet. *Eucalyptus globulus* has been planted fairly extensively in this area, down to about 3400 feet, but apparently this is below its optimum site as development is quite patchy. The native juniper *(Juniperus gracilior* Pilger) can be found both natural and planted in this area. Possibly as a result of past selective cutting, most remaining trees have very poor form; however, a few, especially in one young plantation, are excellent.

Here, as elsewhere on the island, development of patula pine has been disappointing, but a small area on a moist, protected site has basal area near 200 square feet per acre and tremendous cubic-foot volume at age 7.

Masson pine has a higher specific gravity, 0.48, than Honduras pine or uyam pine which average about 0.38, but the bole form is inferior to either of the faster-growing lighter-wooded species.

Summarizing, Jamaica has the oldest and some of the best planted pine seen. Honduras pine has done well everywhere tested, and limited trials of Antillean pine indicate that it may be even better: initial growth of uyam pine above 5000 feet is very promising. The mahoe plantations certainly seem to have justified their establisment, but more information is needed on the site requirements and wood quality of the species. Eucalyptus have shown the fastest growth here, as elsewhere, but the lack of present or foreseeable markets severely limits their usefulness.

### Martinique

Plantation work in Martinique continues, as in the past, to be concentrated on bigleaf mahogany. Most new plantations are being established through the taungya system, with seedlings grown in temporary nurseries near the planting sites. There are perhaps 2500 acres of mahogany plantations now established, up to about 32 years old. Practically all the plantings have been pure mahogany, and shoot-borer damage has been fairly extensive. Damage appears to be more extensive on windward slopes, and tree form is better to the leeward. In addition variations in tree form suggest that seed source varied from year to

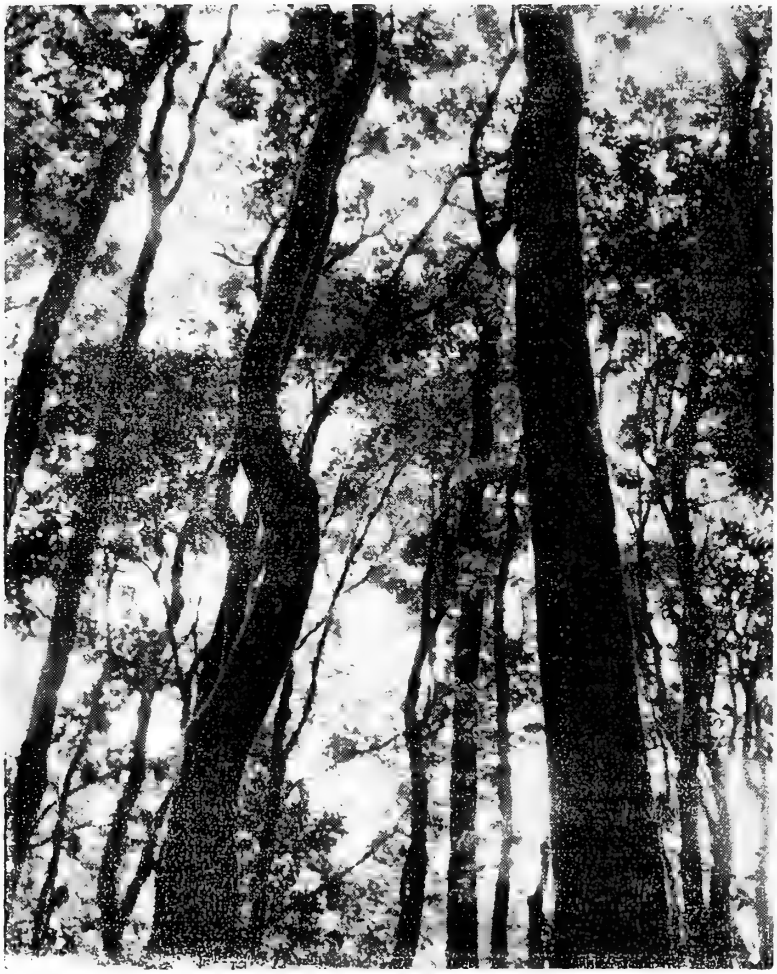

**Figure 2. — Bigleaf mahogany (Swietenia macrophylla) in Martinique, showing variationin form; 16-18 years old, Deux Choux.**

year. Natural reproduction is common throughout the plantations. It is especially imposing on a cove site in the southeastern portion of the island, at about 700 feet above sea level. There advanced reproduction is abundant and of outstanding form.

In this same area simaruba (*Simaruba amara* Aubl.) has excellent form and volunteer reproduction in mahogany plantations is completely undamaged even where the mahogany is severely infested by the shoot-borer.

Work has begun recently with pine, but has not continued long enough to do more than indicate some promise.

**St. Lucia**

Time was very limited here, but excellent teak was seen barely outside the city limits of Castries, and at the Barre de L'Isle nursery area were excellent *Eucalyptus resinifera* Smith, mahoe, and simaruba. Mahoe stands are being thinned to a lower residual density here than elsewhere, and their comparative development will be of interest.

**Trinidad**

It would be needlessly repetitious to review again the excellent work being done in

Trinidad with teak and Honduras pine (Beard, 1943; Brooks, 1939, 1941a, 1941b; Cater, 1941; Chalmers, 1958; and Ross, 1958), as well as the Tropical Silviculture being tested in the Arena Reserve. However, certain points have not been accented previously. Honduras pine has a soft, even texture with a very pleasing birds-eye figure when cut from very young thinnings. If sufficient quantity becomes available in the future, it should command a premium price for special uses. The lumber being manufactured from thinnings in teak plantations 15 years and older is remarkably free from defects. Even boards from the heart center are graded almost entirely on the presence or absence of pith rather than through any consideration of knots.

Of the other species tried on a more limited basis than the extensive plantations of teak and pine, bigleaf mahogany has shown severe cankering which appears superficially to be caused by a virus. The fact that this disease makes a tree completely worthless combined with the importance of mahogany in Latin America as a whole suggests that for the benefit of the entire region studies should be undertaken to determine the nature and control of the disease.

Simaruba, which was seen in good natural stands and plantations on clay soil in Martinique and St. Lucia respectively, also can be seen in an excellent plantation on the very sandy soils in the Arena Reserve in Trinidad.

On clay soil derived from limestone at about 900 feet elevation are excellent small plantings of Spanish-cedar, *Cordia alliodora* R. & P. (Cham.), *Gmelina arborea* Linn., and *Enterolobium cyclocarpum* Gris. At age 12, the cedar is up to about 10 inches diameter breast high, the *Cordia* about 7 inches, and the *Gmelina* 24 inches; at age 11 the *Enterolobium* is up to 29 inches dbh. All these species have satisfactory form, at least for short logs; the *Gmelina* is definitely the least desirable.

In the field of utilization one of the most significant developments in the Caribbean area is the success of the Brickfield forest industry in Trinidad utilizing small teak logs (Ross, 1958). Teak is being used extensively in reforestation in this area and the utilization of thinnings is already a problem elsewhere. The Brickfield installation, organized and operated by the Trinidad Forest Department, consists of a gangsaw, a resaw, a hot-and-cold creosote treating plant, and a picket fence factory. During 1959 this plant produced from teak thinnings 27,400 treated fence posts, 19.5 miles of wirebound picket fencing, and 187,000 board feet of lumber at a net profit of $19,450.00. The fence posts and pickets are produced largely from thinnings from 5- and 10-year old plantations. The sawlogs, with a 5.5 inch minimum diameter, come from thinnings in the 15-year or older plantations. The main product of the sawmill is 2 x 4 inch dimension stock. However, 1/2 x 2, 1 x 2, 1 x 3 and 1 x 4 inch boards are also produced. The 2 x 4's are bought up by the construction trade, and the 1-inch lumber goes into furniture, flooring, and miscellaneous items.

The freedom from knots and other defects indicates that high quality teak lumber will be produced from the mature trees when they reach rotation age. Consideration is being given to the possibility of diverting the larger sawlogs to a local band mill in order to improve the grade of the material recovered from these logs.

The Brickfield plant serves as an example of what can be done to utilize small material from forest plantations in other areas of the Caribbean where raw material and market conditions are similar. It is an important link in the chain of development required to maintain forest land in a productive state.

In Trinidad a total of 12,397 acres of teak have been planted since 1928, with 770 acres established in 1959. In recent years increasing interest has been shown in planting pines, especially on sandy soils unsuited for

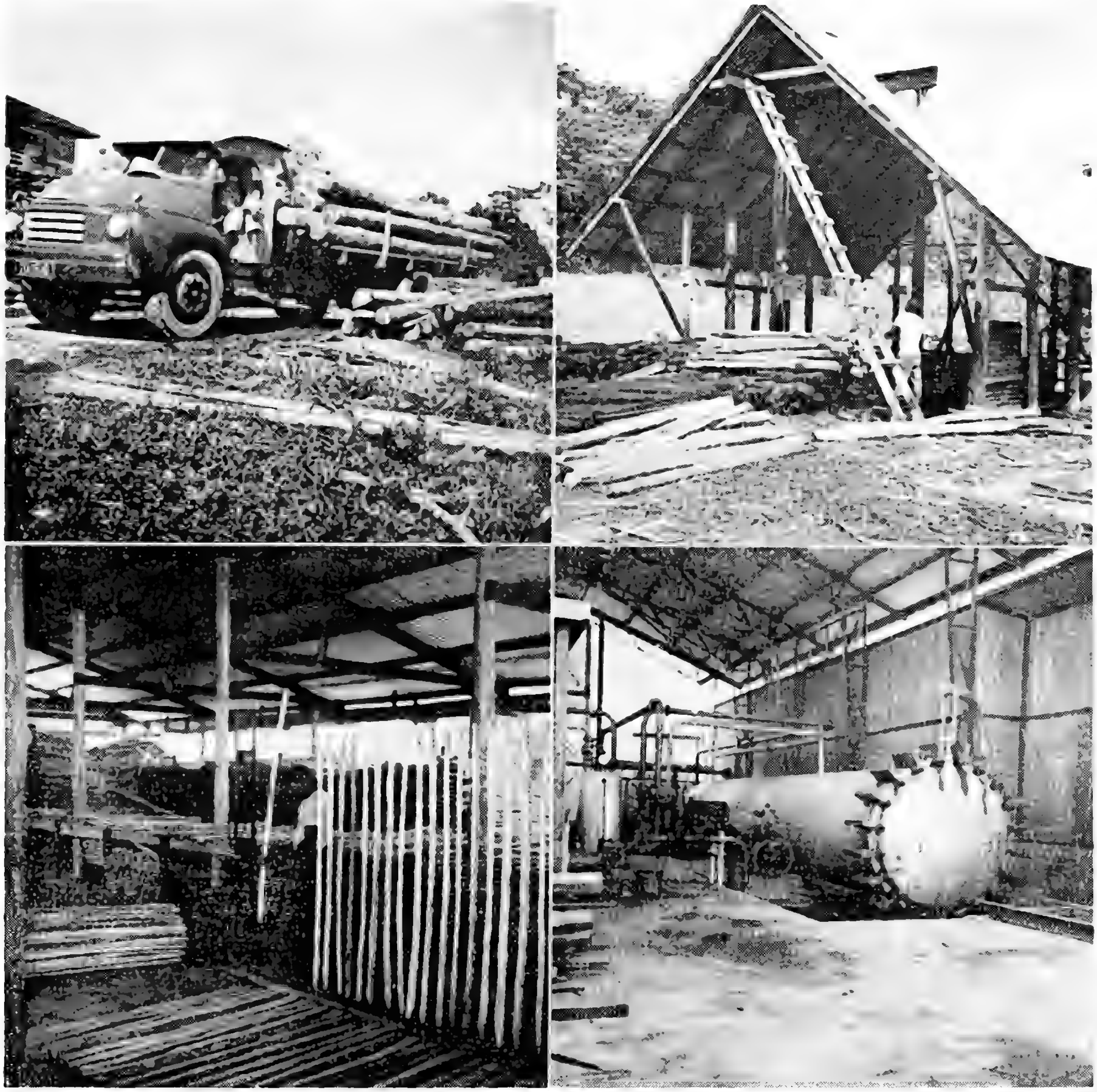

Figure 3. — Utilization in Trinidad. Upper left. Teak (Tectona grandis) logs being delivered to Brickfield Forest Industries. Upper right. Fence post treating plant, Brickfield. Lower left. Fabrication of fence from teak thinnings, Brickfield. Lower right. Pressure treating cylinder, Port of Spain.

teak. The oldest plantations are 12 years old, with 465 acres planted to date.

The publicly owned forest reserves of Trinidad amount to over 328,000 acres or 26 percent of the land area. From these forests 3,450,100 cubic feet of timber, 904,700 cubic feet of fine wood, and 227,700 cubic feet of other split wood were cut in 1959.

The total sawtimber cut from all lands amounts to 31.5 million board feet. Nearly all of this was consumed locally. An additional 1,505,000 cubic feet of coniferous timber, mostly from British Honduras, was imported.

A pressure treating plant is in operation in Port of Spain using Wolman salts as a preservative and treating about two million board feet of lumber yearly. Plans for a second plant are being developed for San Fernando, the second largest city of Trinidad. This indicates the favorable reception of treated lumber in the Trinidad market. Lumber is treated to retain 1.5 pounds of the Wolman salts per cubic foot and the lumber is air-dried to 20-22 percent moisture content.

**British Guiana**

Recent work in timber inventory from aerial photographs in British Guiana has given some of the most encouraging results yet reported from mixed tropical forests. More than 25 different forest associations have been distinguished on the photos, and estimates of greenheart (*Ocotea rodiaei* [Rob. Schomb.] Mez) volume from the pictures have shown excellent correlation with actual volumes available.

Natural regeneration of greenheart following cutting has been good. In the area visited greenheart appears to be on the way toward making up a higher proportion of the stand in the cutover areas than it was in the original forest.

Pine plantings have been made in the last five years. Growth is better on the brown sandy loams, but even on the white sands which support a very inferior native vegetation pines are promising; slash pine is off to a faster start than Honduras pine. The most important problems to date are the high cost of site preparation and the coushi (*Atta* spp.) ants which defoliate the pines, especially after they have been cleaned of competing weeds and brush. The ants are poisoned in their

**Figure 4. — Prefabricated house, British Guiana Timber Corporation.**

Other promising species are *Ocotea rubra* Mez., *O. caniculata* Mez., simaruba, *Tapirira* spp., and *Peltogne* spp. The latter is apparently a very rapid grower for a wood of such high specific gravity.

The Forest Department operates the Central Timber Manufacturing Plant on an experimental basis to interest the local market in a wider variety of species. This installation is comparable to lumber concentration yards found in the southern United States where rough ungraded lumber is bought from small mills, then sorted, dried, surfaced and graded for resale. The plant now handles about 23 species. The price paid to the small mills depends on the species, type of sawing, and whether or not the lumber is of export grade.

In 1958 1,609,000 board feet of lumber were purchased and 1,019,000 sold with about one million board feet remaining in inventory. The spread between buying and selling prices appears sufficient to provide for a profit. Some adjustments can perhaps be made in administrative, machining and other costs to improve the picture. A concentration and remanufacturing yard prospers in a market where specialization and prefabrication are a part of the manufacturing process. Some educational effort in the local market will probably be required to sell the advantages of well manufactured, dry lumber.

Of the commercial sawmills the British Guiana Timber Corporation mill is one of the largest. It is a band mill with two head saws, cutting mostly greenheart for export. This material is well manufactured and treated against splitting with end coating. The lumber for local consumption is not so carefully prepared. This company also has an experimental pre-fabricated house program, based on a pilot model prepared by the Forestry Department, which should contribute to the utilization of non export lumber.

A particle board plant using wallaba *(Eperua* spp.) has recently started production. The panels being produced appeared somewhat darker and heavier than the product found on the general world market.

The furniture industry producing for local consumption is not well developed. A considerable portion of the furniture is made in small home shops.

It should be noted in passing that the Georgetown museum contains some interesting wood exhibits well worth seeing.

**Surinam**

Tremendous strides are being made in the utilization of the Surinam forests. Harvesting is carefully planned and controlled for economical cutting of the forest without unnecessary waste. Silvicultural studies are in progress for improving the composition of the existing overstory, obtaining natural reproduction of the desirable species, enrichment planting of the high forest following selective cutting, and establishing pure plantations of native and exotic species, besides more basic studies of the phenology and growth of the more important species.

In cooperation with a Netherlands paper company an extensive trial is being made of Honduras pine on the white sands. Results to date are very encouraging on the better sites and some small tests of densa pine *(P. elliottii densa* Little & Dorman) have been made on the drier ridge sites; test plantings of slash pine *(P. elliottii elliottii* Engel.) are being considered for moist flats and along waterway margins. The best of the Honduras pine, near Jodensavanna, have a periodic annual increment of 9 feet in height and 1.5 inches dbh. Branches seem a little more persistent than elsewhere for this species.

Of the other species being tested in plantations, okoume (*Aucoumea klaineana* Pierre), baboen *(Virola surinamensis* Warb), *Carapa guianensis* Aubl., and simaruba are the most promising.

In Surinam the wood utilization picture


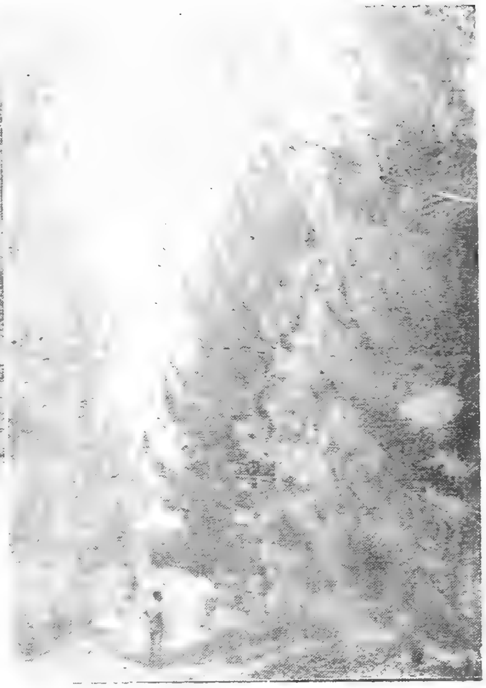

Figure 5. — Pine in Surinam. Left. Honduras pine, 1 year old, planted 5 months after natural forest cleared by bulldozing. Right. Honduras pine, 7 years old. Jodensavanna.

burrows with liquid dieldrin but complete control on these porous sands is very difficult. is dominated by the Bruynzul plywood and parcticle board plant. This is an outstanding woodworking installation producing products to exacting specifications. The principal raw material is baboen. Waste from the plywood plant provides the bulk of the raw material of the particle board plant. A gangmill and flooring mill are also in operation producing end-matched and parquet flooring of high quality.

The Forestry Department has specialists to advise the local woodworking industry. The furniture plants visited showed the results of this technical help. Although small and with limited equipment, these factories turn out well designed, well made furniture. Care was used in organizing and assembling the parts, and the latest resin adhesives were using used to turn out a pleasing product.

There is a wood treating plant in Surinam using both Wolman salts and copper naphthenate. This plant treats flooring, panelling, lumber, and poles.

**Brazil**

On the grounds of the Instituto Agronomico do Norte, Belem, some small plantings of forest tree species have been made in recent years. Brazilnut *(Bertholletia excelsa* H.B.K.), bigleaf mahogany, cumarú (*Coumarouna odorata* Aubl.), *Eucalyptus alba* Reinw, *E. tereticornis* Sw., *Tabebuia serratifolia* (Vahl) Nicholson, and Spanish-cedar, have made a promising start. Eight-year old stands of jacaranda *(Jacaranda copaia* [Aubl.] D. Don) and simaruba are up to about 6 inches dbh and 50 feet tall, with truly excellent bole form. Most of these plantings are spaced 1 meter by 3 meters, which permits cleaning them with a tractor-mounted rotary mower.

At Santarém studies are being made of enrichment of natural forest, and of pure plantations. On heavy black soil *Gmelina* and simaruba look best in plantations; on red clays jacaranda grows as rapidly as the local species of *Cecropia* and attains a larger size and better

**Figure 6. — Curuá silvicultural operation. Upper left. Loading logs on barge for shipment to Santarem. Upper right. Cutting logs, bandmill on moving carriage with log fixed. Lower left. Simaruba (Simaruba amara), 26 months old. Center. Cupiuba (Goupia glabra), 14 months old. Lower right. Jacaranda (Jacaranda cepaia), 26 months old.**

form. Several species show promise underplanted under high forest, but the Spanish-cedar is outstanding.

A sawmill here has made an excellent start in studying the properties and working characteristics of some of the lesser known Brazilian woods. Logs are being supplied from the Curuá Silvicultural Study Area.

The silvicultural studies being made at Curuá, like the studies at Santarém, are being conducted by the FAO Forestry Mission in cooperation with the Brazilian Forest Service. The basic pattern of study at Curuá is essentially the same as in Surinam: improvement of the high forest by eliminating weed trees, striving for natural regeneration of the best native species, and enrichment planting under the native high forest; at the same time studies are being made on a limited scale on the establishment of pure plantations.

Bigleaf mahogany, Spanish-cedar, and *Carapa* have all shown promise in the underplantings.

Many of the more than forty species tested in pure plantings are promising, but cupiuba *(Goupia glabra* Aubl.), jacaranda, and simaruba are outstanding. Several eucalypts have shown their usual rapid growth but have relatively poor form and have suffered frequent damage from leaf-cutting ants; of these, *E. citriodora* Hook has shown the most promise.

Progress in forestry in the Caribbean area, as elsewhere, depends to a considerable extent on the interchange of ideas and information among foresters. Here, more than in most regions, distance and language present obstacles to free exchange of ideas. The inspections reported here were made to help bridge these gaps in communication.

More detailed reports on successful plantations will be found in the second report on Forest Plantations in Latin America of the Regional Committee on Forest Research, Latin American Forestry Commission, FAO. This report is now in preparation at the Tropical Forest Research Center.

It is hoped that additional material will be submitted for publication in the Caribbean Forester as a result of the stimulating discussions that developed from the contacts made in the area. If only a part of the information available in the minds and files of the foresters visited could be published it would provide an important stimulus to the practice of forestry in the Caribbean area and elsewhere.

The staff of the Tropical Forest Center take this opportunity to express their thanks for the cordial hospitality and the stimulating and helpful assistance given during the visits and hope that they in turn may extend similar courtesies in Puerto Rico.

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Par les pages de cette revue les personnes qui travaillent aux tropiques peuvent etre informées sur les problemes specifiques des forets tropicales et sur les travaux effectués pour realiser une ameilloration technique par l'aménagement et l'usage des resources forestiéres. Cette revue pourvoit aussi un moyen de destribuer l'information et les resultats obtenus par le programme experemental du Centre Tropique de Recherche Forestier de Puerto Rico; en plus cette revue offre ses pages a les autres travailleurs forestiers des pays tropicaux pour qu'ils purssent publier les resultats de leur travaux.

Cette revue accepte volontiers des contributions ne depassant pas 20 pages dactilografiées a double espace, cependant que certains travaux du intéret spécial plus long purvent etre acceptés. Les contributions doivent etre ecrites dans la langue maternelle de l'auteur et doivent bien preciser son titre et sa position professionnelle, l'appert doct etre accompagné d'un résumé de l'étude. Les manuscripts doivent etre dactilografiées en double espace su du paper 8½ por 11 pouces.

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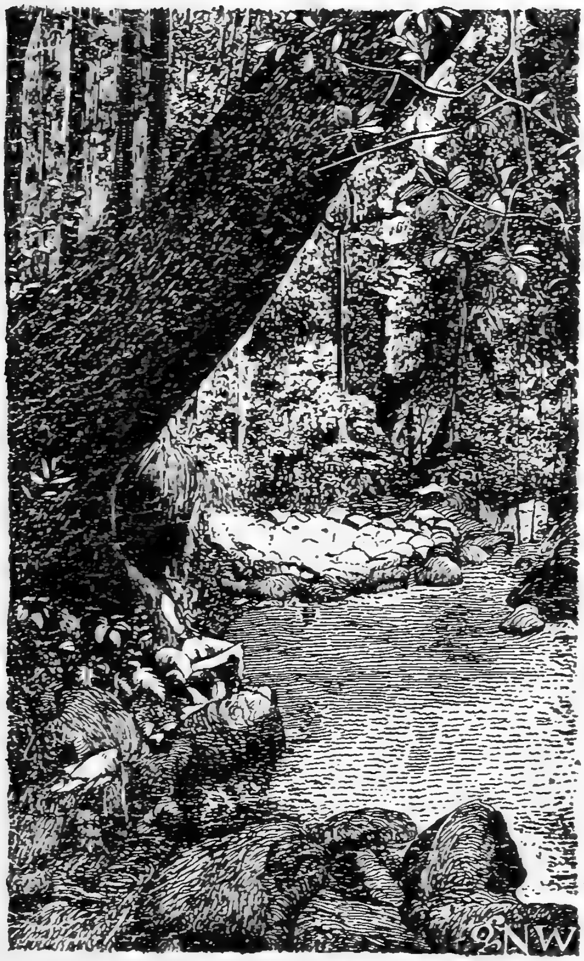




U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

TROPICAL FOREST RESEARCH CENTER
RIO PIEDRAS, PUERTO RICO

VOLUME 21 NOS. 3 AND 4 JULY - DECEMBER, 1960

# Caribbean Forester

El Caribbean Forester es una revista semestral gratuita publicada en Puerto Rico desde el año 1938 por el Centro Tropical de Investigaciones Forestales del Servicio Forestal del Departamento de Agricultura de los Estados Unidos. Esta publicación está dedicada a promover la mejor ordenación y utilización de los recursos forestales del trópico con especial énfasis a la región del Caribe.

Provee información a los que laboran en la dasonomía y ciencias afines sobre los problemas específicos que confrontan, las políticas forestales vigentes y el progreso del trabajo que se lleva a cabo para mejorar la ordenación y utilización de los recursos forestales tropicales. También sirve como medio informativo sobre los resultados y el progreso de los programas experimentales, en ordenación forestal tropical y utilización, que se llevan a cabo en el Centro de Investigaciones en Puerto Rico. También le brinda una oportunidad a otras personas interesadas en la dasonomía tropical para presentar el resultado de sus trabajos.

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Through the pages of the journal tropical foresters and workers in allied scientific fields are informed of specific problems of tropical forestry, policies in effect in various countries, and progress of work being carried out for the improvement of the management and utilization of forest resources. It furnishes a means of distribution of information on the progress and results of the experimental programs of the Tropical Research Center in Puerto Rico. In addition, it affords an opportunity for other workers in the field of tropical forestry to make available the results of their work.

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# Caribbean Forester

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## Sumario

# NOTE

The general policy of the Caribbean Forester is not to print any material published elsewhere. This issue, however, is composed of articles to be published in the Proceedings of the Fifth World Forestry Congress. We hope they will thus inform and stimulate foresters in the tropics who will never see the complete Proceedings of the Congress.

# NOTA

La política general del Caribbean Forester es no reproducir manuscritos publicados en otras revistas. Esta edición, sin embargo, está compuesta de artículos a publicarse con las Actas del Quinto Congreso Mundial de Silvicultura. Esperamos que los mismos informen y estimulen a aquellos dasónomos en los trópicos que no tendrán la oportunidad de leer las Actas del Congreso completas.

# Policy and Economic Problems in the Conversion of Old Growth Forests to Managed Stands in Tropical South America

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What are the problems of adjusting from an economy based on old growth timber to one based on managed second growth from the standpoint of land management adjustments, forest industry adjustments, and social and labour adjustments?

The moist tropical forests occupy a vast area in the Amazon basin, parts of Colombia, Ecuador, and Panamá the upper reaches of the Orinoco, the coastal range in Venezuela, and the catchment of the rivers flowing northwards through French Guiana, Surinam, British Guiana, and Venezuela south of the Orinoco. Trinidad is part of northern South America that has become an island in comparatively recent times and contains similar forest. North of Panama the moist tropical forests extend as far north as British Honduras and Southern Mexico. The climate varies from equatorial to monsoon with rainfall usually over 60 inches per annum.

In these regions population is still sparse. Over large areas it is less than one person per square mile of forest. Demand for wood for the needs of the forest inhabitants is so meagre in comparison with the abundance of trees that the forest may be looked upon as the dominant ecological factor. The Amerindians have made relatively little impression on this forest by the small clearings they make on which to grow their cassava crops. It can hardly be said therefore that a forest economy exists in the remoter forests.

The forests known best to the author lie in Trinidad and British Honduras where rainfall varies from 50 inches to 120 inches per annum and the climate has a dry season from February to May.

It is necessary to mention first the salient features of a forest economy based on old growth timber. Examples of such an economy may be found in the Amazon, British and French Guiana, Surinam, and British Honduras. In the tropics with few exceptions this has meant an economy based on "creaming" of mixed tropical hardwood forest by the extraction over large areas of a few valuable and usually large timber trees and their subsequent export as logs to more advanced industrial countries or their conversion at the port by large sawmills into sawn timber which is dried, graded, and largely exported. In the case of British Guiana a main export has been Greenheart piling.

In these countries there is an abundance of forest and a low population mainly concentrated on the coast. The local market cannot absorb the output of the forest and therefore only the most valuable trees are cut. Unlike temperate forests which are usually composed of a few species, the valuable species form a small proportion of the total crop in a tropical forest. Their removal makes little difference to the light reaching the forest floor and is in fact a thinning of the forest in favour of the less valuable species, which, if continued over long periods may reduce the crop to a stand of mediocre or useless trees.

In none of the countries mentioned has the adjustment of the economy from old growth to second growth gone far. The first step in such adjustments is a land capability survey to determine what areas are to become the permanent forests of the country whether they are owned by the state or by private individuals. With this basis it is possible to constitute the forest estate, demarcate it on the ground and set about the collection of data for managment plans. The first plan must take account of the area of forest remaining outside the permanent forest estate and allow for it to be exploited and subsequently converted to other use. This and the rest of the mature forest will then form the capital which will be liquidated over a sufficiently long period to permit the regenerated forests to reach timber size before the last of the mature forest has been cut.

How very different from theory is practice. It is quite feasible to carry out a land capability survey using aerial photographs and soil surveys. This can be followed by demarcation of the forest estate. But the conversión of the mature forest to regrowth on a large scale by natural regeneration must await the development of markets for a large proportion of the trees in the forest. There are areas of forest in British Honduras where the economy is based on regrowth. These are the drier areas of the north where mahogany *(Swietenia macrophylla)* is the dominant tree and where hurricanes in the past have kept the forest open and permitted natural regeneration to maintain the stocking of mahogany. Occasionally natural regeneration invades abandoned farms and burnt areas or landslides. There are also areas in British Guiana where Greenheart (*Ocotea rodiaei)* is so common that the opening caused by exploitation of the straight medium sized trees for piles and timber is sufficient to ensure the stimulation of advance growth present, but these are exceptions. Generally the conversion of old growth by natural regeneration to managed regrowth is successful only on sandy soils and must be preceded by opening of the canopy. This involves the poisoning of useless trees and the cutting of shrubs and creepers leaving an open canopy or shelterwood of pole size timber trees and all advance growth of valuable species. The cost of the poisoning, creeper and shrub cutting, and subsequent cleaning of the young regeneration necessitates a fairly complete use of the mature timber trees to pay for it.

Likewise in forests where clay soil predominates natural regeneration may be unsuccessful. The alternatives are either lines planted through the degraded old growth or clearance of the forest and planting of the land with either a pure crop or mixture of valuable timber trees. In the tropics the taungya system has been evolved to achieve this. Under it the trees are planted in farms cleared by shifting cultivators but if considerable areas of forest remain unused outside the permanent forest estate, no land hunger is likely, and without it, the taungya system does not work efficiently. To do the work of clearance by paid labour is costly, less satisfactory in the absence of the cultivation given to the food crops, and rarely possible on a large scale.

These basic factors governing the spread of forest management were well brought out in a paper on Silviculture in Costa Rica prepared by L. R. Holdridge[1] for the Fourth World Forestry Congress when he stated seven general policy precepts to be used as guidance when applying silviculture to the mixed tropical hardwood stands of Latin America.

The best and most advanced example of balanced adjustment in forest management known to the writer is found in the small island of Trinidad (1,863 square miles) which has 45% of its surface still covered by forest.

1/ Holdridge, L. R. 1957. The silviculture of natural mixed tropical hardwood stands in Costa Rica. FAO Forestry & For. Prod. Study 13. Tropical Silviculture 2:57-66.

By historical accident the rapid expansion of population, industry, and wealth took place after the appointment of the first Forest Officer in 1901. The revenue from oil helped development, a pitch lake cheapened road development, and there was an adequate and fully constituted forest estate available to supply local needs. The result was an internal market that made it unnecessary for the timber industry to depend on fluctuating foreign markets in which only the cream of forest produce could be marketed. The local markets were mainly in the drier West of the Island and the forests in the wetter East. Rainfall varied from 120 inches in the northeast to 60 inches per annum in the southwest. The sawmill industry started with numerous small mills using inserted tooth circular saws to cut local needs with no facilities for seasoning or preservative treatment and inadequate equipment for dressing and finishing the sawn timber. The efficient export mill, so useful as a training centre elsewhere, was absent.

This industry was based on old growth, it was very wasteful due to the inserted tooth saws and lack of thinner resaws and the product was of mediocre quality. Until the second world war the favourite species were *Cedrela mexicana*, *Manilkara bidentata*, and *Carapa guianensis* hauled by bull for up to five miles to a motor road by small contractors who sold at roadside to sawmill owners owning trucks or to timber merchants who used a convenient sawmill to convert the logs. These contractors were repeating the "creaming" operation characteristic of the forest economics of parts of the Amazon Valley today.

The war brought an enormous increase in the demand for timber. Much of this was supplied by imports but the effect on the local forest economy was the provision of markets for many formerly unsaleable species and for much charcoal. The accessible forests were "creamed" again but a shelterwood was retained and the residue was converted to charcoal in selected forests thus providing ideal conditions for the extension of intensive forest management in the depleted forests.

By this time several techniques for creating second growth forest had been evolved; the tropical shelterwood system was started in Arena forest in 1931[2/] and the conversion of the forest on calcareous clay soils to teak (*Tectona grandis)* plantations started in 1913 and gradually expanded. To these was added the conversion from hardwoods to pine plantations of the forest on acid sandy soils. This was started experimentally in 1948, and was followed in 1952 by the conversion to valuable mixed hardwoods of accessible and fertile parts of the Northern Range of mountains by the taungya system. There was, in addition, an important development on private estates where the more fertile parts had been converted from hardwood forest to cocoa and coffee plantations. This conversion created conditions ideal for the growth of the valuable furniture woods *Cedrela mexicana*, *Cordia alliodora*, *Swietenia macrophylla*, and *Tabebuia pentaphylla* all of which are light demanders. These species had not proved easy to grow in Government timber plantations and their spread by windborne seed through the 150,000 acres of cocoa provided a supplement to the income of the private owner and to the output of the permanent state forest. They formed a mixture among the Erythrina, the planted shade tree, and reached maturity in forty to fifty years. When mature, estate owners usually felled them themselves to minimise damage to the cocoa and sold them at stump for $1.10 per cubic foot to contractors. On several estates timber sales are now a major source of revenue especially when cocoa and coffee prices are low and when the old cocoa trees are being replaced by new high yielding clones.

When conditions became more normal after the war it was already evident that the waste and inefficiency inherent in conversion by

2/ Moore, D. 1957. The effects of an expanding economy on the tropical shelterwood system in Trinidad. Seventh British Commonwealth Forestry Conference, in Australia and New Zealand.

innumerable small circular sawmills could not be tolerated if Trinidad's policy was to be maximum self sufficiency in timber. The cooca estates were producing considerable quantities of the furniture woods, teak thinnings were beginning to influence markets in Southern Trinidad, and logs from the old growth forests were becoming inaccessible. At the same time imports of coniferous timber of good manufacture were tending to make inroads into the local market owing to low standards of manufacture of local hardwoods and lack of seasoning after sawing.

Since before the war the Forest Department had endeavoured to persuade the sawmilling industry to replace the circular with bandsawmills. However it was not till 1951 that the first self contained British Stenner 48-inch bandmill started operation. This change had been advocated in the interests of economy in wood, especially in the smaller material beginning to come from regrowth stands. By 1956 a revolution in the sawmilling industry had been achieved and thirty bandmills were operating. This result was due to the fact that much of the sawing is "custom sawing". When the log owner had his wood cut in a bandmill he got more boards per cubic foot of log and therefore the circular sawmills went out of business. It was remarkable also how quickly the Trinidadian sawmillers mastered the technicalities in sawing large, very heavy, hard woods like *Mora excelsa* with small bandsaws. Since 1956 the tendency has been to put in larger bandmills with 54-inch and even 60-inch pulleys. This tendency to larger units has the advantage that sawmilling becomes a full time business instead of a part-time estate activity. It is then easier to improve the grading, seasoning and preservation of timber to make the local product competitive with the imported article.

However these new mills could not convert the small teak plantation poles under 12 inches in diameter economically. The flow of this material as thinnings from the 12,000 acres of teak plantations was rapidly increasing. To use this, a series of small forest industries was started by Government which used 5- and 10-year old thinnings for wire bond split teak fencing, 10- and 15-year old poles fence and house posts, and larger poles from 20 - 30-year old trees for the production of sawn scantlings, flooring strips, and furniture squares. A hot-and-cold creosoting plant was part of the equipment and was used to render fencing and fence posts durable.

The organization of the marketing of teak thinnings has made use of innumerable small contractors. The 5- and 10-year old thinnings are felled by the government forest workers but their subsequent conversion to pickets is done by small contractors who sell to the fencing factory. The factory workers are paid on out-turn of 25-foot rolls of fencing. After drying, the rolls are creosoted and marketed through depots in the larger cities. Similarly, larger poles for sawing are delivered from a radius of up to 30 miles by contractors owning lorries. The price for transporting them is decided by tender and all thinnings in the older plantations have to be extracted unless rejected by the Forest Rangers owing to defect. Of all timber used the size 2" x 4" is the commonest. Twenty-year old teak poles give one such scantling 12-14 feet long and may give in addition two flooring strips from the off-cuts and fence posts or pickets from the top. Conversion is by twin bladed circular gangsaw and resaw in an electrically powered mill. There is in addition a large market for creosoted fencing posts.

Most of the teak thinnings are saleable and consequently much of the cost of these plantations is being recovered at an early stage in their growth. It has not been so easy however to market the intermediate yield of the mixed hardwood stands. There is less uniformity in the products, it is usually not durable and may be less concentrated. The first successful sale was in a 12-year old research area where the stocking in the regenerated stand was reduced to 75 trees per acre. How far thinning in regenerated mixed hardwoods can be paid for by revenue from sales remains to be seen but is probable that this form of thinning will be necessary on an extensive scale. Because of the abundance of the regeneration much will depend on the possibility of economic production of chipboard and paper in Trinidad.

Another development which has improved the quality of timber sold in Trinidad was the installation in 1956 of a commercially operated wood preservative plant in Port of Spain the capital. This treated both the imported softwoods and the local hardwoods and will prevent much of the termite damage so prevalent throughout Trinidad. It has become possible to render perishable woods and sapwood durable in this way and has extended the market for the faster growing and softer timbers.

When the Northeast Morā Forest Working Plan was introduced to control cutting in 19,000 acres of forest where *Mora excelsa* was dominant, its most important provisions were the concentration of all felling operations in three cutting sections. These were made accessible by public roads which were extended as new, all weather forest roads to permit the 120 small contractors working there to extract their logs and charcoal economically. The previous unplanned creaming of the whole forest had made supervision expensive, regeneration impossible on an organised basis, and yield control unsatisfactory. There was much opposition to planned management at first but the provision of easy access to formerly inaccessible untapped stands won over the contractors. The very complete utilization which followed concentrated working, caused much soil disturbance and plentiful regeneration has been the result. Nevertheless most of this regeneration is of low grade timbers and silvicultural work to improve its quality is essential.

By the middle nineteen fifties it was possible to draw up a forest development plan for the whole country indicating the lines along which the adjustment of the forest economy from being chiefly dependent on old growth stands to being supplied by second growth forest, could be carried out. Throughout the half of Trinidad covered by privately owned estates, timber production as shade above cocoa and coffee and as shelterbelts would tend to become more concentrated on the sites best suited for the food trees. On these the high yielding cocoa strains would received manurial treatment. On some estates plantations of mahogany, teak, and pine were being developed and, on parts of the Northern Range, natural regeneration of mahogany had proved successful in mixed hardwood forest after opening of the canopy. It was estimated therefore that output from private estates would be maintained and might increase under a Government sponsored forest dedication scheme which has been started.

The state forests would eventually cover about 318,000 acres or 25 percent of the country Of this 100,000 acres was protection forest on high steep hills on the Northern Range and Trinity Hills, 8,128 acres were swamp, and 50,000 acres were scheduled for conversion to teak plantations. The pine plantation scheme was still being developed but was likely to absorb 50,000 acres of acid sand and sandy clays of the Talparo type at a planting rate of 1,000 acres per year and natural regeneration of mixed hardwoods was already planned over 31,800 acres at 1,000 acres per year on a 30-year cycle. These add up to 131,800 acres of state forest allocated for treatment out of approximately 190,000 acres which may eventually be made accessible. Parts of the unallocated portion have been and will be included in nature reserves and will receive no treatment other than protection, but the major part unallocated will come under regeneration treatment when the soils have been mapped.

This conversion plan will be paid for mainly by the revenue from the mature forest. In Trinidad owing to the very large number of small contractors, forest produce is not normally sold by auction to the highest bidder but at fixed royalty rates, although it may be worth considerably more. This is done to safeguard the small contractor but it has administrative disadvantages in areas where demand exceeds supply. If sale by tender were permitted a much higher Government revenue might well be possible.

The population of the country is now about 750,000 and it absorbs approximately 1,328,000 cubic feet of imported sawn wood and 2,630,000 cubic feet of local sawn wood or 5.65 cubic feet per head. By the end of the century the population may well exceed 1,200,000 with a requirement of 9,000,000 cubic feet of sawn timber and a considerable absorption of small wood in chipboard, matches, and possibly a paper factory. There may then be 36,000 acres of teak and 40,000 acres of pine plantation producing an estimated volume of 4,000,000 cubic feet of sawn wood per year and the regenerated mixed hardwood forest with an increment provisionally estimated at 40 cubic feet sawn wood per acre per annum over 40,000 acres providing 1,600,000 cubic feet of lumber per annum. Timber from private estates may amount to 400,000 cubic feet per annum. There may always be a large import of wood but these conservative figures give some indication of how Trinidad may develop its managed forests to supply its need.

In carrying out the plan, the plantation programme, whether a conversion to teak, pine, or furniture woods, depends on the cooperation of an adequate number of gardeners willing to grow food crops on the area to be converted each year. Future prospects in this respect are good because of the rising population. In the mixed hardwood forests, however, although there is a good market in the match factory for one suitable species, *Didymopanax morototoni* a new market is required to absorb branchwood, defective trunks, and unsaleable species. In the past this has been sold as firewood and the bulk of it has been converted on the spot to charcoal by primitive pit methods. However in recent years there has been a gradual change in domestic practice from cooking on charcoalpots to cooking on oil or electric stoves. This trend is likely to spread with higher living standards and the demand for charcoal and firewood may fall.

The chances of developing a new market for this low grade material are dependent on several economic factors. Cordwood from mixed tropical forest is variable both in hardness and shape compared with debarked coniferous billets available in temperate countries. It is liable to insect attack and decay in storage. The yield per acre is usually low in mixed tropical stands and no convenient cold season occurs to harden the ground and provide easy skidding conditions. Nevertheless the all weather road system being developed in the forests, the concentrated plantations, and the short distances, should make prospects in Trinidad better than in most other tropical forest countries.

A recent United Kingdom publication[3] "Board Mill Survey," H. M. Stationery Office, London, December 1958, lays down the price that could be paid at mill for bone dry debarked billets of coniferous thinnings as Pds. 8:10:0 per long ton and remarks that this is the equivalent of typical North American costs of coniferous pulpwood thinning. About 10,000 bone dry long tons per annum would be necessary for the smallest economic unit. This is equivalent to 750,000 cubic feet of billets obtained from pine, teak, and mixed hardwood sources. Such an output should be quite possible from the Trinidad forests provided mixed species of varying shape and hardness are acceptable. However a great deal of investigation into the technique of chipping such mixed raw material would be necessary. Teak, for instance, is an abrasive timber and so are several local hardwoods. There are also in Trinidad several groups of sawmills producing waste and a large source of raw material in the form of bagasse, an offshoot of sugar production which is now exported to England for manufacture to Celotex but could be used for insulation board in Trinidad in

3/ Anon. 1958. **Board Mill Survey. H. M. Stationery Office, London** an integrated fibre and chipboard factory. It would be necessary to render the products of such a factory resistant to termite attack by the inclusion of a suitable wood preservative during the process of manufacture. Markets would lie in the Caribbean and adjacent Latin American countries.

The stage now reached in Trinidad is beyond the experimental stage of management and silviculture. The population appreciates the value of the forests to the country, funds are not a limiting factor to expansion. Future development will however be greatly accelerated if cordwood can be readily marketed as chipboard or in a fibre board factory.

The problems that face tropical South America in improving its mixed hardwood forests are common in greater or lesser degree to all mixed hardwood tropical forests. Large manufacturing units prefer a uniform raw material; extraction costs per ton in the wet tropics are usually high unless level country, sandy soils roads, and/or water transport are available; yield per acre and increment in the mixed hardwood stands are usually low compared with pure plantations[4/]; silvicultural work is expensive except where a ready market permits the removal of low grade material without cost; markets in the tropics tend more and more to prefer "manufactured" wood which is stable, insect proof, and uniform in its properties. Industries based on temperate coniferous forests and tropical plantations of pines and Eucalypts have major advantages in mass production of a standardised product. The new particleboard factory in British Guiana uses only wallaba *(Eperua falcata)* a very hard durable wood which grows pure on poor sandy soil. Their problem is the cost of transport to distant markets.

It is evident therefore that in tropical forests, silviculture is greatly influenced by utilization. Heavy expenditure on silviculture can be justified only where revenue is high or where there is an assured high increment such as occurs in tropical pine plantations. There will indoubtedly be a market for furniture woods grown in mixture and for woods which have special uses such as balsa but the size of it will probably be less than ten percent of total demand. The trend is towards natural regeneration and plantations of one or a few fast growing species of proved value for bulk supplies.

Nevertheless there will be areas allocated to forest in each country where the removal of the mixed forest and its replacement by pure, or even mixed, plantations may be unsound silviculture because of rapid soil deterioration under tropical conditions. Examples are the Arena sands in Trinidad, and the sandy soils of British Guiana, and the Benin sands of Nigeria. Even on these however the shelterwood technique is tending towards a forest of a limited number of species which regenerate prolifically.

Policy should aim at cheap uniform bulk supplies and a much smaller production of valuable woods for furniture and special purposes. This is Trinidad's policy. It will tend to spread in other tropical countries as increased population develops more balanced land use and creates internal markets forest products.

4/ Dawkins, H. C. 1958. The volume increment of natural tropical high-forest and the limitations of its improvement. 2nd Session of the Inter-African Forestry Conference Pointe Noire.

# Educación de Dirigentes Políticos e Industriales en Materia Forestal

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Como sucede en todos los casos que se refieren a la conservación, fomento y correcto aprovechamiento de los recursos naturales, especialmente los de carácter renovable, el problema fundamental para asegurar el futuro de los bosques, y la máxima utilización de la riqueza potencial que encierran —obtenida en forma que no ponga en peligro su conservación— es lograr una correcta educación ciudadana, que pueda servir de base clara y sólido apoyo al desarrollo de una buena política forestal.

Frecuentemente sin embargo, la opinión pública en materia forestal oscila entre dos actitudes igualmente nocivas a los bosques y a los mejores intereses sociales.

La primera, es de absoluto desprecio para el monte y puede manifestarse de dos maneras.

En primer lugar es frecuente, especialmente en países poco desarrollados y con notoria riqueza forestal, que se considere ésta como de gran valor económico, pero inagotable; y que, en consecuencia, se explote en forma desordenada e intensa, superior a sus posibilidades de reemplazo, lo que pone en peligro su futuro.

En otras ocasiones, cuando la mentalidad de las colectividades es fundamentalmente agrícola o pastoril —y ésto se ve frecuentemente cuando se trata de grupos que han emigrado hacia zonas boscosas provenientes de otras regiones— es frecuente que se piense que el bosque no es sino un obstáculo para la agricultura y la ganadería. En tales casos su destrucción es sistemática, con objeto de dejar superficies más o menos grandes de tierra abiertas a las nuevas actividades. Y aunque naturalmente se hace uso de la madera de los árboles derribados, y ésta tiene importancia en la vida de las comunidades para la construcción de casas, cercas, aperos de labranza, o bien para combustible, sólo se considera ello cosa secundaria, pensando que, fundamentalmente, lo esencial es lograr los mayores productos agrícolas o ganaderos, para que con el valor de éstos, se pueda tener en el futuro la madera necesaria, por compra y no por corte directo.

Y frente a éstas dos actitudes, que tanto daño han causado y causan a la conservación de los bosques, encontramos otra diametralmente opuesta, que en principio parece correcta, pero que en realidad causa también graves perjuicios. Nos referimos al amor romántico y el culto fetichista del árbol que, usando figuras poéticas, habla del sufrimiento de uno de éstos seres cuando recibe el golpe del hacha o siente los dientes de la sierra y que —exagerando la metáfora— compara sus secreciones con la sangre de un animal sacrificado. Esta actitud romántica no comprende cual es el verdadero significado y el ciclo ineludible de los seres vivientes que, sin excepción alguna, nacen, crecen, se reproducen, y mueren; en consecuencia, no porque el hombre deje de utilizar el árbol productor de madera en el momento más adecuado, va éste a conservarse indefinidamente, pues acabado su ciclo entrará en un período de franca decadencia, que acabará con su muerte y desintegración.

Consecuencia de esta actitud, que no alcanza a entender que el árbol es cosa transitoria — mientras que lo permanente es el bosque—

son las orientaciones políticas fuertemente restrictivas, que postulan, como única manera de proteger los recursos forestales, prohibir o estorbar al máximo posible su aprovechamiento.

No es necesario que ampliemos la descripción de estas actitudes de todos conocidas. Ni es tampoco menester enfatizar los graves perjuicios que a los bosques han causado, pues también ésto es perfectamente conocido, especialmente para un auditorio especializado, como el aquí reunido.

Es necesario y urgente, si queremos asegurar el futuro del bosque y de la industria forestal, orientar a la opinión pública, creando una actitud correcta frente a estos problemas, que se alce indignada contra una explotación irracional, que amenaza agotar una riqueza que debe ser permanente; y que también se oponga enérgicamente a los desmontes con fines agrícolas o ganaderos, cuando no están justificados. Y que —por otra parte— no sólo no mire con aprensión y trate de estorbar o impedir el aprovechamiento racional del bosque, sino que lo estimule basado en dos premisas fundamentales: (a) que el hombre tiene derecho a utilizar en su provecho los recursos que la Naturaleza le brinda a través de los árboles; y (b) que un bosque bien explotado, no se encuentra en peligro de extinguirse, sino que tiene mayores posibilidades de conservarse y mejorarse que uno sujeto a las causas naturales de destrucción, en cuyo cuidado no intervenga un móvil de interés económico que, como bien sabemos, es el más importante de todos.

Educar al pueblo en materia forestal es de extraordinaria importancia. Y frecuentemente se piensa la forma en que tal educación debe darse a los escolares, a los agricultores, o a las masas de adultos en general, pensando preferentemente en grupos de obreros o campesinos.

Pero a menudo se olvida que en la formación y mantenimiento de la opinión pública, intervienen otros sectores sociales de gran importancia, entre los cuales hay que mencionar muy especialmente a los dirigentes políticos, sociales, o industriales.

En las colectividades actuales, la acción de estos elementos sigue siendo tan importante, como lo fué en las sociedades primitivas. La democracia moderna, permite la intervención del mayor número posible de individuos para orientar la marcha de los pueblos; pero en realidad, muchas veces esta intervención colectiva se manifiesta sobre todo para dar respaldo y poder a un grupo de personas —precisamente los dirigentes que mencionábamos— quienes adquieren con ello fuerza capital para orientar la opinión pública. Es pues indispensable educar también a estos dirigentes en materia forestal, pues la experiencia muestra que frecuentemente abrigan a este respecto ideas que por lo absurdas y anticientíficas no difieren de las que tienen los sectores menos preparados.

Es pues necesario aceptar que este tipo de ciudadanos, de actuación tan decisiva en la vida moderna, requieren una educación en materia forestal, como la que pueda requerir cualquier otro grupo social.

Pero hay que señalar también las serias dificultades que existen para convertir en realidad ese propósito; mucho mayores que las que se presentan en otros grupos sociales más fácilmente accesibles.

No nos referimos, claro está, al caso de los escolares, donde cualquier tarea de educación resulta relativamente sencilla puesto que, en esta etapa de la vida, la sociedad ha hecho comprender al ser humano que su principal misión es la de adqurir conocimientos y experiencia.

Entre los adultos, quienes no logran un éxito en la vida que los coloque en situación preponderante, frecuentemente tienen una actitud de relativa humildad, y fácilmente aceptan sus limitaciones y su ignorancia. En estos casos lo único que hay que vencer, para adoctrinarlos, es la fuerza de la inercia; una vez logrado, se tiene un auditorio al que en nada ofende que se parta del presupuesto de que no conoce el tema sobre el cual se le va a ilustrar, y que al conocerlo, obtendrá gran provecho en su superación cultural.

Pero cuando se trata de personas destacadas, cuando se trata de dirigentes — como los que se mencionan en el título de este trabajo— la situación varía. El hombre que ha tenido éxito en la vida —en cualquier forma que sea— se encuentra en situación de predominio que le permite influir en el destino de otros seres que han caminado con menos suerte. Y consecuentemente está sujeto a una continua adulación, de muy variadas formas, pero en la que los aduladores destacan siempre la gran capacidad y profundos conocimientos del halagado. Y este llega a creer sinceramente que la habilidad que le permitió colocarse en el sitio destacado que ocupa, le capacita también para opinar —y aún imponer su opinión— en cualquier otro terreno.

En tales condiciones, la persona a quien se quiere educar en material forestal no suele recibir con simpatía la sugestión de que debe y puede ser educado. Por el contrario, piensa que sus ideas erróneas, falsas, o insubstanciales, son en realidad las que deben aceptarse, y que en consecuencia, ninguna necesidad tiene de cambiarlas.

Hay pues que recurrir a medidas sutiles, y a una serie de artificios para lograr que este sector, al que es urgente educar, se preste a ello.

Desgraciadamente, como el medio en que actúan los diversos tipos de dirigentes políticos, sociales, o económicos es muy variado, resulta casi imposible sugerir una medida general que permita allanar el camino para llegar hasta ellos y lograr que, posiblemente sin darse cuenta, se coloquen en una aptitud receptiva, que es la primera e indispensable condición para lograr que una enseñanza cualquiera pueda fructificar.

Habrá que estudiar, caso por caso, cuales son los intereses de cada grupo y, en lo posible, usar como punto de partida la admiración que puedan tener sus integrantes para quienes lograron destacarse en el mismo, y que en alguna forma —directa o indirecta — puedan haber dicho o hecho algo de valor para la causa forestal.

Exponer las ideas de un técnico, de un hombre de ciencia, de un trabajador profesional en materia forestal, seguramente no servirá de mucho, pues el espíritu de grupo, y esa autosuficiencia que como antes dijimos suele ser compañía inseparable de los dirigentes humanos, le harán pensar que aquel individuo, cuyo éxito material en la vida seguramente no se compara al suyo, pudo también estar equivocado en lo que decía; mientras que él, que tan alto se ha colocado, debe seguramente tener ideas más claras sobre esos problemas. Pero si se logra encontrar un representante de su mismo grupo que haya hecho o dicho algo en materia forestal —aunque a veces ésto tenga que exagerarse en su significado— pensará que el juicio de aquel sí es válido y que, en consecuencia, él también debe interesarse por esos asuntos.

Por otro lado, dentro de la tésis pragmática que generalmente suele predominar en este grupo de personas, será conveniente encontrar alguna ilustración fácilmente comprensible, de cómo una correcta actuación con respecto a la cosa forestal, puede directa o indirectamente beneficiarlo.

Tomemos por ejemplo un líder en el campo político; esto es, un alto funcionario en cualquier ramo de la administración, un legislador, o el miembro destacado de algún partido. En tal caso, será conveniente hacer notar cómo la correcta administración de los recursos forestales no solamente puede contribuir al desarrollo de la economía nacional, y a una mejor marcha de la cosa pública, sino que, además, coloca a quien tiene estos conocimientos en situación de poder destacarse frente a sus otros colegas en el campo de la política, que carecen de tal preparación; lo que indudablemente repercutirá en su propio beneficio. Es decir, habrá que hacer ver los resultados prácticos que se persiguen, y tratar de ligar tanto como sea posible el interés colectivo con el individual del que escucha.

Si se trata de líderes de carácter social, es decir de dirigentes de masas obreras o campesinas, habrá que abordarlos explicándoles cómo los grupos que conducen y representan, pueden beneficiarse grandemente con un adecuado tratamiento de los bosques. Cuando se trata de grupos campesinos esto es relativamente más sencillo, puesto que el hombre de campo se encuentra ligado con la Naturaleza, y en muchas ocasiones deriva del bosque productos importantes para su vida. Pero aún en el caso de aquellos que no están directamente ligados con el bosque sino que se dedican a actividades agrícolas o ganaderas, existe siempre la posibilidad de demostrarles que un buen manejo de los bosques en las cuencas hidrográficas, se traduce en mejor conservación del suelo y mejor utilización del agua, recursos básicos para obtener buenas cosechas o tener pastos de mejor calidad para el ganado. Y así también, junto al aspecto de interés colectivo, puede colocarse el de interés particular, mostrando a dicho líder que el tratar adecuadamente un tema que muchos de sus compañeros enfocan incorrectamente, no sólo le da mayor prestigio, sino que le permite explorar nuevos caminos en su tarea de dirigente.

Por último, si se trata de personas destacadas en el campo económico, esto es de dirigentes relacionados con la industria, el comercio, o las finanzas, podrá hablarse ante ellos de que, en el complicado engranaje de la sociología y economía modernas, la correcta explotación de todos los recursos está estrictamente ligada y, en consecuencia, la falla que en el aprovechamiento de cualquiera de éstos pudiera incurrirse, habrá de repercutir en todos los demás. Claro está que si se trata de un industrial que beneficie la madera, o de un comerciante que trafique con productos forestales, o de un financiero que maneje créditos para actividades silvícolas, no será mucho lo que habrá que decir para despertar su entusiasmo, ni tampoco será menester insistir para que comprendan que cualquier falla que pueda ocurrir en el campo forestal, habrá de tener repercusiones en otras actividades con las que ellos están ligados.

Si se logra este punto fundamental de aproche, si se llega a conquistar la confianza de tales dirigentes, el siguiente paso será seleccionar cuidadosamente el material que debe usarse en esta tarea de educación forestal.

Tal material debe ser lo más concreto y conciso posible. Hay que tener desde luego en cuenta esa peculiar psicología a que antes aludimos, que hace pensar a los miembros de estos sectores privilegiados que poseen conocimientos de los que en realidad carecen y, en consecuencia, si comenzamos nuestra tarea expresando algunas verdades fundamentales en forma de correcta exposición pedagógica, corremos el riesgo de despertar su antipatía, pensando que les hacemos perder el tiempo con ello. Por eso, será menester hacerles suponer que pensamos que ellos ya tienen un conocimiento básico sobre la materia, que poseen ideas claras y constructivas, y que lo único que se requiere es clarificar y sistematizar las mismas para ponerlas al servicio de una buena causa.

Es también indudable frente a estos individuos, que no van a intervenir de manera directa en el manejo de los bosques, que no sería util darle normas y orientaciones de carácter técnico. Lo que se requiere, es brindarles conceptos generales, mostrar que deben aceptar con simpatía lo que los especialistas en la materia exponen y que, ellos a su vez, con su gran influencia social, deben procurar que la buena semilla fructifique. Es decir, hay que crearles la psicología del sembrador, haciéndoles notar claramente que si nos dirigimos a ellos, no es tanto porque pensamos que ignoran el problema, sino porque queremos utilizar su influencia para que nos ayuden a hacérselo comprender a quienes si lo ignoran; y que, en consecuencia, nuestra aportación más que para brindarles nuevos conocimientos la dirigimos simplemente a darles una técnica con la cual puedan exponer estos problemas para influir a la opinión pública.

Los conceptos básicos que deben hacérseles llegar son extraordinariamente variados, y dependen grandemente del estado general de la conciencia forestal en cada país o región. Por ejemplo, en algunos países con conciencia forestal aún no desarrollada o con una opinión pública que se ha conducido por caminos erróneos, será necesario insistir sobre tres o cuatro principios básicos, de enorme importancia inmediata, para usarlos como cimiento de futuras construcciones. En estos casos, será inútil tratar asuntos detallados de índole más elevada, puesto que los problemas a que se refieren no podrán ser enfocados, hasta en tanto no se hayan superado las primeras etapas.

En cambio, si tratamos de enfocar así el problema en un país con una industria forestal sólida y bien orientada, donde los ciudadanos ya están familiarizados con muchos de estos conceptos, no haríamos sino repetir lugares comunes y, en consecuencia, rápidamente perderíamos el interés de nuestro auditorio.

Hemos hecho pues el agrupamiento de los conceptos básicos que en materia forestal deban tener los dirigentes sociales, distribuyendo a éstos en tres grupos: (a) aquellos de países con una gran riqueza forestal, que por inaccesibilidad de la misma, escasez de población, u otras causas no ha sido aún tocada; (b) aquellos de países que tuvieron una riqueza forestal en el pasado, pero que por un tratamiento inadecuado de la misma han llegado casi a extinguirla; (c) aquellos otros que aún tienen una riqueza forestal apreciable y que la están explotando de manera inadecuada que, de continuar por algún tiempo, pondrá en peligro su futuro; (d) aquellos otros en que existe riqueza forestal, y ésta se maneja en tesis general de manera correcta; y (e) por último, el de aquellos países prácticamente sin recursos forestales de valor económico, pero en los cuales la forestación pudiera ser esperanza para el futuro, ya sea por el papel protector de los bosques en las cuencas hidrográficas, por su importancia como sitios de recreo — en el caso de los Parques Nacionales— o bien por la posibilidad de crear nuevas fuentes de riqueza.

Cada uno de estos casos requerirá un tratamiento que, orientando en forma semejante en lo que hace a la técnica de transmisión del conocimiento y formación de una conciencia forestal, diferirá sin embargo notoriamente en lo que respecta a las peculiaridades específicas de los temas abordados.

Naturalmente, cuanto más concreta sea la manera de exponer los problemas en cada caso, cuanto más ligadas estén las ilustraciones que se ofrezcan con la vida diaria o con las experiencias pasadas del sujeto, más fácil será despertar su interés y cautivar su atención.

En consecuencia, aún aceptando la posibilidad de usar como guías los lineamientos generales acabados de mencionar, resultaría estéril entrar en detalles que, para ser útiles, deberán enfocar aspectos peculiares, imposibles de abordar en una generalización.

La cooperación del experto en problemas forestales, el psicólogo práctico, y el especialista en relaciones públicas, dará las bases convenientes para formular, en cada país, un adecuado programa de educación forestal para sus elementos dirigentes, que tanto necesitamos para clarificar y orientar la opinión pública.

# Natural Regeneration in the Humid Tropical Forest

by

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This paper is general to conditions of the humid tropical forest but, as the writer has had experience of these forests only in West Africa his personal experience is limited and considerable reference has had to be made to the literature. The paper is based largely on Ghanaian conditions with notes on pertinent variations noted from other countries.

What the term "natural regeneration" means in the conditions of the humid tropical forest must be defined. As a forestry term in the forests of the temperate zone "natural regeneration" has a reasonably logical meaning.

The ecologist also uses the term but his natural regeneration is the process by which a climax community maintains itself. A very large proportion of the commercial forests of the world are not climax communities but seral stages. Left undisturbed the existing species would be superseded by others and the foresters operations to stimulate natural regeneration of the existing crop is actually perpetuating a seral stage and not letting nature take its course.

The humid tropical forest, with very few exceptions, is a most complex mixture with hundreds of tree species growing intimately together of which the commercially usable species only furnish a very small percentage.

Natural regeneration in the ecologist's sense here has a perfectly valid meaning: that the forest should be perpetuating itself by new seedling growth of the whole or greater part of the great mixture of species; that it is going to remain forest of relatively similar type; that it will neither die away and be replaced by another vegetative type, say tropical wet grassland, nor remain forest but be replaced by an entirely different set of species or a single species.

The "natural regeneration" of the tropical forester is quite different. His business is to bring the forest to the highest productivity for man's use. He is concerned therefore with the regeneration of these species which are either of known present value or those which are likely to be usable by man. Only if other species are conducive to such regeneration or to its health, which includes the very important factor of maintenance of the soil, will they be considered and fostered by the forester. All others can only be considered detrimental, as reducing the growing space of, and competing for light, moisture and nutrients with the favoured trees, and as such are weeds.

"Naturally regenerating" the humid tropical forest is an attempt to convert a very complex mixture of species into a much simpler one with a high proportion of certain species (determined on the basis of their utilisable potential and not of their silvicultural or ecological characteristics) and as small a proportion as possible of any others.

Further, we wish this regeneration to arise in quantities which will at least replace, but much more often greatly exceed, the amount of these species taken by commercial exploitation from the existing forest. This replacement must, therefore, be not only equal in quantity but at the same rate, which involves the subsequent growth of the regeneration.

Lastly, in practically every case in which it has so far been attempted this "natural regeneration" has also aimed at the conversion of the existing forest, which is allaged or at least all-sized, into a roughly evenaged crop in which all stems will have arisen within 10 - 20 years of each other. This is another enormous change in the ecological environment, the full effects of which are still unknown.

The "natural" part of such regeneration is therefore reduced to the reliance upon existing seedlings and saplings or to seedlings arising from seed from individual stems of the desired species in the existing forest. All the techniques so far used and the results are quite "unnatural" as they do not occur in nature and are artificial.

I should like to refer again to the condition that such "natural regeneration" must at least replace, and preferably exceed trees removed by commercial exploitation. This would appear to conflict with the foresters maxim that the yield must be based on the growth. Net growth in the undisturbed mature humid tropical forest is nil, such growth as occurs is replacement of death and decay. If exploited for commercial species but otherwise untreated, further growth will occur in the forest but largely of the remaining unwanted species. Restrictions of yield to estimated potential growth on the remaining portion of the commercial species in the stand would be quite uneconomic and the forests would simply not be worked or developed for timber. Almost certainly the remaining areas would be taken over for other cultivation. Enormous areas have already vanished to cultivations which are of doubtful permanent value but give an immediate return. The only sure way to stop this process is not by legal (but barren) protection of the remaining forest but by showing that these forest can yield an economic and increasing return to mankind as forests, in preference to the "mining" by temporary cultivation of the accumulated nutrients in their top soil. The tropical forester must work on the basis that a yield to justify the opening up and treatment of the forest will be cut and it is up to him to replace and grow the trees to make this good. When it is known that a fair average productivity of timber from the lands devoted to its production is being attained then the yield should be restricted to the growth in the interests of sustention.

The regeneration of the tropical humid forest must be assessed on this basis and if natural regeneration will not ensure reasonable productivity then recourse must be made to artificial method such as compensatory plantations or enrichment planting.

The decision as to whether natural or artificial regeneration should be followed is not however a matter for *ex-cathedra* decisions. It can only be taken in respect of one particular forest or type of forest as it actually exists on the ground. In Ghana certainly, natural regeneration is the most suitable for some types while in others it is so unlikely to attain the desired ends that resort must be made to artificial regeneration. I think circumstances in other countries are likely to be similar.

Before passing on to the techniques currently employed by the forester I should like to discuss what is known of the natural regeneration as the ecologist considers it. Though, as pointed out above, the forester must employ largely artificial means these would be doomed to failure unless they took into consideration the silvicultural characters of the species concerned and the general ecology of the forest.

The first question is whether the humid tropical forest as it exists today is in seral stages or is true climax vegetation. In West Africa it is very doubtful any of these forests are truly primeval. The great bulk, throughout the centuries since man became a cultivator, must have been broken at some time for cultivation. After a period of between 60 and 100 years since such cultivation, it is imposible in the writer's experience to differentiate with certainty from the vegetation alone whether there has been any disturbance by man. The investigations of the Cambridge Botanical Expedition to the Benin Forests of

Nigeria, which showed from evidence in the soil that these forests must all have been cultivated anything between 200 and 400 years ago, demand a considerable readjustment in the idea of what is primeval forest and also I consider of the climax concept. With the absence of growth rings in all the major tropical trees the forester and ecologist is deprived of one of the most useful tools for the study of forests, but from such growth rate studies as have been made the life span of most of the emergent species would appear to exceed 300 years. To ensure that the existent vegetation was the climax it would be necessary to know that the same emergents were dominant 600 years previously which is practically impossible in West African conditions.

The question whether the general type of forest occurring in each region can be broken down into a series of associations or associes with definite composition or whether it can only be considered a wide pan-association with the proportion of the component species varying fortuitously is also of interest when it comes to treatment designed to favour certain species. In Ghana the broad pan-association concept appears the more reasonable. Over the whole area of the humid forest zone, 30,000 squares miles, we have only been able to distinguish five or six broad types correlated with rainfall and soil and not solely by species composition. Nigeria has tended to drop even these distinctions and at present considers that the whole humid forest should be treated as one type until more is known about it. In Malaya conditions would appear to be the same, they divide their forest into Lowland Dipterocarp Forest and Upland Dipterocarp Forest but do not differentiate further and the late F. H. London was quite definite as to their status: "The undisturbed forests have reached ecological maturity and fluctuations in time and spare are probably due more to chance than anything else." In British Guiana however much more clearly defined types correlated with different soils which can be considered as associations are evident. They are however, climax associations regenerating themselves.

Uganda, whose humid forests are outliers of the great Central and West African Forest, is the exception, distinct seral stages are to be found in these forests leading to a potential climax dominated by *Cynometra alexandri* and the regeneration in each seral associes is not its own but that of the next colonisation stage. In the Belgian Congo the botanists consider they can define associations in the mature forest. It is considered however that the greater part must have been subject to disturbance by cultivation at some time in the past and that they are in stages of development subsequent to this. The very important stands of okoumé, *Aucomea klaineana* in Gabon and French Equatorial Africa are also known to be seral stages following disturbance. One cannot therefore generalise too far and expect that a single silvicultural technique will be valid over all the humid tropical forests.

In Ghana early investigations showed that most of the desired trees such as the *Khayas* and *Entandrophragmas* required fairly full light for their development. They were definitely light demanders. As the undisturbed forest is generally dense with only a very little light reaching the forest floor the regeneration of these species would appear to be threatened and a gradual change of the forest towards one composed solely of the shade bearing species to be expected. We have however, now enumerated 64,280 acres in sample strips covering 4,362 square miles of Forest Reserves dispersed over the humid forest zone, all fairly mature forest, some still at the stage where effects of past cultivation can be detected, the majority probably cultivated during the past 5 centuries and some areas possibly truly primeval. When the all-species number/girth curves from these enumerations are examined they all show that the forest as a whole is being regenerated as there are ample smaller stems to replace the larger, and when individual species curves are prepared the great majority show the same position. The *Khayas* and *Entandrophragmas* definitely show that there are sufficient young individuals to replace all the existing mature individuals allowing for the heavy mortality which occurs in the undisturbed forest, so that in spite of their being light demanders it is evident they do find sufficient niches for successful regeneration to maintain themselves. We have discovered that there are two valuable trees *Triplochiton scleroxylon*, one of the commonest trees, and *Terminalia ivorensis* both fast growing and very strong light demanders which have practically flat curves, similar numbers being found in each size class. These might with more reason be considered species due for suppression and extinction with time but very curiously this is repeated in all the enumerations examined. In none are they represented by a few old individuals with a complete absence of young regeneration though, as our sampling must cover a very wide range of maturity of the forests, this would be expected to occur. How they maintain themselves is not completely clear but it is evident that they do.

From the literature it is evident that similar conditions exist throughout this type of forest in West and Central Africa, Malaya, and British Guiana.

This regeneration is geared to the rate of natural change in the forests, with the emergents and dominants of the upper storeys surviving until death by old age or destruction by storms. Natural fires do not play any part within the tropical humid forest proper. The rate of regeneration is therefore very slow, and unchanged would be most unlikely to meet man's demands upon these forests for timber production.

That this natural regeneration in the ecologists sense is established for large areas is however not unimportant. In those areas where forest must be retained solely for protective reasons it can be taken to be self perpetuating without further treatment than simple protection, and, if at some time it becomes technically and economically possible to exploit these forests they will be no poorer in valuable species than at the present time. Also forests which are not specifically protective but are uneconomic to exploit at the present time due to lack of access or transport facilities are unlikely to deteriorate if protected.

It is not only in Ghana but is fairly general throughout the tropical humid forest that the commercially desirable species are light demanders. They are practically all emergents or trees of the dominant canopy and as such are physiologically adjusted to the full light to which they are exposed for most of their lives. The strong shade bearers are the species of the middle and lower storeys which rarely attain dominant or emergent status. As the young individuals of the emergents have at some time or another to pass through the lower shady canopies of the forest their seed generally germinates in the shady conditions of the forest floor and the seedlings are capable of surviving for a time. If there is any break in the canopy they will develop to saplings and again survive for a period in this stage. They cannot however continue growth and development unless some accident opens the canopy above them. The seed of these emergents are dispersed either by wind or by animals, and though the dispersal mechanisms are in many cases not very efficient and the bulk of the seed descends fairly near the mother tree occasional seedlings and saplings are found at considerable distances. Seeding in many species tends to be periodic rather than annual but in most years it is profuse. For the purpose of maintaining these species in the undisturbed forest it is adequate but the irregular seed years may have to be taken into account in silvicultural treatments for concentrated regeneration .

Besides the emergents such as *Khaya*, *Entandrophragma*, *Mimusops*, and others which are regular constituents of fairly mature forest there is an ever increasing demand for light easily worked woods such as the Merantis of

Malaya, Obeche or Wawa *(Triplochiton scleroxylon)* from West Africa, Limba *(Terminalia superba)* from the Congo, and Gaboon *(Aucoumea klaineana)* from Gaboon and French Equatorial Africa and this trend is likely to continue. These trees are all very strong light demanders and very fast growers and though they occur sporadically through the natural undisturbed forest they are much more common in recently disturbed forest where they may constitute a seral phase. Their light requirements from youth are much greater than described above and that they maintain a fairly steady population in the mature forest would appear anomalous. In West Africa at least (I have not seen it described so specifically from elsewhere) the regeneration of the natural forest appears to proceed in cycles. It may have started partially even aged from past cultivation and developed slowly to mature forest with a regular structure and full canpy. As more trees become emergent the middle storey becomes more sparse but as the emergents reach their life span and die the forest becomes vulnerable to the occasional storms and large breaks in the canopy occur. Existing seedlings and saplings of the emergent species make a spurt in growth, seedlings of *Musanga, Trema, Macaranga* quickly colonise the area along with seedlings of *Triplochiton, Terminalia superba, Ricinodendron,* and many others. The lianes also swarm in, annuals and perennials, and within a year or two it is a dense climber tangle impenetrable except to the elephant who finds this an excellent grazing ground and if they are common may by their regular foraging maintain it in this state for a considerable period. If they are not present the normal succession would be for this dense thicket of stems to push gradually upwards the fastest growers, *Musanga* etc. forming the upper layers followed by the *Triplochiton, Terminalias,* etc. then the emergents of the mature forest. Initially they carry the climbers up with them but gradually these die away and do not regenerate below the thicket. The short lived initial secondary species die a little later and the faster growing *Triplochiton* and *Terminalias* become dominant followed by the emergents of the mature forest till the general structure and composition of the forest is regained but with a proportion of these very strong light demanders among it. This is occurring over fairly large areas in the Benin forest of Nigeria, as described by Jones, probably because larger areas were originally under cultivation. In Ghana it occurs on relatively small individual areas and is not maintained by elephant as only in a few forests are they still present and then not in great numbers.

A very similar colonisation sequence follows native cultivation but as fire is used the existing seedlings and saplings are either killed outright, or all stemwood is destroyed and they must start again from the root stock, but most recruitment is from new seed entering the area. With the increase of population and the introduction of cocoa outside the forest reserves the post cultivation seral stages are usually broken again when they are in the stage of mature Musanga, about 10 - 20 years, and the mature forest form is never regained.

The canopy of the undisturbed forest generally consists of an incomplete canopy of emergents, a fairly full canopy of the deep dominant canopy, Richards B canopy, and a very dense canopy of the understorey. The leaves of lianes increase the density in all storeys but principally in the B canopy.

When we turn from the natural regeneration as it occurs in the undisturbed forest to the concentrated natural regeneration of economic species it is evident that as we are dealing almost entirely with strong or moderate light demanders a very considerable lightening of the canopy is indicated, either to induce growth on existing advance growth or that there will be sufficient natural seed falling and germinating to form the new crop, or to both.

The initial stage is always an attack upon the lianes by severing them at ground level and as high as can be reached. This not only lightens the canopy but allows mother trees freer crowns, reduces later felling damage, and reduces regrowth. In Ghana this is accompanied by a cutting of all the unwanted understorey species which can be severed by a cutlass. This is then immediately followed by the poisoning of all larger unwanted trees in the lower canopy, any broad crowned trees, and a selection of other trees in the middle canopy to leave what we designate a medium canopy which has been raised from 10 to 20 feet (at which the bottom of the normal understorey canopy occurs) to about 40 to 60 feet.

In the following year a further poisoning is done reducing the overwood to the emergents both economic and worthless and underneath this a light open canopy consisting of medium sized economics and light crowned straight boled trees of other species. Under this regime the existing advance growth of economics has a chance to get away and we also, in most cases, get an appreciable recruitment from seed falling from the mother trees which are all still standing. In the third year the regeneration is cleaned and assessed by a grid of quadrats, in the 3rd and 4th year further cleanings are carried out. Exploitation takes place in the 5th, 6th, or 7th year and is followed by a cleaning, mainly of climbers, and coppicing of any regeneration damaged but not wholly destroyed by felling or hauling operations. This is repeated in the 10th year when a decision is taken as to how and when the remaining overwood is to be removed. We have only a few plots, and these all research plots, exceeding 10 years and the removal of the overwood, which, owing to the restricted range of commercial species, is still considerable, is still a matter of research and we have not yet defined a standard practice for field use. It is however, known that removal of this remaining overwood is essential.

We have by this method, in favourable circumstances which may be defined as in dry, not swampy, forest, of mature form with all canopies reasonably represented, and with above average stocking of mature economics, especially if they include *Entandrophragma utile*, raised thicket crops with over 200 of our Class I economics per acre in among a much greater number of stems of Class II species and with smaller numbers of other potential timber species and in which this thicket has closed canopy without too great a proportion of climbers. It has therefore been extended from the purely research project to prescribed treatment in a number of working plans for reserves in which these favourable circumstances given above occur. This is prescribed in Conversion Working Circles based on an annual treatment of 60 to 100 acres per annum and a possible rotation of 80 to 100 years. In no case has the whole of a reserve been allocated for conversion in one rotation. The labour cost to 10 years is 20 to 21 mandays per acre and as net revenue available for regeneration and improvement ranges from 3 to 12 mandays per acre this intensive conversion work must be subsidised from revenues from other areas.

In Malaya and Nigeria complete conversion is being undertaken. Malaya, which initiated such natural regeneration treatment in the tropical humid forest, after starting with a technique rather similar to that now used in Ghana, have now greatly simplified it. Conditions are not however the same as they are now concentrating on raising the fast growing *Merantis* (*Shorea* spp.) of which a considerable number class as a single timber, occupy the position rather of the nature that *Triplochiton* and the *Terminalias* occupy in West African forests, and after seed years (which are periodic, but not so irregular as *Triplochiton* of which the last full mast year was 1948 in Ghana) there is a very large seedling stocking throughout the forest. Exploitation with a strong internal demand is much more complete. Their technique is therefore, where an adquate stocking of seedlings has been found, to climber cut and clear the lower canopy, allow full exploitation of all marketable stems, and then poison all remaining overwood. The regeneration of all species on the ground, of which a large proportion is of economics, is then allowed to grow up as a dense thicket covered with climbers and not until it has reached a height at which a man can move underneath the canopy is any cleaning done. It is then restricted to climber cutting and cutting out some weed species but closed canopy is always maintained to prevent re-development of climbers.

Nigeria, like Ghana, cannot rely on advance growth alone and must pre-treat some years before exploitation to induce a greater number. So far they have also been carrying out several cleaning operations but as they are working on a much larger scale, taking up several square miles annually, they are trying to reduce cleanings and simplify all operations. They again open the canopy from the bottom upwards.

In the Belgian Congo so far little reliance has been placed on natural regeneration in field operations but it has been the subject of research and Mr. Donis and Maudoux have devised a system which they term "Uniformisation par le haut." This is not a straight natural regeneration scheme but an attempt to bring the forest into a state more fit for direct natural regeneration by freeing existing economic species in their varying stages with a view to treating the forest later, depending on the relative abundance in the various stages, as a number of periodic blocks to be regenerated successively. The initial treatment works from the top downwards. After the preliminary climber cutting the trees competing with existing economics are girdled or poisoned taking those from the upper canopies first. Recently the French foresters in the Ivory Coast have also commenced to work a system based largely on existing advanced growth but in the hope of stimulating further regeneration, or to be used with supplementary planting, in which the canopy again is opened from the top downwards. Again the first operation is very careful climber cutting then the unwanted emergents are removed followed by thinnings in the middle canopy and only then is the understorey tackled and openings in this are carefully made to prevent the regrowth of climbers. If 100 naturally occurring saplings or poles per hectare are established in this canopy this is considered a sufficient basis for the new crop. If less than these numbers supplementary planting is used. To prevent the remaining understorey from swamping the valuable trees subsequent to this opening it is proposed to clean every 3 years to the 10th year.

The importance of climbers in all these natural regeneration operations is evident. The climbers like the emergents are light demanders and any treatment designed to give more light to the regeneration will also stimulate growth of the climbers. Continual cutting is merely a palliative and is shockingly expensive. The Malayan solution is dependent on really thick regeneration which is not always attained in West Africa and the solution proposed by the French foresters is interesting. The young emergents require a clearing overhead but do not suffer so much from lateral competition from trees in the same storey or below.

Root competition for water and nutrients has not been fully investigated but the increase in growth upon removing the overwood above young regeneration on a test plot in Ghana was far greater than would have been expected from the additional light made available alone.

As the crops established by natural regeneration are developing it has been found that though the aims of a simpler mixture and a very great increase in the proportion of the economic species have been attained and that the crops are even aged it has been found that this stand does not develop in the same way as similar temperate crops. The variation in growth rate between the species is enormous and very shortly, within 20 years, you are faced with a crop again in stages and reverting in appearance to the natural forest. The same result has been found in mixed plantations, and even in pure plantations, as some of the species will not grow pure and can only be maintained if a matrix of other species is allowed. The further treatment of these crops is going to vary very greatly depending on which of the economics is most desirable, and in any case is going to provide a whole series of problems for the forester in the tropics.

Ghana, for this and other reasons, has tended to revert to the Selection System. It is evident that large amounts of natural regeneration of the economic species are available in the undisturbed forest and that if this could be brought through without the enormous losses due to inter-specific competion, and the unwanted species deliberately destroyed, the aims of a much simpler mixture and a far higher proportion of economics could also be obtained but with an all aged stand. As exploitation and treatment is by stems the very fast growers could be removed as they reach exploitable size very much more easily than in a uniform system. The main question is whether we can induce a growth rate and productivity sufficient to meet the demands both in gross amount and per unit of exploited area so that it is economic for the timber man to make the partial cuts entailed.

In conclusion natural regeneration of the tropical humid forest has been shown to be a possible and valid technique but like everything in forestry it must be related to the ecological and economic conditions of the individual forest under consideration. There is no single solution to the silviculture of the tropical humid forest and an immense amount of research both on the regeneration techniques and on subsequent management is still required.

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# The Regeneration of Tropical Forests by Planting

by

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A summary of past experience and future prospects for forest planting in the tropical world, prepared without personal familiarity with Asia and Africa where nearly all of the work has been done, necessarily must be general. It may be excessively influenced by experience on an island of the West Indies where population density and forest poverty are more extreme and economic development is more rapid than in most tropical areas.

## EXPERIENCE

Historically, forest planting in the tropics first appeared in south-eastern Asia. Then it was extended to Africa and generally later to America. In India research on planting of teak began in 1830. The famous teak plantations at Nilambur date from 1844. Early beginnings in Java are evident in the fact that the natural occurrence of teak there is debated. Plantation techniques were well developed by 1880. Forest planting was first undertaken in Burma in the 1840's, and in Ceylon in 1890.

Forest planting spread to Thailand and the Philippines in the first decade of the present century. Soon thereafter planting was undertaken in tropical Australia and in Trinidad. In the 1920's work started in the British, French, and Belgian colonies in Africa. Now it is probably safe to say that at least a few forest plantations have been established in every tropical country, including the American republics. More than a million acres have been planted to date.

In the western tropics extensive areas have been planted in southern Brazil, the northern Andes, and in Trinidad. Large-scale planting projects are continuing in Brazil, Trinidad, and Surinam. Species adaptability tests and smaller scale planting programs are being carried out in Mexico, British Honduras, Nicaragua, Costa Rica, Cuba, Jamaica, Haití, the Dominican Republic, Puerto Rico, the French West Indies, Venezuela, British Guiana, Colombia, Ecuador, and Perú.

## SITES AND SPECIES

Planting sites in the tropical zone span the temperature range from sea level to elevations of several thousands of feet. In rainfall they range from semidesert conditions to hundreds of inches of precipitation per year. Seasonality of rainfall, sharply defined in many areas, has greatly influenced techniques and results. Planted soils range in texture from fine clays to coarse sands and from excessively drained to swampy.

For tree species tropical foresters have drawn on the world's richest flora and have traded seed without regard for distance. Certainly more than 1,000 species have been planted in the eastern tropics and nearly half that number have been tested in tropical America. Widely planted genera include *Acacia*, *Agathis*, *Albizzia*, *Casuarina*, *Cedrela*, *Cupressus*, *Eucalyptus*, *Khaya*, *Pinus*, *Swietenia*, *Tectona*, and *Terminalia*. About a dozen indigenous timbers and some 20 exotics now are being planted extensively in tropical Africa (6). Current large-scale planting programs in the American tropics also use a variety of species, mostly exotic.

## MAJOR TECHNIQUES

At least two important forest planting techniques have had their roots in tropical experience. The taungya system, initiated in Burma in 1856, ingeniously so uses the shifting cultivator that his ultimate product rather than ruinate land, becomes cheaply established forest plantations. Applicable wherever laborers are willing to clear forest for food crops and where rapid growing tree species have proven adaptable, this system has given rise to hundreds of thousands of acres of excellent plantations in Asia, Africa, and on a lesser scale in tropical America, particularly in Trinidad. It has been particularly successful in the moist deciduous forest zone.

A second major tropical planting technique is enrichment. The planting of trees within forests has held forth unusual promise in the tropics because (1) vast and increasing areas of cutover forest are inadequately stocked with desirable regeneration yet deforestation preparatory to planting is very costly, (2) many of the preferred tree species have not grown well when openplanted, and (3) controlling weeds and vines in young open-grownplantations has proven very expensive. The trees may be planted beneath natural openings in the canopy, in lines cut through the forest, or in small cleared blocks. Extensively used in Africa and tested throughout much of the tropical world, the success of enrichment remains a subject of debate because of maintenance costs.

## YIELDS

Published data on pure plantations under favorable conditions show a wide range of increment. Gymnosperms, including species of pine, *Agathis*, and *Araucaria* in tropical Australia and Indonesia at ages of 25 to 37 years range from about 200 to 400 cubic feet per acre per year (13,19). *Eucalyptus naudiniana* in tropical Australia has shown increments as high as 486 cubic feet (2). Teak in India, Java, and Trinidad at 30 years on the best sites ranges from 114 to 150 cubic feet and at 80 years from 85 to 109 cubic feet (1, 9, 17).

Financial yields from thousands of acres of 65-year-old teak plantations at Nilambur surpassed 4 percent, compound interest (17). At the other extreme, on 10-year fuelwood rotations teak and casia plantations have proven extremely profitable in Nigeria (4).

## PRESENT POSITION

It is seen that in the tropics forest plantations are capable of spectacular increment, yet they cover an insignificant portion of the forested area. In only a few countries is planting being done on a scale which will make an important contribution toward meeting future timber requirements. The reasons are various.

Where large volumes of uncut forests remain, as in parts of tropical America, interest in forestry may barely support a minimum degree of control over exploitation, let alone investments in the future crop.

Where extensive forest resources and strong support for forestry both exist, foresters understandably have been more impressed by the need to market in an orderly fashion the standing mature timber while protecting for future harvests the immature trees of marketable species and the vast volume in other species for which utilities may be just around the corner than with the prospects of starting on bare land. Thus, we see girth limits, improvement fellings, shelterwood, or "clearcutting" such as has recently been developed in Malaya. The results of these practices have not always come up to expectations, but they have generally been helpful silviculturally. Where dipterocarps or other species of high quality have regenerated abundantly, they are considered successful.

Even where no large accessible timber resource remains, the problem has generally been met by importation of timber supplies rather than reforestation. This is in part because forest planting in the tropics has been fraught with failures, usually due to inadequate knowledge of the site or the species.

A number of factors other than those already mentioned have produced in tropical foresters a degree of conservatism toward planting. Planting is considered costly at the outset and appears to involve risks of failure from unforeseen causes. These may include inferior wood quality, insect and disease attacks, and gradual site deterioration. There is evidence that these hazards may commonly be exaggerated (11, 14, 17).

On the other hand, forest planting in the tropics is on the increase. In Trinidad, for example, the annual area of planting has doubled since the second world war. In countries with extensive natural forests, such as the Philippines, Brazil, and Surinam, the planted area is rapidly expanding. Even in Malaya the prospect of extensive plantations has been under study.

## PROSPECTS

The future of forest planting in the tropics is dependent upon trends in the demand for the products or tropical forests, the area and character of the land which will be available for their production, and the effectiveness of the planting practices developed for this purpose.

### DEMAND FOR FOREST PRODUCTS

Population growth in the tropics, now at unprecedent rates, will inevitably make heavier demands upon tropical forests. Trends in th United States suggest that overall consumption of forest products per capita is increasing (18). Rising standards of living and shifts of population from rural to urban areas can be expected to increase demands particularly for the more valuable or highly processed forest products such as lumber and paper. Pulpwood consumption per capita in the United States has doubled in the past 25 years, and this product now makes up more than 25 percent of all industrial wood consumed (18). The use of fuelwood and charcoal in the tropics can be expected to decline because of substitutions, a development which may eliminate an important incentive for deforestation preparatory to taungya plantations.

### LANDS FOR FUTURE FORESTRY

The area and character of the tropical lands available for future forestry will depend increasingly upon the economic relationship between forestry and alternative land uses.

#### COMPETITION FROM OTHER FORMS OF AGRICULTURE

For centuries the growing populations of tropical areas have been encroaching upon the forests in search of land to cultivate. The grassy wasteland which surrounds the central African forest, a heritage from generations of shifting cultivation, is in places as wide as 180 miles (3). In Nigeria alone a thousand square miles of forest are destroyed by shifting cultivation every year (5). In the western hemisphere land clearing also has been a common practice. As a result forests have largely disappeared from areas around population centers in tropical America.

The demand for field and forage crops can be expected to rise further. The yields from these crops per unit of land area are also rising. The overall effect of these developments may be to reduce the total area needed to supply a specified yield. However, since population is rising rapidly, no permanent release of lands for forest use necessarily will follow. In fact, with every increase in yield per unit of area these crops can more forcefully compete with forestry for any lands capable of producing either crop.

#### COMPETITIVE FORESTRY

Uncontrolled forest exploitation in the tropics seldom contributes toward any other permanent economic land use. Removal of the best trees may with little apparent effect leave the forest unproductive, yet the land has not been prepared for any other use. Large areas of completely deforested lands, because they do not sustain continued cropping, become abandoned and remain unforested or gradually return to secondary brush, also of little value. In the face of growing demands for forest products the area covered with exploitable forests is declining. Future requirements will soon have to be met by production on lands now cutover, brush covered, or deforested.

Current timber productivity on most of these lands, even those under extensive management may be so low that they are vulnerable to encroachment by land uses which are temporary in nature and destructive of the soil. To prevent this the returns from forest production must rise at least to a level that is competitive with other uses for these lands. There appear to be two ways in which this can take place, in higher yields of the best timbers per unit of area and in greater uniformity of products.

Large productive potentials of lands available for tropical forestry, even where tree-covered, are largely untapped because of the presence of the following:

1. Tree species deficient in utility, of inherently slow growth, small size at maturity, or poor form.
2. Genetically inferior trees.
3. Damaged trees too poorly formed to be utilized.
4. Areas overstocked with stems, many of which can never reach merchantable size.
5. Areas understocked, possibly supporting weeds.
6. Nutrient deficiencies.
7. Losses to insects and diseases.

The removal of these limitations calls for drastic changes in existing forests, close control of growing stock, and probably also the use of some of the same techniques which are augmenting the returns from other forms of agriculture.

The lack of uniformity in the size and quality of the trees in most tropical forests, with relatively few per unit of area suitable for any one use, constitutes an obstacle to utilization which does not characterize most other crops. For this reason tropical evergreen forests are not a promising source of raw materials to supply growing paper requirements (7). Greater uniformity should foster the same efficiencies of mechanization in production, harvesting, and utilization of forest crops which are making other forms of agriculture more competitive.

## FUTURE PRACTICES

The growing demand for forest products and the related need for financial returns from tropical forestry competitive with those of other land uses suggest that full consideration be given to those cultural practices which have been largely responsible for the increase in productivity of other forms of agriculture. These are as follows:

1. Greater concentration on the most productive lands.
2. More specialized production.
3. Development of superior plant varieties.
4. Increased use of fertilizers.
5. Chemical control of weeds, insects, and diseases.
6. Greater uniformity of production and resultant mechanization.

The nature of these developments and the growing area of unregenerated land apparently assures the establishment and management of plantations a prominent place in the future of tropical forestry. The discontinuation of natural regeneration techniques is not foreseen, but if forestry is to profit by these developments a number of inherent advantages appear destined increasingly to favor plantations. The magnitude of these advantages is to be seen in the land requirement to supply a 100-ton paper mill in Malaya:

400,000 acres of mixed forest, or less than one quarter of that area of pure plantations (12). Paper companies in Surinam and Brazil, despite access to extensive mixed tropical forests, are establishing large areas of plantations.

The only rational approach to intensification of tropical forestry is through research, some of which will require years to bear fruit. This circumstance is itself the best argument for early acceleration of tests of the best available sites, species, and growing conditions.

## SITE SELECTION

The capacity of trees to grow on soils generally unsuited for other crops and man's preoccupation with the production of food on the other lands have focussed the attention of foresters on these relatively unfavorable sites. Advocates of other crops, in contrast, bid for the best lands available in anticipation of higher yields.

It must be admitted that forest crops, as a group, may never surpass in financial returns the more important food and forage crops. However, the quality of land which forestry really merits will never be known until returns from intensive forest management are determined. Results in South Africa suggest tree planting on soils now in other crops (8). Accordingly it would appear in order to test plantations on a variety of sites normally considered "too good" for trees. These should have climate and soil favorable to plant growth, proximity to markets and labor supply, and slopes suitable for the use of mechanized equipment.

## SPECIES SELECTION

In the selection of tree species for intensive management tropical foresters should maintain a broad and flexible outlook, embracing changes in demand, the prospect of superior exotic species and, if indicated, prompt rejection of former favorites. It is time that the forester, like the agronomist and horticulturist, ceases to dwell on the question of "exotic vs. native" species. Obviously this criterion has little or no influence on our selection of other crops. Added initial risks are involved with exotics, but with most other crops these risks have been found well worth facing, in view of the greater returns obtained. Long-term results with pines in South Africa (8) and with teak in Trinidad show that foresters may under favorable conditions expect equal rewards.

Trials of new tree species whatever their source, should not be made without an understanding of the environment preferences of the species within its natural range. Howver, tests need not be limited to these conditions. *Pinus radiata*, for example, a species with a very limited natural range, has been found adapted to a wide variety of conditions elsewhere and the trees in their new habitats show significant genetic variations not previously evident (10, 15).

Tests of species adaptability, a task which has seemed almost endless and fraught with discouragement, is nevertheless a necessary prelude to intensive forestry. It could be greatly simplified if information on the promising species and the results of tests to date were more available. In this regard, the current series of FAO Development Papers represents a beginning. The survey of plantations now in progress by the Latin American Forestry Commission of FAO, is yielding more information of this character. A continued, world-wide search for superior species is warranted.

Among the species considered for planting in the tropics the gymnosperms are receiving much attention now, and this apparently was long overdue. A recent survey by Weck (19) shows that of some 200 tropical conifers, 16 have already proven promising for planting, and in a wide range of conditions within the tropical zone. Included are the genera

*Agathis, Araucaria, Callistris, Cupressus, Dacrydium, Pinus,* and *Podocarpus.*

### SEED SOURCES

The prospects of genetic improvement of tropical trees are so great that results of many other types of tests will be materially affected thereby. The possible magnitude of greater returns through mere selection of seed sources is seen in a specimen of *Pinus radiata* in New Zealand. Growing in a 27-year-old plantation in which other dominant trees averaged 16 inches in diameter, one tree had attained 27 inches (16). There this species shows marked variation also in tree form, silvicultural requirements, and timber (15). Superior trees to serve as seed sources for the more promising species should be located before they are cut. Progeny and provenance trials, continued selection, and breeding should lead to better tree adaptability, form, growth rates, disease resistance, and wood properties.

### SPACING

Spacing of planted trees should be such that maximum financial returns are obtained. This involves quality as well as growth rates. Traditional spacings have been found too close for maximum financial yields from pines in South Africa (8). These findings may not be equally applicable to the tropics but tests are warranted, possibly in combination with chemical control of weeds. Another consideration in initial spacings of plantations is the prospect of more efficient plantation care and harvesting where trees are planted in a strict geometrical arrangement and sufficiently separated to permit machinery to pass between them.

### NUTRIENT SUPPLY

Plantations using good sites, tree species of high quality from superior seed sources, and spacing favorable to high yields should grow at a rate which is limited primarily by the supply of variable nutrients. This limitation is probably a major source of plant competition on soils subject to the constant leaching typical of the humid tropics. With all other factors favorable, it may prove practical to remove this limitation by the application of fertilizer, not merely to eliminate obvious nutrient deficiencies as has characterized much past work of this type, but to provide adequate levels of all nutrients. With some other crops, including forage grasses, it has proven economically advantageous to fertilize so heavily that the inherent supply of some nutrients in the soil becomes unimportant, thus minimizing the limitations of infertile soils.

### CONTROL OF ENEMIES

The control of insects and diseases in tropical forests, heretofore considered impractical under most conditions, may become more necessary in intensively managed plantations, but because of the high yields at stake it should prove correspondingly more practical. The use of low-volume mists, systemics, and other new practices developed for other crops should warrant trial.

### THE NEED TO COMBINE PRACTICES

Testing of tree species, superior varieties, spacing, and fertilizers must take into consideration their interactions. Past experience in which one or two of these factors have proven effective probably does not indicate the prospects of fully combined effects. With other crops it is the combined effect of ALL desirable practices which brings the greatest return.

## PROSPECTIVE RETURNS

How much would the intensification described increase yields? Would it pay? Only a few indications are available. As to yields, an intensively cultivated eucalyptus plantation in Nyasaland produced dominant trees of 4.4 to 5.1 inches d.b.h. and 40 to 45 feet in height 30 months after planting (20). Intensive pine plantation culture in temperate

South Africa produced yields to 20 years which compare favorably with those of the tropical zone (8).

A further indication may be evident in recent results in Puerto Rico with what appears to be parallel intensification with a similar crop, coffee. The typical coffee plantation in Puerto Rico has much in common with natural tropical forests subject to extensive management. A large portion of the stand (the shade trees) does not enter into the yield. The trees which provide the harvest (the coffee trees) are not of selected strains, and they vary considerably in productivity. Both the shade and the coffee stand, as a result of growth and natural regeneration, become and are maintained overstocked, with many low yielding coffee trees. Culture consists of occasional light thinning and pruning of the shade trees and cleaning sufficiently around the coffee trees to permit harvesting. The mean yield of these plantations is from 110 to 200 pounds of market beans per acre per year.

Experiments in the intensification of coffee culture in Puerto Rico have introduced changes which are of the same order as those which should be tested for timber production, with the exception that better lands were not used. Different varieties showed similar yields under the prevailing culture, a situation which may apply equally to forest trees. Response to fertilizing old plantations was weak. More marked increases in yield followed the use of wider spacing of both coffee and shade trees and application of fertilizers. However a combination of all treatments using selected varieties, adequate separation of coffee trees, elimination of the nonproductive shade stand, heavy and frequent applications of fertilizer, and chemical control of insects and diseases, produced the first crop in two-thirds the time otherwise required, and the average for the first five annual harvests was 1,800 pounds of beans per acre. This increase was almost tenfold. Net profit rose at about the same rate. Harvesting costs were reduced one third.

The new intensive techniques in coffee culture in Puerto Rico are not yet proven to the satisfaction of all. Skeptics still anticipate unforeseen problems. However, now that the magnitude of the advantages of intensification are known, far more can be invested than has ever been possible heretofore, if need be, toward the solution of such problems.

The intensification of forest planting and plantation management in the tropics will require much more complete knowledge of the factors of production, as well as substantial capital investment. It can only develop gradually. In large areas existing stands must be the basis for timber production for indefinite periods in the future. Nevertheless, as population and demands for land and forest products grow and as other types of agriculture progress, intensive plantation culture may prove to be the only economical source of timber in the tropics.

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# Surveys Particulary Applicable To Extensive Forest Areas

by

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Modern development of aerial photo and sampling techniques has made it possible to perform in an efficient way surveys for extensive forest areas. For inaccessible regions and countries with few means of communication, the aerial photographer has opened the way for various kinds of accurate mapping, from which in the frame of this paper, the mapping of the general topography and the vegetation are the most interesting. These mapping possibilities enable the forester to apply modern sampling systems to his survey, whereas "at random" sampling and its modifications can be added to the well-known "selective" and "systematic" sampling systems.

Every survey is performed with a certain purpose. Mostly the aim is to obtain an estimate of the volume of standing timber from a certain D.B.H. and up. The aims for surveys of extensive forest areas are more complicated. At the moment the Food and Agriculture Organization of the United Nations is assisting the Brazilian Government in the execution of two large-scale forest surveys, i.e. one in the Amazon Basin and one in the State of Santa Catarina in the region where Parana pine or *Araucaria angustifolia* occurs. Both surveys have an entirely different aim. The purpose of the forest survey in the Amazon Basin is to get data about the composition of its mixed tropical rain forests, to help provide a base for a better economic consideration. The survey of the Parana pine forests is initiated because of a certain existing anxiety that they are overcut, so this survey has to find out what the actual situation is and what can be done about a proved "overcutting".

The mixed tropical rain forests of the Amazon Basin cover an area of approximately 400,000,000 ha. The region where Parana pine originally occurred and where this tree still is found either growing in groups or single, can be estimated at approximately 8,000,000 hectares. The first difficulty met in planning a survey for areas of this extent is: Where to start? In other words, which areas will have to be suveyed successively to make the survey, from the start, as effective as possible. At the time the survey of the Amazon forests was planned, two of the three forest experts who made an economic survey of these forests, as given in F.A.O. report No. 171, were present and assisted in this planning. It was decided that a survey would be made of the central part of this forest area located close to the Amazon River and its big tributaries navigable for seagoing vessels, starting with the plateau or "planalto" region South and South-East of Santarem (halfway between Belem and Manaus along the Amazon River). After having obtained present survey data covering an area of approximately 17,000,000 hectares, it can be said that this first part surveyed is still one of the most promising. The first or "pilot" area of the Parana pine region was selected by the director of the Federal Forest Service, because in that area the most Parana pine was cut and because of its central location on the high plateau in the State of Santa Catarina.

A first essential for any kind of forest survey is a map. The minimum required is a controlled planimetric map. For most purposes, except of course for detailed inventory and management plans, scales 1:50,000, 1:100,000 and 1:200,000 can be regarded as useful and convenient. Neither for the Amazon Basin nor for the Parana pine region in the State of Santa Catarina were detailed planimetric maps available. These maps had to be made first. The best way to obtain maps is to let them be prepared by an aerial survey company, but at the time maps were needed for th forest survey of the Amazon Basin, we could not order these maps through the Brazilian aerial survey companies, for reasons which will be explained shortly. At the start of the forest survey work in the Amazon Basin only trimetrogon aerial photographs taken by American flyers during the last world war were at our disposal. Trimetrogon aerial photographs are mostly taken for reconnaissance purposes. The survey plane uses three cameras, one in the middle for the vertical photograph (in this case mainly on scale 1:40,000) and two at the sides for the oblique pictures. The three pictures taken at the same time cover a stretch of the surface of the earth from horizon to horizon perpendicular to the direction in which the survey plane moves. It has not been common practice and it is fairly difficult to make detailed planimetric maps from trimetrogon aerial photographs.

To do this work for the Amazon Basin is the more difficult because this Basin is almost totally covered by dense tropical forests which conceal most of the natural topographical features of the region. Through previous experience we knew that if the mapping of the topography from these pictures were done by people not accustomed to this special kind of photo-interpretation, we could at best expect a map of the smaller and bigger rivers visible on the aerial photographs. However we wanted planimetric maps made from these trimetrogon photographs as detailed as possible, so it was decided to prepare them in our own office by specially trained personnel. All other maps made from vertical photographs were made by a Brazilian company.

Before drafting a map from aerial photographs can start, its geographical base must be provided. The denser the net of geodetic or astronomic station points which can be used for this base the more exact will be the geographical location and the more accurate and uniform will be the scale of the map. For the mapping work of the Amazon region only a few reliable astronomic station points were available. Sometimes the trimetrogon flight runs were too far apart, so it became difficult to tie them properly. The most accurate parts of these maps are those parts for which we could use the geodetic maps, prepared by the National Brazilian Oil Company or Petroleo Brasileiro, S.A., based on newly made astronomic station points. Most of our Amazon maps were produced on a scale 1:200,000, which does not pretend to give a high accuracy in distances and directions, but presents an excellent overall picture of the country surveyed. Our other maps, made from vertical aerial protographs (the aerial survey company who prepared them guaranteed their accuracy, based on reliable astronomic station points available or provided by their own geodetic service) were produced on a 1:50,000 scale.

After obtaining a network of triangulation points in which the single photograph can be fitted, the actual map can be drafted by photo-interpretation. Referring only to our map-making in Brazil, it can be said that the easiest part of it is: (1) the mapping of the artificial topographical features, (2) the drawing of the water limits or the borders of the rivers and sea as long as they are not obscured by vegetation, (3) the borders between forest, agriculture and grasslands and the borders between forest and scrub or grass savannah. In reality these are all features or borders which can be observed directly in the stereoscopic view of the aerial photographs and for which the common photo-interpretator does not need special training. In our experience the difficulties start always when the natural topographical features of the country are hidden by the vegetation. For Example, in this case the borders between permanently or temporarily waterlogged areas and dryland cannot be observed directly but have to be deduced from the appearance of the vegetation canopy. When the country to be mapped is completely covered by dense forests, as is true for most of the Amazon Basin, even the mapping of the drainage system, i.e., the mapping of the rivers and creeks up to the gullies, causes considerable trouble and can only be performed by photo-interpretators who have had a special training in this kind of mapping work.

Up to now all our maps were made as planimetric maps, i.e., maps without contourlines or indications about altitudes other than by way of formlines making edges of plateaux or "planaltos" and tops of outstanding hills. The areas mapped in the Amazon region with the help of the trimetrogon photographs are practically flat with differences in the plateau or "planalto" region of less than 150 meters, so the oblique pictures could be used. This has to be regarded as an advantage whereas in areas with high and steep hills or in mountainous country the hills and the mountains appear with their flanks on the oblique parts and hide all what is behind. Because the oblique pictures of these flight runs were often clouded or hazy, for the detailed mapping work they could not always be used up to the centre part; when on top of this the flight runs were too far apart we had to leave here and there some gaps in these maps.

The planimetric maps are made to serve as a base for the sample to be taken from the forests under survey and as the base for the ultimate forest type map. It will be clear that from the start as much information about the forests as possible was put on these maps by pure photo-interpretation. Through the demarcation of the areas flooded by seawater, areas temporary and permanently waterlogged by river- and/or rain-water, and the dryland areas, the forests growing on these parts were automatically subdivided in formations, i.e. saltwater swamp, sweetwater swamp and marsh, and dryland forest formations. Up to now in the Amazon region only dryland forests have been surveyed. It is possible to separate inside these dryland forests, the secondary forests and the savannah or caatinga forests.

According to our experience both forest types can easily be identified on aerial photographs up to scale 1:45,000. They are lower than the surrounding forests and have a smooth crown canopy. In the secondary forest the pattern of the shifting cultivation fields can usually be recognized. At the border of the savannah or caatinga forests a gradual change can be observed from a coarse to a smooth crown canopy, contrary to the similar changes for the secondary forests, which are abrupt. The appearance of the savannah forests amid the common high, dryland forests in the Amazon region practically always parallel a change in soil, i.e. from loam, clay or sandy soil into white sand soil covered by a thick layer of humus. In exceptional cases they were found on soil on which the rain water stagnated because of a hard clay pan underneath. These forests are often found on top of or near watersheds, their average total height is around 20 meters, and rarely have trees with a D.B.H. of more than 35 centimeters.

On the vertical photographs (1:25,000) from the Parana pine region in the State of Santa Catarina it is very easy to recognize the big Parana pine trees. When these trees grow in closed stands they show an unmistakably clear pattern. When they grow mixed with other trees, they normally emerge high above the others and their typical disk-shaped crowns can easily be spotted. When they grow isolated on grass savannahs (campos) or are left over on agriculture areas, they can always be recognized with certainty by their crown and/or their shadow. At the time the planimetric maps needed for the first survey of the Parana pine region in the State of Santa Catarina were ordered, the aerial survey company was asked to subdivide the dry-land forests on these maps into easily and surely identificable parts. It turned out that, from the stereoscopic view of the pictures, it was possible to divide these forests into the following types: (1) pure Parana pine stands, (2) broadleaf trees, mixed with Parana pine, (3) broadleaf trees, (4) secondary forests, (5) devastated forests from which most of the Parana pine were cut out, (6) grasslands or savannahs with scattered growth of Parana pine.

In this last summing up of what can be achieved by pure photo-interpretation for the Amazon region and the Parana pine region, one of the main problems of the photo-interpretation for forestry purposes in tropical countries has been touched. In case of the survey of the Parana pine, being the only conifer growing in between broadleaf trees or in pure stands and as a light-demanding tree emerging above the broadleaf species or growing up in the open, we are able to give part of these forests a floristic name. We were able to locate the places where Parana pine occurs with a high degree of certainty.

By using only the stereoscopic view of the aerial photographs it is very difficult to give the real tropical rain forests their correct floristic name. The exceptions are: (1) The saltwater swamp forests, with only the species *Rhizophora mangle* and *Avicennia nitida*, (2) several marsh and swamp forests with only a few species in their upperstory and which have a distinctively shaped crown, as for example *Hura crepitans* and *Virola surinamensis*, (3) some patches of dryland forest dominated by ~~one~~ tree species as for example *Eperua falcata* and (4) dryland forests with clearly visible concentrations of one species in the upperstory so the possibility exists to name at least one of the components of its composition. After five years of experience in the field, we are not yet able to give the highly mixed dry land forests of the Amazon Valley a floristic name by pure photo-interpretation. The naming of concentrations of an upperstory tree, which often was possible in Dutch Guiana, could here only be done for angelim pedra *(Hymenolobium petraeum)* and is questionable for massaranduba *(Manilkara huberi)*.

For the planning of an aerial survey for forestry purposes these facts are extremely important. For example the possibilities of seeing more of the smaller Parana pine trees on the aerial photographs by changing the scale from 1:25,000 to 1:10,000 or even to 1:5,000 are practically unlimited. Especially for detailed surveys and management planning these changes can be very useful. In practice such changes will have to stop there, where the savings in supplementary outdoor and sampling work will be less than the increase in expenses for the larger scale photographs compared with the costs of the smaller scale pictures; in addition to the growing expenses for the more time consuming photo- interpretation and mapping work.

For the survey of the highly mixed tropical rain forests we use mostly aerial photographs scaled 1:40,000 and a few on scale 1:25,000 and 1:45,000. Scale 1:40,000 is sufficient to map the general topography and as a consequence is also sufficient to divide the forests into formations.

When making a proposal for an aerial survey of these forests with larger scale photography, it is necessary to have a very sound reason to do so. In general, the value of these forests is not high as long as only a few tree species are exploited. If through direct observation in the stereoscopic view of the larger scale pictures the trees to be exploited can be located with certainty, it is also possible to draw a stand map which can be used directly for management purposes. If through observations made during previous exploratory surveys it is known, that certain valuable forest types coincide with the occurrence of a palmtree visible between the upperstory trees, larger scale photographs offer a very good chance to map these forest types.

accurately and quickly, by indirect observation in the stereoscopic view of the photographs. The larger palmtrees of the genera *Mauritia* and *Maximiliana* are clearly visible on photographs scale 1:20,000 and the smaller palmtrees of the genera *Euterpe* on photographs 1:10,000. For the justification of the higher cost of aerial survey, it has to be considered that in the very inaccessible parts of these forests, i.e. the swamp and marsh forests, the outdoor and sampling work is very expensive and can never be done as well as similar work in the dryland forests. In these swamp and marsh forests the surveyor and his labourers can hardly move without having to overcome extreme physical difficulties. It can be expected that the data obtained through pure photo-interpretation are in these cases, more reliable than those obtained through the common amount of outdoor and sampling work.

Based on experience in photo-interpretation and observation made in the field, it can be assumed, for the time being, that for the Amazon Basin it is impossible to give the highly mixed dryland forests their correct floristic name through observing only its crown pattern under a stereoscope. From our experience with the clear and cloudless oblique parts of the trimetrogon flight runs of the Amazon region we know that the subdivision of these tropical forests into formations is very possible up to the centre part of the obliques. From the bottom of the obliques up to the horizon the scale of the picture changes gradually parallel with the flight direction and is near the centre more or less 1:70,000, provided the scale of the vertical is 1:40,000. Given these facts the possibility exists that aerial photographs scaled 1:70,000 can do this job of mapping the forest formations and the general topography. When the financial means permit it, the intention is to make an experiment in this regard for an area already covered by one of our exploratory surveys so the results can be compared. The justification for this experiment is based on two very important reasons: (1) the cost of the aerial survey per square kilometer will be less than half compared with a survey on scale: 1:40,000 and (2) the few cloudless days per year suitable for survey work in the Amazon Basin will give a much bigger photocoverage.

For the Parana pine region we were also able to subdivide the area on which this tree grows into several density types. In the stereoscopic view of the vertical photographs scales 1:25,000 the big Parana pines were counted in squares of one hectare. The types separated are: (1) *type 2*, consisting of the pure Parana pine stands with an average crown density of 15 and more crowns per hectare, *(2) type 1*, consisting of the more mixed Parana pine forests (mostly mixed with embuja-*Phoebe porosa)* with an average crown density of 5-14 crowns per hectare and (3) *type O*, consisting of broadleaf forests with scattered growth of Parana pine with an average of more than zero and less than 5 crowns per hectare.

The planning of the sampling work and the choice of the sampling system depends always on former experience and the information obtained from the aerial photographs about the forests to be surveyed. At the start of our inventory work in the Amazon Valley very few qualitative descriptions based on quantitative observations or so-called samples were available for the Amazon forests in general and none about the forests in which the survey had to start. The valuable Parana pine forests are of course much better known, but reliable quantitative data were few. Even volume tables for the standing timber of the virgin trees had to be constructed first.

The objective of the survey of the Amazon forests is to get as quickly as possible information about their composition and their accessibility, to be able to select the most valuable parts suitable for modern management, with a big degree of certainty. This selection can be done for direct use but the main purpose will be to preserve these parts for the future by transforming them into national forest reserves. Therefore the sampling system chosen was an *exploratory survey* with the accent on the exploring part.

The objective of the survey of the Parana pine forests, which are practically all privately owned, is to find out if they are overcut or in other words if they are disappearing. Looking at the statistical data of sawn Parana pine timber over the years 1954-1958 as given in Table 1, below, we see that a large quantity of timber is cut annually and it comes from states of the United States of Brazil.

NOTE: For more and better information regarding this subject, it is recommended to consult "The Consulting Department for Aerial Survey" of the International Training Centre for Aerial Survey in Delft, Holland, under the directorship of Prof. Dr. W. Schermerhorn.

*Table 1. — Data about sawn Parana pine timber obtained from Anuario Brasileiro de Economia Florestal. Año 11, No. 11, 1959. Added is a comparison for the equivalent of standing timber with bark.*

| Name of State | 1954 | 1955 | 1956 | 1957 | 1958 |
|---|---|---|---|---|---|
| | Quantity of sawn Parana pine timber in m³ | | | | |
| Sao Paulo | —— | 2,640 | 4,750 | 5,010 | 5,040 |
| Parana | 1,182,072 | 1,286,227 | 1,138,999 | 895,487 | 1,000,744 |
| Sta. Catarina | 1,340,173 | 1,492,489 | 1,293,115 | 1,294,335 | 1,424,210 |
| R. Gr. do Sul | 665,207 | 611,975 | 429,355 | 500,007 | 449,006 |
| Total | 3,187,452 | 3,393,331 | 2,866,219 | 2,694,839 | 2,879,000 |
| | Approximate volume of standing timber with bark needed for total amount of sawn timber given. In m³. | | | | |
| Total | 12,750,000 | 13,600,000 | 11,450,000 | 11,800,000 | 11,500,000 |

This widely scattered cutting made necessary recently taken aerial photographs. Without previous knowledge of how to execute such a survey and the time it would take to accomplish it, it was thought inadvisable to start the survey for the whole Parana pine region at once, but perform first a "pilot" or experimental survey. In the State of Santa Catarina where the most timber is cut (see table) a comparatively small area of 550,000 hectares was selected for this experiment, to be performed with 1:25,000 aerial photographs taken in the middle of 1957. The work for this survey started at the end of 1958 and has just been finished.

After having chosen the sampling system, it is necessary to plan the actual sampling work in the field in such a way that an unbiased sample is obtained. For both the pure exploratory and the pilot survey it is not necessary to know beforehand how big the sample must be to achieve a certain degree of precision, whereas it is one of the aims of this kind of survey to provide data about sample size.

The Amazon maps gave only the location and the extension of the dryland forests. In the field we had to find out: (1) how to enter and penetrate these forests, (2) their composition, (3) whether these forests can be subdivided into types and (4) the best method to perform more detailed surveys.

Entering an unknown forest type, as we always have to do during our exploratory surveys, and enumerating a sampling unit at the point of entrance, this sampling unit will be unbiased, but when the second sampling unit is taken without following a prearranged plan it can be biased. Therefore, before our field trips started, the transects to be cut perpendicular on the topography of the country were more or less regularly spaced along the rivers we assumed could be entered and attention was paid to regular distribution over the area to be surveyed. The sampling units of one hectare each were taken along the transects at planned intervals. Over the length of one kilometer the trees with a D.B.H. of 25 cm and up were enumerated five meters left and right from the centre of the transect. The sampling density of the exploratory surveys is about, and less than, one hundredth of a percent.

For the Parana pine forests, the planimetric maps with the vegetation types and the photographs with the crown density types gave us their exact location and extension. The only thing we had to find out in the field, by way of sampling, was the volume of standing timber and the diameter distributions. Before the planning of the sampling work could start, a very interesting difficulty came up. The Parana pine grows practically everywhere, on grassland used for cattle grazing, on agriculture lands, etc. On those places the trees are also cut by the sawmills. Because the areas outside the forest types mapped are nearly three times as big as those occupied by these types it was thought possible that these areas could produce a considerable amount of timber. Therefore these areas were included in the sampling procedure. On the planimetric maps from the whole area was drafted a network of east-west running lines two kilometers apart. The starting point of the network was chosen at random. If all these lines were transects in the field and five meters left and right all Parana pines were enumerated, this network could provide an unbiased sample of 0.5 percent for the whole area, it could given in reality: 2800 kilometer transects or 28,000 sampling units of one tenth of a hectare each, what was considered to be a sampling density which could cope with exceptional variabilities in volume distribution. The actual sample taken was enumerated in five groups. This separation was made to be able to make an analysis of variance, i.e. to be able to find out if the Parana pine type called type 2 at the eastern side of the area can be regarded as belonging to the same or "homogeneous" type as that from the western side of the area. All Parana pines including the seedlings and the saplings were enumerated along the transects in sampling units of 0.1 of a hectare. This small sampling unit was chosen because some very small patches of Parana pine had to be crossed. The strip system was applied due to the very heavy undergrowth of these forests. On one occasion a transect had to be cut through an unbroken patch of bambu for the length of five kilometers. More than 600 kilometers of transect were cut, giving more than 6,000 sampling units or a sampling density of a little more than 0.1 of a percent.

During the sampling work and after its conclusion the results are evaluated with the help of statistics. Especially for the Amazon region a considerable amount of experimental work has been done, in which we were assisted by the Statistics Department of the Central Organization for Applied Scientific Research for the Netherlands.

A. For the Amazon region our data showed that not all the species have the same chance to grow up and survive. Groups of species were found which were enumerated *constantly* in big numbers; groups of species which only locally were enumerated in big numbers and groups of species which were always enumeratd in small and very small numbers. The conclusion is that the species of these forests do not appear "at random" but have a competitive power which differs substantially.

After having obtained at present more than 1200 sampling units of one hectare each, spaced out over a front of 1600 kilometers, i.e.

from the Río Madeira up to the Río Maracassumé in the State of Maranhao, it can be said that the composition of these forests is very uniform. The occurrence of the abiuranas (*Pouteria spp.)* is practically constant from the Río Madeira up to south of Belem, i.e. more or less ten percent of the number of trees enumerated or 12 trees of a D.B.H. of 25 cm and up per hectare, what can be regarded as a big number for this kind of highly mixed forests. Going to the eastern tip of the Amazon forests in the State of Maranhao slight changes in composition occur, the dominance of the abiuranas is taken over by the mata matas *(Eschweilera spp.)* Except these latter forests the others can be called abiurana forests belonging to an abiurana association. Inside these abiurana forests were found several types of facies. Mainly in the understory appeared at once a species in abundance not yet found elsewhere or only occasionally or seldom. The division of these forests into types or facies was based on the occurrence of these species appearing in abundance, which characterized part of the abiurana forests. The borders of these types were defined by way of sampling. Only on one occasion these borders could also be defined with the help of the aerial photographs, i.e. for the "planalto" forest types whose borders coincided with the border of the flat top of the plateau or "planalto".

To obtain a representative sample of a forest type it is necessary to take a sample of 30 sampling units of one hectare each.

It appeared that the trees of most of the species were distributed "at random" and followed a Poisson distribution. The Poisson distribution was used because it deals with the occurrence of isolated events in a continuum of area. Applying the distribution to the data, it was frequently upset by one or some sampling units with a very large number of trees. The larger the average number of trees per hectare becomes the more often this happened. This means in reality that the species of these forests tend to grow in clusters or colonies. The species with the greatest tendency to grow in colonies are the species which characterise one of the forest type or facies. A statistical rule could not be applied to the distribution of these species.

To get an estimate of the average number of trees per hectare of tree species not character species with a precision of 10% with a chance of 5% of making a mistake, it is necessary to take an unbiased sample containing 400 to 500 trees. This is nothing uncommon if a species appears at a rate of 5 to 6 trees per hectare but becomes very difficult and expensive when a species appears only once on 20 ha.

How many trees of one species have to be enumerated to obtain the same precision and reliability in volume estimate was also calculated. These calculations were performed for 95 species. For 91 of these species 400 - 500 trees were more than sufficient and for four species they were not. The calculations for these last four species were based on very few trees.

For the groups of valuable or so-called economic tree species a sample of 200 hectares maximum can give the same accuracy in estimate as mentioned for the number and the volume of the trees of the single tree species.

B. The evaluation of the sampling results for the Parana pine forests which seemed at first sight to be very similar to a survey of conifer forests in the temperate region caused some very particular difficulties. The sampling unit of 0.1 hectare gave, especially for the areas outside the forest types, large numbers of zero sampling units. The volume of standing timber without bark was calculated for the trees with a D.B.H. of 20 cm and more (paperwood limit) and for the trees with a D.B.H. of 40 cm and more (the legitimate limit for tree cutting) in tenths of a $m^3$. Through the omitting of the smaller diameters the amount of zero sampling units increased once more.

It is possible to transform the sampling series obtained into a Poisson distribution by grouping the units into volume classes.

For example, from a certain part of secondary forest outside the Parana pine forest types, we have 549 sampling units, from which 464 are zero for the trees of D.B.H. 40 cm and up. By grouping these units into volume classes of 6 $m^3$ the following distribution is obtained:

| | | | | | |
|---|---|---|---|---|---|
| class 0 | (0.0 $m^3$ ) | 464 | units found | 461.8 | P.D. |
| 1 | (0.1 - 6.0 $m^3$ ) | 76 | " " | 79.9 | " |
| 2 | (6.1 -12.0 " ) | 8 | " " | 6.9 | " |
| 3 | (12.1 -18.0 " ) | 1 | " " | 0.4 | " |
| Total | | 549 | | 549.0 | |

The observed distribution (units found) is nearly a perfect Poisson distribution and has a chi-square of 1.28, between the 0.750 and 0.500 level. This means in reality that these volume classes are distributed "at random" throughout the area occupied by the Parana pine forest types or the areas outside these types where the Parana pine occasionally appears. Through this transformation the calculations for the accuracy of estimate and sample size become easy and simple.

The survey work mentioned for the Amazon region is described in detail in the F.A.O. reports No. 601, 949, 969, 992, the report "Caeté-Maracassumé" (not yet released), the report "A 100% survey in the Curua-Una" (FAO Report 1271), and an Interim report in six parts (not yet released).

The survey work mentioned for the Parana pine region is described in detail in Boletim No. 1 and Boletim No. 3 (not yet released) from the Inventory section of the Federal Forest Service of Brazil.

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# Obstacles to Tropical Forestry - Lack of Markets and Incomplete Utilisation

by

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The forested area of the world can be divided more or less equally into temperate and tropical forests. Yet the production of industrial wood from the tropical forests is a mere 7% of the production from the temperate forests. Production of fuelwood, including wood for charcoal, is however of much the same order in the two zones, when allowance is made for the unrecorded production of the tropical forests, which is certainly much higher than for the temperate forests. The disparity between the production of industrial wood in the temperate and tropical forests cannot be ascribed in any great measure to the degree of accessibility in each, if we accept country assessments of this factor. For according to these assessments, as much as 40% of the area under tropical forests is rated to be accessible as against 55% for the temperate forests. Nor can the disparity be resolved more than partially by considering industrial wood production in relation only to the area of forests in use, which term might be construed to be an expression of effective accessibility. The area of forests in use is presumably determinable with greater precision than the area of accessible forests, for accessibility in the generally acknowledged sens of area within exploitable distance of existing communications and their short term expansion potential is susceptible in practise to fairly wide interpretation. Of the area under tropical forest cover, about 16% has been reported in use as compared with 44% for the temperate forests, and per hectare production of industrial wood from the tropical forests in use is then only about 16% of that from the temperate forests in use. Corresponding percentages per unit area of forests in use for the three main subdivisions of industrial wood adopted in FAO Forest Products Statistics also provide an interesting commentary — they are 21.4% for sawlogs, veneer logs, and logs for sleepers, 7.4% for pulpwood and pitprops, and 8.3% for other industrial wood. To sum up, for each hectare of tropical forests under significant exploitation there are roughly 2.2 hectares of temperate forests similarly engaged to produce about 14 times as much industrial wood. It will have been noted that production of pulpwood and pitprops, of which pulpwood comprises the dominant item, is markedly more backward in the tropical forests. It represents only 13% of the industrial wood production from the tropical forests, as against 29% for the much larger production from the temperate forests.

Since growing stock and annual gross increment per hectare are if anything higher on average in the tropical forests than in the temperate forests, we must ascribe th poor performance of the tropical forests in industrial wood production to be due for the greater part to the fundamentally poor market for all but a select few of the very numerous tropical species. Of course, marketability and intensity of production of tropical woods vary greatly with circumstances. In the comparatively few more or less gregarious tropical stands of commercially acceptable species in reasonably accessible locations, the intensity of production can be comparable to that in many temperate stands operated on a selection system of felling. Instances are — the greenheart stands of British Guiana, the tropical pine forests of Central America, and the occasional pure dipterocarp forests of South-east Asia. And there are the cases, of which almost any major tropical city will provide an instance, where the demand, whether for industrial wood or for fuel, from dense centres of population on forests in their near vicinity can be such as to endanger the continuity of the growing stock through overcutting. This danger is of course more acute where forest management is indifferent, which is unfortunately so often the case in the tropical regions. Indeed, the tendency for some time past has been for effective timber production to recede farther and farther away from most major tropical cities, and as the distance increases between forest and the markets it serves, so the demand on species and specifications become more selective.

But far the greater part of the tropical forests is of heterogeneous composition and lies in remote sparsely inhabited regions served by poor communications. These regions include some of the most backward in the world, where emergence from a subsistence economy is yet incomplete. The commercial cut in these distant forests is quite often negligible and almost invariably highly selective, while the light timber demands of the local populations are ordinarily gathered in person by the ultimate users, with little impact on the vast store that may be available. In such regions, the most serious threat to the growing stock is the practise of shifting cultivation that is so prevalent among the under-developed peoples.

That accessibility varies with species as well as with distance and with the effectiveness of communications is the major difficulty confronting the rational exploitation of tropical timber. An extreme case is teak, which constitutes the only species that can be profitably extracted from the remote headwater forests of Burma and Thailand, where communications are virtually limited to stream beds capable of floating timber only during brief periods of spate in the monsoons. Teak owes this distinction not only to its high price in world markets, but also to its buoyancy after girdling and to its invulnerability to insect attack and decay during prolonged periods of transit from forest to sawmill. In Ghana, which may be taken as characteristic for West Africa, more than 75% of the commercial timber production is accounted for by five species only — mahogany, wawa, sapele, utile, and makore; and of the many hundreds of species to be found in the tropical rains forest zone, significant commercial exploitation extends to only 20 or so.

Home markets are in general much less selective, both as regards species and specifications, than export markets, but they become progressively more selective as the distance from the forests increases. For one thing, the nearer the forests to the markets, the more possible is it to absorb the waste from commercial production, the lop and top in the forests as well as the slabs and offcuts in the sawmills, for domestic heating and inferior construction of a temporary nature, or for packaging and dunnage. In the home markets, national timber is often afforded substantial protection in one form or another against imported timbers. However, the competition between timbers from different national sources remains. It is for this reason that Belem at the mouth of the Amazon makes so much more liberal and comprehensive use of the timbers of the Para forests than a comparably populated unit in the Distrito Federal some 2,000 miles away by sea, where competition from Parana pine, peroba and other south Brasilian timbers is intense. That the home markets will take up lower specifications than the export markets is partly ascribable to the less exacting constructional and forniture standards of the tropical regions in general. Unfortunately, the home markets in the tropical regions are seldom of a magnitude to absorb more than a fraction of the potential production of the forests, despite the progressive improvement with rising living standards and increasing populations. India provided an exception, but the indigenous timber production potential of India is able to furnish little if any surplus to demand, while along the very heavily populated Ganges valley, supply from local forests falls well short of demand. The backwardness of the tropics in regard to consumption of industrial wood may be judged from the fact that per caput it is appreciably below 10% of average per caput consumption in the temperate zone. It is hardly surprising therefore that the timber industry of so many tropical countries is heavily oriented to sales abroad.

Of the export markets, those located within the tropics are in general less exacting both as to species and specifications than the markets of the temperate zone. This is partly an effect of lower transport costs and partly of easier user standards. Thus the Hongkong market will accept a wider species range and lower specifications from Southeast Asia than say the European markets. But tropical intra-regional timber movements are comparatively light. As an instance, for Southeast Asian hardwood exports in 1955 and 1956, only about 14% of total sawnwood exports and less than 17% of log exports went to tropical markets.

The various markets for tropical timbers, the near and distant home markets, the intra-regional and inter-regional export markets, are all of them complementary to each other, but as will be deduced from the foregoing they are seldom in proper balance to offset each other effectively. At the root of the problem, there is the inadequate offtake of the less favoured species and of the poorer specifications by the sparsely inhabited, economically backward forest hinterlands. Utilisation of available timber is therefore fractional, and as for waste in forest and sawmill, the greater part of it has to be left to rot or burn.

The price paid for a timber is dependent on its intrinsic properties and on the specifications in which it can be produced. Basically it is fixed within comparatively narrow bargaining limits by world market levels, which in effect are a compounding of prices for competing materials, including non-ligneous materials. The break-even points for the different tropical timbers that enter trade are smoothed out to some extent by differential royalties or stumpages, export duties, rail freights, etc. FOB prices for timbers sent overseas are conditioned by many considerations at the buying end: competition with timbers from all other sources, temperate and tropical, differential shipping rates, import duties, foreign exchange regulations, quotas, preferential treatments, etc. Thus imports of sawnwood to much of Continental Europe are subject to considerably higher duties on the whole than log imports, and this constitutes a hurdle to be surmounted by tropical countries in the general drive to process timbers as far as possible prior to export. With UK timber imports, Commonwealth countries are favoured by a preferential tariff, placing non-Commonwealth tropical timbers at a comparative disadvantage. As a rule, export of timbers from tropical countries are oriented towards countries with close political association, as from Ghana, Nigeria, and Malaya to the U K, from Surinam to the Netherlands, and from Amazonian Brazil to Portugal. Adverse effects of quota restrictions are exemplified in the case of India, whose timber imports since the war have been subject to a monetary ceiling, causing difficulties to the Burma teak trade owing to the resultant inadequate offtake of secondary grades that are not in demand by Europe. And as for the effect of unstable foreign exchanges, the complicated procedure for timber transactions between Paraguay and Argentina will provide an example.

Marketability of individual tropical species is again dependent on the usage pattern, traditions, and idiosyncracies of the various markets. Least marketable anywhere and in particular in any export market are the more refractory heavy to moderately heavy tropical woods of dubious durability and poor permeability to preservatives. It is unfortunate that so many of the tropical species, particularly of those found in the tropical rain forests, fall into this category. Naturally durable heavy woods on the other hand are much sought after in tropical markets, where timber in general is so prone to insect attack and decay. The use of preservatives is spreading in a number of tropical countries, broadening the range of acceptability of species for local consumption, though much still remains to be done in this field. There has been an increasing resort to the preservative treatment of woods for sleepers, piling, decking, and construction. Impressive progress in this regard has been achieved in parts of the Caribbean and in Malaya. As for the export demand for the very heavy timbers, it is circumscribed by the somewhat limited call for wood for piling, wharf decking, heavy duty flooring, etc. Timbers that are much sought after for these purposes include greenheart from British Guiana and azobé from West Africa. The prices offered for the heavy, non-buoyant woods ordinarily do not warrant too deep a penetration of the forests on their account alone, so that their extraction is confined largely to the near vicinity of motorable roads and railways, and to a narrow zone along main waterways where bamboos, reeds, and other rafting materials are freely available or where transport by barge or mechanical craft is possible.

Durable, stable constructional woods in the moderately heavy class, such as teak and afrormosia, are in brisk demand in export markets and are often highly priced. But the less durable, less stable woods of this weight class are priced as utility timbers, so that it is only when they are easily accessible and in fair concentration in the forests, like the Southeast Asian dipterocarps and shoreas, that they can be worked effectively. These timbers are used locally in fair volume, but the lower specifications developed during production for export in most cases all but satisfy any local demand.

Popular woods for furniture and interior trim generally range from moderately light to moderately heavy in weight, with emphasis on the less weighty timbers. Their reception in tropical home markets is uneven and dependent on living standards and traditional usages. The demand for the cedrelas in Latin America for instance is such as to leave very little surplus of this excellent timber available for shipment overseas. By contrast, mahogany in Latin America is indifferently appreciated, though its use has been growing in recent years, partly on account of the growing insufficiency of the supply of the cedrelas. It was the easy access and insect-repellent properties of the cedrelas, allied to bland working properties, that was largely responsible for the traditional usage of the timber. But the tropical market for furniture woods is in general of secondary importance, the poor tropical demand for furniture of a standard acceptable in the temperate zone providing little incentive for the setting up of industrial production within the tropics. So that the main outlet for the tropical furniture and joinery woods is in export, either in the round for veneer and plywood manufacture abroad, or as sawnwood. Though the manufacture of veneer and plywood for export is developing in a number of tropical countries, such as in the Philippines, Ghana, Nigeria, and Surinam. Sarawak ramin is a utility furniture-cum-joinery wood that virtually has only an export market, for it is too vulnerable to decay for local usage, even with the surface treatment to which all sawn stock must be subjected prior to export. The significance of medium weight furniture and joinery woods to the trade may be judged from the following — for Ghana, they constitute over 50% of total exports overseas; for the Amazon, they constitute about 60% of disposals to south Brazilian and overseas markets combined; while for Sarawak, ramin exports alone account for more than 80% of total exports.

Light weight, perishable woods find a very limited outlet in tropical markets, although their use has been expanding with the development of preservative treatment, notably in parts of the Caribbean. Indeed, in Trinidad a form of shelterwood sylviculture has been developed which favours the fast-growing soft hardwoods. The export market for the light weight woods with reasonably firm textures and good mechanical properties relative to density has increased very markedly since the war. They serve largely as softwood substitutes, strictly in the utility range, and are priced accordingly. The post-war demand for good grade light-weight timbers in the round for the European plywood industry has been outstanding. Quick extraction and the protection of the logs from insect depredations and stain has been the key to development. The remarkable post-war transformation of the Ghana trade in wawa provides an interesting example. Exports of this timber from Ghana, which were negligible in the pre-war, comprised almost 60% of log exports in 1957 and 15% of sawn exports.

A serious obstacle to development in the exploitation of tropical woods is the general infrequency of reasonable concentrations of commercially marketable trees of a single species. Thus in British Guiana, of the 200 more common species only 10 of them provide on average more than one tree of 16 inches in diameter and over per hectare in those forest blocks in which they are most favourably represented. In Ghana, the number of exploitable trees per hectare —for which purpose 22 species, some of them of secondary significance, were enumerated —varies from 1.6 in the wetter to 9.5 in the drier forests. Only in the case of four species does the record show more than one exploitable tree of each per hectare in any single main block of forests. The tenuous representation in the forests of the greater majority of individual tropical species constitutes a damper on export in all but exceptional cases. It will be found to be more or less a general rule that the tropical timbers commanding most attention in world trade are among those of commonest occurrence the forests, which seems logical enough an outcome of the marked preference of the trade for substantial and regular parcels of a single species. There has been resistance in export markets to mixed parcels of closely related species, though within a narrow colour range and of similar working properties. Malaya has achieved most success in this field with the marketing of mixed Dipterocarps and Shoreas.

The typically low yield of marketable timber per hectare in the tropical forests puts severe limitations on the profitability of opening up long lines of land communications for the trucking of production. In Liberia for instance, where rail facilities are poor, the stands of exportable timbers, though in similar density in the forests to that in other parts of West Africa are mostly beyond economic trucking range. Transport costs can be alleviated substantially by conversion of subgrade logs in or near the forests, but mill waste then tends to be heavy and in excess of the power generating needs of the sawmills. For the movement of shorts and the lower specifications to main markets is often unprofitable. Increasing the volume carried over a transport system can change an operational loss to a profit. Thus for a West African costing for transport by road over a distance of 120 miles, an operational loss of 12.5% was converted into a profit of 10.5% by doubling the volume to be carried . Operators are therefore content with a modest margin on the less valuable species and specifications in order to lessen the incidence of overheads on the main product. Even so, most tropical species are at present either virtually unmarketable or priced at levels that provide no margin over production costs, even with quite moderate haulage distances.

Accessibility is in a sense delimited by the margin between price and production costs and it is from this margin that the incentive for development arises. What may be thought to be a fair operational margin can vary with the security offered to entrepreneurs by legislatory provisions and political stability. There are countries in the tropics where this security has not been rated too highly, particularly by foreign capital, and this has served as a brake on the development of the ganisations with capital resources and the remote forests, where an assured medium term tenure is necessary to justify embarking on heavy outlay on equipment and communications. In practise, the most satisfactory and rational method of exploiting the remote tropical forests is through medium to longish term concessions calling for fairly large or-technical know-how to render them profitable. With export the main objective, as it so frequently is, foreign capital may be highly desirable if not essential to development and the degree of security offered will define terms of entry acceptable to entrepreneurs. The export trade of Southeast Asia, West Africa, and the far Amazon has been largely built up by foreign capital.

Of price and production costs relative to tropical timber production in the post-war, it is production costs that appear to have provided the more flexible element. As will be seen from the tables in th annexure to this paper, FOB prices for tropical hardwood exports have been comparatively static between 1950 and 1957. Of course, the figures obscure changes in quality and specifications of exports. In the case of tropical logs for instance, more of the cheaper light-weight woods were exported in 1957 than in 1950. Similar considerations, though of lesser moment, also applied to sawnwood exports. But if prices for individual species are studied, it will still be apparent that, allowing for rising labour and equipment costs, the great post-war increase in the volume of tropical timber exports cannot be ascribed purely or even in serious degree to price movements; though the widening of the price gap between coniferous and tropical hardwood exports undoubtedly directed the attention of an expanding world trade to the merits of a number of tropical utility woods, such as the West African Triplochitons and Sarawak ramin. The main incentive to produce more tropical timbers and to extend the area of accessibility almost certainly arose from savings effected by improved production techniques. Underlying causes for the improvement in West African production include improved road systems and port facilities, careful pre-planning of extraction on the basis of inventory, better mechanical equipment and the training of personnel to handle it, better sawmilling and seasoning standards, the grading of round and sawn output, and effective though superficial treatments of logs and sawnwood to minimise decay and insect attack. Much the same causes underly the increased production in the Philippines and other parts of Southeast Asia. In Sarawak, the increased post-war production of ramin can be ascribed to the development of a technique of extraction along temporary light rail tracks from the fresh-water swamp forests, allied to advances in seasoning and preservation processes.

Sawmilling has increased considerably in many parts of the tropics since the war, from 1947 to 1957 by 250% for West Africa and by 55% for South and Southeast Asia. The increased production has served both the home and the export markets and has certainly assisted in a more rational exploitation. But other forms of industrialisation of forest products have made small progress throughout the tropical regions, with rather better results in the field of veneer and plywood production than of pulp and boards. But the volume of tropical plywood production is still less than 4% of the world total. Even so, a considerable part of tropical plywood production is exported. Thus, almost all Surinam production leaves the country, and in the case of West Africa, more than 80%.

The great plywood production and consumption centres of the world —North America, Europe, and Japan— are of course concerned with the welfare of their own industry; and between them they have provided the major outlet for the better grade tropical veneer logs. With the need to import capital, equipment, glues, and technical know-how, the advantage to be derived from the setting up of plywood industry within the tropics, with export the principal objective, is generally quite marginal. So that the security factor can turn the scales when decisions are made by foreign entrepreneurs as to the merits of investing in plywood manufacture to be located in the tropics. However, promising results have been achieved in plywood production by foreign enterprise in West Africa, Surinam, and Southeast Asia, the linkage between the capital and its origins helping to direct output into amenable channels. Production of veneers for export, which requires a smaller capitalization, provide in some instances an interesting alternative to plywood production, where the home market for plywood is feeble. Progress with tropical production for export will certainly continue and seems rational in the sense that the nearer production is to source of the bulky raw material, the more economic will be the utilisation of sub-grade logs. But the rate of progress must be dependent to a considerable degree on plywood consumption within the tropics, for it is the indifferent home market for plywood to date that has constituted a major obstacle to the free development of a tropical industry. In this regard it is significant that in Insular Southeast Asia, where home consumption of plywood increased by about 250% from 1951 to 1957, possibly the most substantial expansion has taken place in the tropical regions in the production and export of plywood.

The slight home offtake in the tropics of boards from wood residues, such as the fibreboards and the particle-boards, is even still more marked than for plywod. The tropical production of these two commodities is still in its infancy. It is of the order of only 1% of the world total, with the major part of the production coming from agriculture waste. Mexico has been producing hardboards from billets of mixed tropical species for some years past. There are very few particle-board plants to be found in the tropics that are based on wood residues as raw material and most of them are captive plants producing extruded boards. The prognosis for development of tropical production of these boards is for the present much poorer than for plywood, since the export prospects are so much the less promising. The outlook for particle-board production may be the superior of the two, since capital expenditure for an effective plant is lighter than for fibreboard. The contribution of tropical production of fibreboards and particle-boards to more complete utilisation is unlikely to be of particular significance for some time to come, especially so in view of the limitations that exist to the mixing of species during processing.

As for pulp production in the tropics, the main interest still centres on the use of tropical pines and agricultural residues. Production from the mixed boardleaf species is technically feasible, but has yet to command the serious attention of investment capital. Progress has been achieved with bamboo, notably in India, with cetico in Peru, and there has been a recent interesting development in East Pakistan in the use for newsprint production of gewa — *Excaecaria* spp. It will be noted however that in not one of these cases is a mixture of species involved. Almost certainly, the serious pulping of mixed tropical hardwood species is unlikely to take place until tropical agricultural residues are more fully taken up for short-fibre pulp requirements. It is in long-fibre pulp that the tropical regions as a whole are deficient and attention has been focussed on the tropical pines in order to remedy this. The demand for paper and paper products in the tropics is developing, somewhat unevenly but positively, but there is still a long way to go before the pulping of tropical hardwood mixtures becomes a necessity.

The brief account that has been given above of the vagaries of the domestic and export trade in tropical timbers and their derivatives has been aimed at providing not only a commentary on the difficulties attendant on an immense species range, but also evidence that the position is far from being static. Despite the many and serious obstacles to rational production of tropical woods, their export has made remarkable advances in recent years, as can be seen in the tables in the annexure to this paper. Timber consumption within the tropics has also increased substantially in recent years, in South and Southeast Asia for instance, by as much as 50% between 1951 and 1957. The home markets for tropica hardwoods are due to expand still further with increasing populations and improving living standards, so that the future should see an extension of effective accessibility and a market trend towards more complete utilisation. The process can be stimulated by more inventory, by careful pre-planning of extraction and by a continuance of applied research into the properties of tropical woods.

**ANNEXURE.** (Estimates based on FAO Forest Products Statistics.)

I Area of forests — 1,000 hectares.

| | Tropical | Temperate |
|---|---|---|
| Total area | 2,130 | 1,785 |
| Accessible | 879 | 995 |
| Forests in use | 347 | 780 |

II Removals 1957 — millions $m^3(r)$

| | From tropical forests | From temperate forests |
|---|---|---|
| Sawlogs, veneer logs & logs for sleepers | 46.1 | 487.6 |
| Pulpwood & pitprops | 7.4 | 225.0 |
| Other industrial wood | 3.8 | 103.7 |
| Total industrial wood | 57.3 | 816.3 |
| Fuelwood, including wood for charcoal | 312.4 | 365.1 |

III Removals 1957 in $m^3(r)$ per 1,000 hectares.

| | From accessible forest | | From forests in use | |
|---|---|---|---|---|
| | Tropical | Temperate | Tropical | Temperate |
| Sawlogs, etc. | 53 | 489 | 133 | 622 |
| Pulpwood, etc. | 9 | 226 | 21 | 289 |
| Other i.w. | 5 | 108 | 11 | 132 |
| Total industrial wood | 67 | 823 | 165 | 1,043 |

**ANNEXURE.**

IV Export statistics — volumes in millions of $m^3$, (r) for logs and (s) for sawnwood; values in millions of \$; prices in \$ per $m^3$ FOB.

| | Volume of exports | | Value of exports | | Price per $m^3$ | |
|---|---|---|---|---|---|---|
| | 1950 | 1957 | 1950 | 1957 | 1950 | 1957 |
| LOGS | | | | | | |
| Coniferous | 1.5 | 2.0 | 16.8 | 35.3 | 11.4 | 17.8 |
| Hardwood | | | | | | |
| Temperate | 0.7 | 1.0 | 17.0 | 31.9 | 23.7 | 31.7 |
| Tropical | 1.9 | 6.1 | 36.4 | 113.6 | 19.2 | 18.6 |
| SAWNWOOD | | | | | | |
| Coniferous | 21.2 | 29.9 | 620.0 | 1137.5 | 29.2 | 38.1 |
| Hardwood | | | | | | |
| Temperate | 2.1 | 1.8 | 136.7 | 93.9 | 64.5 | 53.6 |
| Tropical | 0.7 | 1.7 | 32.2 | 94.0 | 48.1 | 54.4 |

V Percentages increases from 1950 to 1957 in

| | Volume of exports | Value of exports | Price Per $m^3$ |
|---|---|---|---|
| LOGS | | | |
| Coniferous | 35 | 210 | 56 |
| Hardwood | | | |
| Temperate | 40 | 87 | 34 |
| Tropical | 323 | 310 | - 3 |
| SAWNWOOD | | | |
| Coniferous | 39 | 83 | 30 |
| Hardwood | | | |
| Temperate | - 17 | - 31 | - 17 |
| Tropical | 258 | 292 | 13 |

double-spaced typewritten pages, although an occasional longer article of special interest may be acceptable. Articles should be submitted in the author's native tongue, and should include title or position of the author as well as a brief summary of the material. Manuscripts should be typewritten, double spaced, on one side of the page only, on 8½ x 11 inch white bond paper.

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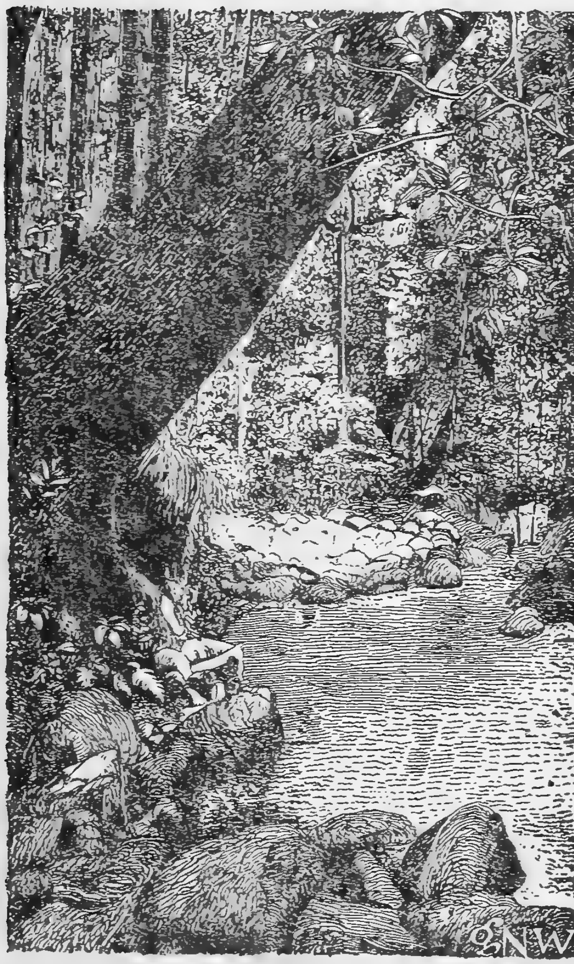

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# Caribbean Forester

El Caribbean Forester es una revista semestral gratuita publicada en Puerto Rico desde el año 1938 por el Centro Tropical de Investigaciones Forestales del Servicio Forestal del Departamento de Agricultura de los Estados Unidos. Esta publicación está dedicada a promover la mejor ordenación y utilización de los recursos forestales del trópico con especial énfasis a la región del Caribe.

Provee información a los que laboran en la dasonomía y ciencias afines sobre los problemas específicos que confrontan, las políticas forestales vigentes y el progreso del trabajo que se lleva a cabo para mejorar la ordenación y utilización de los recursos forestales tropicales. También sirve como medio informativo sobre los resultados y el progreso de los programas experimentales, en ordenación forestal tropical y utilización, que se llevan a cabo en el Centro de Investigaciones en Puerto Rico. También le brinda una oportunidad a otras personas interesadas en la dasonomía tropical para presentar el resultado de sus trabajos.

Se solicitan aportaciones de otras fuentes en el campo de la dasonomía tropical siempre que no estén considerándose para publicación en otras revistas. El manuscrito generalmente no debe exceder 20 páginas escritas a máquina a doble espacio, aunque ocasionalmente podría aceptarse un artículo más largo cuando tuviera un interés especial.

Los artículos deben someterse en la lengua vernácula del autor, deben incluir su título o posición que ocupa y un resumen corto. Deben estar escritos a máquina a doble espacio, solamente en un lado de la página, en papel blanco primera, tamaño 8½ por 11 pulgadas.

Las tablas deben numerarse consecutivamente, cada una en una hoja separada con su título. Las notas al pie usadas en las tablas deben escribirse a máquina como parte de la tabla y designarse por medio de números.

Las ilustraciones deben designarse con números y numerarse consecutivamente. Los títulos para cada ilustración deberán someterse en una página separada. Las fotografías sometidas como ilustraciones deben ser claras, bien definidas y en papel glaseado, preferiblemente 5 por 7 u 8 por 10 pulgadas en tamaño.

Las notas al pie deben numerarse consecutivamente con un número de llamada siguiendo la palabra en el texto a la cual hace referencia la nota al pie. La nota al pie debe aparecer en el texto en la línea siguiendo el número de referencia y separada del texto por medio de una línea corta hacia dentro desde el margen izquierdo del texto. Las notas al pie se usan para dar crédito a material no publicado y a comunicaciones. Si se hacen solamente unas pocas referencias a la literatura entonces dichas citas pueden aparecer como notas al pie. Las citas incluirán el nombre del autor, el año de publicación, el título del trabajo, y el nombre y páginas de la publicación.

Los manuscritos deben enviarse al Líder del Centro Tropical de Investigaciones Forestales, Río Piedras, Puerto Rico.

Las opiniones expresadas en esta revista no coinciden necesariamente con las del Servicio Forestal. Los artículos publicados en el Caribbean Forester pueden reproducirse siempre que se haga referencia a la fuente original.

The Caribbean Forester is a free semi-annual technical journal published since 1938 in Puerto Rico by the Tropical Forest Research Center, Forest Service, U. S. Department of Agriculture. This publication is devoted to the development of improved management and utilization of tropical forest resources, with special interest in the Caribbean region.

Through the pages of the journal tropical foresters and workers in allied scientific fields are informed of specific problems of tropical forestry, policies in effect in various countries, and progress of work being carried out for the improvement of the management and utilization of forest resources. It furnishes a means of distribution of information on the progress and results of the experimental programs of the Tropical Research Center in Puerto Rico. In addition, it affords an opportunity for other workers in the field of tropical forestry to make available the results of their work.

Contributions for the journal are solicited. However, material submitted should not be under consideration for publication elsewhere. Manuscripts should not ordinarily exceed 20

(Continúa en la portada #3)

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# DATOS DE CRECIMIENTO DE PLANTACIONES FORESTALES EN MEXICO, INDIAS OCCIDENTALES Y CENTRO Y SUR AMERICA

Segundo Informe Anual
de la
Sección de Forestación

COMITE REGIONAL SOBRE INVESTIGACION FORESTAL
COMISION FORESTAL LATINOAMERICANA
ORGANIZACION DE LAS NACIONES UNIDAS
PARA LA AGRICULTURA Y LA ALIMENTACION

Frank H. Wadsworth
Presidente

Compilado
en el
Centro Tropical de Investigaciones Forestales
Servicio Forestal
Departamento de Agricultura de los Estados Unidos
Río Piedras, Puerto Rico

Diciembre 1, 1960

## DATOS DE CRECIMIENTO DE PLANTACIONES FORESTALES EN MEXICO, INDIAS OCCIDENTALES Y CENTRO Y SUR AMERICA

La Sección de Forestación del Comité Regional Sobre Investigación Forestal de la Comisión Forestal Latinoamericana de la FAO, establecida en el 1958, presenta a continuación un informe del trabajo realizado durante sus primeros dos años. La Sección tiene por objeto recopilar y publicar información concerniente a la región en cuanto a: (1) las condiciones de crecimiento y productividad de las plantaciones que han tenido éxito, (2) las limitaciones de adaptabilidad de los árboles señaladas por los fracasos de plantaciones, y (3) especies de árboles adicionales que merecen ser probadas. Hasta la fecha el trabajo de la Sección se ha limitado casi totalmente al primero de estos objetivos.

Una relación del trabajo de la Sección durante el primer año apareció en su primer informe anual titulado "Plantaciones Forestales en América Latina" y publicado por el Centro Tropical de Investigaciones Forestales en diciembre del 1959. Durante ese año se adoptó un formulario para anotar la información sobre las plantaciones. Noventa técnicos en representación de 25 países fueron invitados para que se unieran a la Sección y cooperaran enviando descripciones. Cuarenta cooperadores en representación de 17 países enviaron datos sobre 129 plantaciones y 45 especies. El Centro arregló la información recibida para que cada plantación apareciera en una página e incluyera todos los datos obtenidos en cuanto a productividad, sitio y fuentes de información adicional.

### El Segundo Año de la Sección

La experiencia adquirida por la Sección durante su primer año demostró tanto las potencialidades futuras como las limitaciones actuales de la colección de descripciones confiables, comparables y completas por medio de correspondencia. Algunos cooperadores enviaron descripciones excelentes lo bastante completas para proporcionar ayuda substancial a otros dasónomos. Otras descripciones presentaron solamente una información mínima. Tales descripciones se publicaron cuando tenían suficiente información para indicar al lector la conveniencia de escribir a la fuente de información o de visitar la plantación sobre el terreno. Otras que carecían de información básica necesaria para relacionar el comportamiento del árbol al sitio o que no se entendían claramente fueron retenidas para completarse más tarde. Por lo tanto el primer grupo de descripciones publicado no presentó un cuadro completo ni exacto de las mejores plantaciones de la región. Estas fallas motivaron comentarios útiles, correcciones y adiciones de varias fuentes. Sin embargo, se demostró claramente que la calidad de estas descripciones no podía mejorarse meramente por correspondencia. Por lo tanto, el Presidente de la Sección obtuvo autorización del Presidente del Comité Regional Sobre Investigación Forestal para enviar técnicos capacitados a la región para ayudar a los dasónomos locales a completar las descripciones ya recibidas y para obtener datos sobre más plantaciones prometedoras.

Dasónomos del Centro Tropical de Investigaciones Forestales al servicio de la Sección examinaron durante el año plantaciones forestales en muchas partes de la mitad norte de la región. El Dr. F. B. Lamb visitó la Península de Yucatán en Mexico, Guatemala, Honduras Británica, Honduras, Nicaragua, Costa Rica, Panamá, Colombia y Ecuador. El Dr. Briscoe visitó a Jamaica, Martinica, Sta. Lucía, Trinidad, Guayana Británica, Surinam y la región baja del Amazonas en el Brazil. El Presidente de la Sección visitó la parte central de Mexico. Mayormente a consecuencia de estas visitas el número de miembros cooperadores aumentó de 40 a 54 durante el año, el número de plantaciones descritas aumentó de 129 a 257 y el número de especies informado aumentó de 45 a 72.

El crédito por los logros alcanzados por la Sección durante el año 1960 pertenece principalmente a aquellos miembros que contribuyeron información nueva sobre las plantaciones de la región. Los viajes de los Dres. Lamb y Briscoe fueron especialmente significativos para el logro de este objetivo. La Sección debe reconocimiento especial a ambos por su trabajo de organizar, preparar para publicación y completar cuando podían las descripciones aquí incluídas. El Dr. L. R. Holdridge de Costa Rica también merece reconocimiento por sus comentarios útiles sobre los datos climáticos y la clasificación ecológica que aparecen en el primer informe. Un examen minucioso del primer informe por el señor Carlos Flinta de la FAO también produjo varios comentarios que nos fueron de utilidad al preparar este segundo informe.

## Planes Para el Próximo Año

La Séptima Sesión de la Comisión Forestal Latinoamericana celebrada en la Ciudad de Mexico en agosto del 1960, solicitó del Comité Sobre Investigación Forestal que continuara este proyecto, dándole atención especial al género *Eucalyptus*, en preparación para el Congreso Mundial Sobre Eucalipto a celebrarse en Sao Paulo, Brazil durante el otoño del 1961. Este informe describe 36 plantaciones de eucalipto pero está incompleto en cuanto a esa parte de la región situada al sur del Río Amazonas. La Sección se propone llevar a cabo este trabajo por correspondencia hasta donde sea posible pero también por medio de viajes adicionales utilizando dasónomos que tengan responsabilidades regionales.

Se solicita de todos los dasónomos de la región que se unan a la Sección y que contribuyan información concerniente a las plantaciones prometedoras que corrija o suplemente la de este informe. Tal información debe enviarse al Presidente, Sección de Forestación, Apartado 577, Rio Piedras, Puerto Rico. Se suplirán los formularios que se necesiten. Los nombres de los cooperadores se añadirán a la lista de envíos para recibir copias de informes futuros según se publiquen.

La nueva organización de servicios establecida en el 1960 bajo la Oficina Regional Forestal de la Comisión Forestal Latinoamericana, denominada Grupo Asesor de Capacitación e Investigaciones Forestales para América Latina" (GACIFAL) posiblemente represente una nueva fuente de información sobre plantaciones. Los planes preliminares de este Grupo presentados ante la Sesión de la Comisión en Mexico indican que posiblemente la Sección reciba mucha ayuda de dicha organización a este respecto.

## Descripciones de las Plantaciones

Este informe presenta todas las plantaciones estudiadas por la Sección desde sus comienzos. Por lo tanto es cumulativo y sus descripciones substituyen las del primer informe. Esta duplicidad fué inevitable debido a las muchas correcciones y adiciones en las primeras descripciones como resultado de comentarios subsiguientes recibidos y de los estudios de campo. Los números de las plantaciones anteriores se retuvieron de manera que la referencia a cada plantación sea consistente.

La agrupación de las descripciones de las plantaciones en el primer informe por categorías amplias de temperatura y lluvia ocasionó algunos comentarios. Esta base para agrupar todavía parece servir mejor los objetivos de estas descripciones, a saber, permite al dasónomo comparar el desarrollo de todas las plantaciones de la región establecidas bajo sus condiciones sin considerar la especie o la localidad. Las plantaciones aparecen en el índice no sólo por especie como en el primer informe sino también por país, cooperador y número de plantación para facilitar así la contrarreferencia.

La clasificación de formaciones forestales del Dr. Holdridge[1/] como base para agrupar plantaciones en medio ambientes similares tiene la ventaja que depende del único tipo de datos climáticos locales generalmente disponibles. Además los grupos son de una amplitud proporcionada con el conocimiento actual de diferencias climáticas de mayor significación en el comportamiento de los árboles en la región. Las bases esenciales de la clasificación según se modificaron para la preparación de este informe son como sigue:

Grupo Ecológico

| Temperatura Promedio °C | 24° C+ | 12 - 24° | | 6 - 12° |
|---|---|---|---|---|
| Promedio de Precipitación Anual | Tropical | Subtropical (Sin heladas) | Templado (Con heladas) | Fresco |
| mm | | | | |
| 8000+ | 1. Pluvial | | | |
| 4000-8000 | 2. Muy húmedo | 6. Pluvial | 11. Pluvial | |
| 2000-4000 | 3. Húmedo | 7. Muy húmedo | 12. Muy húmedo | 16. Pluvial |
| 1000-2000 | 4. Seco | 8. Húmedo | 13. Húmedo | 17. Muy húmedo |
| 500-1000 | 5. Muy seco | 9. Seco | 14. Seco | 18. Húmedo |
| 0-500 | | 10. Muy seco | 15. Muy seco | |

1/ Holdridge, L. R. 1947. Determination of world plant formations from simple climatic data. Science 105 (2727): 367-368.

La Sección considera esta compilación como un principio hacia un fondo de tales conocimientos que aumentará indefinidamente. La información incluída ahora es tan cuantiosa que el costo de la reproducción anual en un informe cumulativo, como se hizo este año, podría hacerse prohibitivo. Por lo tanto las páginas se han perforado al margen para encuadernarse y facilitar la inserción de datos futuros según se publiquen hasta que se haga una reproducción completa, posiblemente cada cinco años.

NOMBRE Cordia alliodora

GRUPO ECOLOGICO Tropical Muy Húmedo

PAIS Costa Rica PLANTACION 130

CRECIMIENTO

DOMINANTES Y CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 3 | 10 | |
| 8 | 21 | |

SITIO

LAT. 10°N LONG. 84°O ELEV. 100

PRECIPITACION 4420 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE mixta SUELO aluvial

TOPOGRAFIA plana

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION corte de malezas FECHA 1950

ESPACIAMIENTO 3 x 4 AREA 1.5

MATERIAL de vivero a raíz desnuda, 50 cm

CUIDO 2 o 3 limpiezas

LUGAR Los Diamantes Nos. 1 & 2, 50 km al norte de San José

ORIGEN DE INFORMACION G. Budowski, IICA, Turrialba, C. R.

ESPECIE Cordia alliodora

GRUPO ECOLOGICO Tropical Muy Húmedo

PAIS Costa Rica PLANTACION 131

CRECIMIENTO
DOMINANTES Y CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 7 | 22 | |
| 12 | 30 | |

SITIO
LAT. 10°N LONG. 84°O ELEV. 100

PRECIPITACION 4420 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE mixta SUELO aluvial

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS rodal natural de la localidad

SIEMBRA
PREPARACION Corte de maleza FECHA 1946

ESPACIAMIENTO 3 x 4 MATERIAL semillas

CUIDO pocas limpiezas

LUGAR Los Diamantes No. 3, 50 kms al norte de San José

ORIGEN DE INFORMACION G. Budowski, IICA, Turrialba, C. R.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Muy Húmedo

PAIS Jamaica Plantacion 132

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 15 | 10 | 1440 | | |

RENDIMIENTO postes a los 10 años

SITIO

Lat. 18°N LONG. 77°0 ELEV. 600

PRECIPITACION 5000

MESES DE SEQUIA Enero-Abril, Julio-Agosto

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso duro

TEXTURA DEL SUBSUELO arcilloso duro REACCION 5

DRENAJE impedido ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA ondulada ASPECTO S

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Honduras Británica, 300 m, 3000 mm

SIEMBRA

PREPARACION desmonte completo FECHA 1950

ESPACIAMIENTO 2.5 x 2.5 MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 95% a los 3 meses; 91% a los 8 años

CUIDO Dos limpiezas al año durante 3 años; aclareo a los 10 años

COMENTARIOS Especie prometedora

ORIGEN DE INFORMACION Conservator of Forests, Kingston, Jamaica

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Muy Húmedo

PAIS Costa Rica PLANTACION 133

CRECIMIENTO

| DOMINANTES Y CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 15 | 41 | 27 | 239 | | |

SITIO

LAT. 8°30'N LONG. 83°30'O ELEV. 40

PRECIPITACION 5800 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE caliza SUELO aluvial

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 2+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS plantacion, Summit Garden, Panama Canal Zone

SIEMBRA

PREPARACION desmonte del bosque FECHA 1945

ESPACIAMIENTO 5 x 5 AREA 10

MATERIAL de vivero a raíz desnuda HERRAMIENTAS pala

SUPERVIVENCIA 60% a los 15 años

CUIDO 2 limpiezas anuales durante 3 años; despues ocasionalmente

REPRODUCCION semillas abundantes

LUGAR Finca Calera, Km 50-51, Distrito Esquinas, División Golfito

COMENTARIOS troncos no circulares, ramosos

ORIGEN DE INFORMACION Cia. Bananera de Costa Rica, División Golfito, San José, C. R.

ESPECIE Casuarina equisetifolia

GRUPO ECOLOGICO Tropical Muy Húmedo

PAIS Puerto Rico PLANTACION 3

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA: VOL. |
| 8 | 13 | 15 | 1299 | 16 |
| 16 | 24 | | | 23 |
| 19 | 28 | | | 21 |

SITIO

LAT. 18°20'N LONG. 65°45'O ELEV. 100

PRECIPITACION 3429 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO coluvial

TEXTURA DEL SUELO franco arcilloso

TEXTURA DEL SUBSUELO arcilloso y con piedras grandes

REACCION 6.2 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 5% inclinación leve ASPECTO NO

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION limpieza con machete FECHA 1937
ESPACIAMIENTO 2.5 x 2.8
MATERIAL de vivero a raíz desnuda
HERRAMIENTAS zapapico SUPERVIVENCIA 91% a los 8 años

CUIDO limpieza el primer año; aclareos a los 16 y 19 años

REPRODUCCION semillas abundantes

LUGAR Sabana, Bosque Experimental de Luquillo

COMENTARIOS Los árboles aparecen maduros a los 19 años; disminución en el vigor.

ORIGEN DE INFORMACION USFS Estudio #2019L, Tropical Forest Research Center, Box 577, Rio Piedras, Puerto Rico

ESPECIE Cedrela mexicana

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 4

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 16 | 22 | |
| 21 | 28 | |

SITIO

LAT. 18°15'N LONG. 65°45'O ELEV. 250

PRECIPITACION 3800 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO arcilla pesada PROFUNDIDAD 3 cm

TEXTURA DEL SUBSUELO arcilla pedregosa

PROFUNDIDAD 50 cm DRENAJE impedido

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA inclinada 15% ASPECTO SO

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION abrir calles FECHA 1936

ESPACIAMIENTO esparcidos AREA 100 árboles

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico

CUIDO varias limpiezas

LUGAR Tracto 41, Bosque Experimental de Luquillo

ORIGEN DE INFORMACION FMR Estudio 1995L; Tropical Forest Research Center, Box 577, Rio Piedras, P. R.

ESPECIE Cedrela mexicana

GRUPO ECOLOGICO Tropical Húmedo

PAIS Panamá PLANTACION 134

CRECIMIENTO
DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 12 | 24 | 21 |

SITIO
LAT. 8°20'N LONG. 83°0 ELEV. 8

PRECIPITACION 2600 MESES DE SEQUIA Enero-Abril

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 6 cm

TEXTURA DEL SUBSUELO franco arenoso

PROFUNDIDAD 3+ REACCION 6.5 DRENAJE libre

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA 7 años al cultivo de guineos

ORIGEN DE SEMILLAS local

SIEMBRA
PREPARACION corte de maleza FECHA 1948

ESPACIAMIENTO 4.5 x 9.2 AREA 4

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 50% a los 12 años

CUIDO 2 limpiezas

REPRODUCCION semillas escascas

LUGAR Finca Majagua, 11 km al N de Puerto Armuelles

ORIGEN DE INFORMACION Chiriquí Land Co., Puerto Arnuelles, Panamá

ESPECIE Cordia alliodora

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 6

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 12 | 17 | 889 | 10 | |

SITIO

LAT. 18°20'N LONG. 65°45'O ELEV. 300

PRECIPITACION 3040 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 1+

REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 8% inclinación ASPECTO NO

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS desconocido

SIEMBRA

FECHA 1949 ESPACIAMIENTO 2.5 x 2.5

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA 56% a los 10 años

CUIDO limpiezas durante 3 años

REPRODUCCION ninguna

LUGAR Vivero Catalina, Bosque Experimental de Luquillo

ORIGEN DE INFORMACION FMR Estudio 2364, Tropical Forest Research Center, Box 577, Rio Piedras, P. R.

ESPECIE Cybistax Donnell-smithii

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 7

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 3 | | 9 | | | |
| 8 | 16 | 23 | 750 | 15 | |

SITIO

LAT. 18°20'N LONG. 65°45'O ELEV. 300

PRECIPITACION 3048 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 1+

REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinada, 5% ASPECTO NO

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Guatemala, Costa del Pacífico

SIEMBRA

PREPARACION cultivo FECHA 1951 ESPACIAMIENTO 3 x 3

MATERIAL de vivero a raíz desnuda HERRAMIENTAS zapapico

SUPERVIVENCIA 68% a los 8 años

CUIDO limpiezas a menudo durante los primeros años

REPRODUCCION ninguna

LUGAR Vivero Catalina, Bosque Experimental de Luquillo

ORIGEN DE INFORMACION FMR Estudio 2365, Tropical Forest Research Center, Box 577, Rio Piedras, P. R.

ESPECIE Cybistax donnell-smithii

GRUPO ECOLOGICO Tropical Húmedo

PAIS Costa Rica PLANTACION 8

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 15 | 24 | 236 | | |

SITIO

LAT. 9°59'N LONG. 85°45'O ELEV. 10

PRECIPITACION 2300 MESES DE SEQUIA Dic.-Marzo

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO arena muy fina PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO arena fina PROFUNDIDAD 1+

REACCION 6.6 DRENAJE pobre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivado

SIEMBRA

FECHA 1952 ESPACIAMIENTO 2.5 x 2.5 AREA 0.25

MATERIAL de vivero a raíz desnuda, 45 cm

SUPERVIVENCIA (15% a los 7 años)

REPRODUCCION flores escasas

LUGAR Granja Socorrito, Barranca, Puntarenas, Costa Rica;

a 120 km, en carretera de San José a Puntarenas

COMENTARIOS La larga temporada de sequía hace que la vegetación nativa parezca pertenecer al grupo Tropical Seco.

ORIGEN DE INFORMACION C. L. Lizano, Jefe, Sección Forestal, Dpto. Tierras y Bosques, Min. de Agri. e Ind., San José, C. R.

3 - 8

ESPECIE Cybistax donnell-smithii

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras PLANTACION 28

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 36 | 23 | 250 | 25 | |

SITIO

LAT. 15°45'N LONG. 87°30'O ELEV. 8

PRECIPITACION 2002 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 28° HELADAS ninguna

ROCA MADRE granito SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO franco arenoso grueso

PROFUNDIDAD 3+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivo durante 10 años

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION abrir calles FECHA 1949

ESPACIAMIENTO 5 x 5 AREA 60

MATERIAL de vivero en potes, 60 cm HERRAMIENTAS pala

SUPERVIVENCIA (62% a los 10 años)

CUIDO limpieza cada 4 meses

REPRODUCCION semillas abundantes, arbolitos escasos

LUGAR San Alejo, 12 km al S del Puerto de Tela, Honduras

ORIGEN DE INFORMACION P. L. Shank, Tela RR Co., Progreso, Honduras

ESPECIE Enterolobium cyclocarpum

GRUPO ECOLOGICO Tropical Húmedo

PAIS Trinidad PLANTACION 135

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 15 | 30+ | | | 45 |

SITIO

LAT. 11°N LONG. 60°W ELEV. 270

PRECIPITACION 3000 TEMPERATURA PROMEDIO 25°

HELADAS ninguna ROCA MADRE caliza

SUELO residual TEXTURA DEL SUELO franco arcilloso friable

PROFUNDIDAD 8 cm

TEXTURA DEL SUBSUELO franco arcilloso friable

PROFUNDIDAD 60 cm REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA abra, 10% inclinación

ASPECTO NE

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS Grenada

SIEMBRA

PREPARACION tumba FECHA 1948

ESPACIAMIENTO 1.2 x 1.2 AREA 0.5

MATERIAL semillas, 4/lugar

SUPERVIVENCIA 50% al año

CUIDO 3 limpiezas /año durante 3 años, ocasionales hasta los 10 años

REPRODUCCION semillas escasas

LUGAR Brigand Hill

COMENTARIOS Germinación retardada un año. La forma no es comparable al mahoe, pero trozando con cuidado se obtendran de 2-4 trozas por árbol.

ORIGEN DE INFORMACION Conservator of Forests, Port of Spain, Trinidad, B.W.I.

ESPECIE Eucalyptus naudiniana (syn. deglupta)

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras PLANTACION 9

CRECIMIENTO

| DOMINANTES Y CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 30 | 26 | (400) | | 55 |

SITIO

LAT. 15°40'N LONG. 87°30'O ELEV. 30

PRECIPITACION 3084 MESES DE SEQUIA Marzo-Mayo

TENPERATURA PROMEDIO 28 HELADAS ninguna

ROCA MADRE arenisca SUELO aluvial

TEXTURA DEL SUELO franco limoso PROFUNDIDAD 50 cm

TEXTURA DEL SUBSUELO franco arenoso con piedras

PROFUNDIDAD 2+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA ondulada, 0-5%

ASPECTO NO CONDICION ANTES DE LA SIEMBRA cultivo 25 años

ORIGEN DE SEMILLAS Australia

SIEMBRA

PREPARACION cultivado FECHA 1949-50

ESPACIAMIENTO 5 x 5 AREA 14

MATERIAL de vivero en potes HERRAMIENTAS pala

SUPERVIVENCIA 100% a los 10 años

CUIDO 3 limpiezas anuales durante 3 años

REPRODUCCION semillas abundantes

LUGAR Centro de Introducción de Plantas de Lancetilla

COMENTARIOS siembra en hileras

ORIGEN DE INFORMACION P. J. Shank, Tela RR Co., Progreso, Honduras

ESPECIE Eucalyptus naudiniana (syn. deglupta)

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras PLANTACION 136

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 18 | 20 | 470 | 9 | |

SITIO

LAT. 15°40'N LONG. 87°0 ELEV. 20

PRECIPITACION 3084 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 5.5 DRENAJE libre

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS plantación local, de semillas australianas

SIEMBRA

PREPARACION limpieza FECHA 1955

ESPACIAMIENTO 4.5 x 4.5 AREA 1

SUPERVIVENCIA (95% a los 5 años)

CUIDO 3 limpiezas por año durante 5 años

REPRODUCCION semillas abundantes

LUGAR Lancetilla Garden, Plot 24; 6 km SE de Tela

ORIGEN DE INFORMACION P. J. Shank, United Fruit Co., La Lima, Hond.

ESPECIE Hibiscus elatus

GRUPO ECOLOGICO Tropical Húmedo

PAIS St. Lucia, B.W.I. PLANTACION 137

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 14 | 21 | | 11 | |

SITIO

LAT. 14°N LONG. 61°O ELEV. 20

PRECIPITACION 3000 MESES DE SEQUIA Enero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO arenoso franco arcilloso

PROFUNDIDAD 60 cm REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA pendiente mediana, 50% ASPECTO NO

CONDICION ANTES DE LA SIEMBRA cultivo 8 años

ORIGEN DE SEMILLAS plantación local, semillas de Jamaica

SIEMBRA

PREPARACION corta total FECHA 1953

ESPACIAMIENTO 1.8 x 1.8 AREA 0.5

MATERIAL de vivero a raíz desnuda, 60 cm

HERRAMIENTAS machete SUPERVIVENCIA 80% al año

CUIDO 3 limpiezas durante 2 años, 1 vez despues; aclareo del 50% al tercer año; 25% al sexto año; poda hasta 2.5 m el tercer año

REPRODUCCION semillas abundantes

LUGAR Barre de L'Isle

ORIGEN DE INFORMACION W. G. Lang, Forest Dept., Castries, St. Lucia

ESPECIE Hibiscus elatus

GRUPO ECOLOGICO Tropical Húmedo

PAIS Jamaica PLANTACION 138

CRECIMIENTO

DOMINANTES & CODOMINANTES — DENSIDAD POR HECTAREA

| EDAD | DAP. cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
|---|---|---|---|---|---|
| 16 | 21 | 31 | | 16 | |

SITIO

LAT. 18°N LONG. 77°30'O ELEV. 300

HELADAS ninguna ROCA MADRE caliza

SUELO residual TEXTURA DEL SUELO franco arcilloso friable

PROFUNDIDAD 17 cm TEXTURA DEL SUBSUELO franco arcilloso

PROFUNDIDAD 60 cm REACCION 6.0 DRENAJE libre

TOPOGRAFIA abra ASPECTO 0

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION quema y cultivo FECHA 1944

ESPACIAMIENTO 2.5 x 2.5 MATERIAL de vivero a raiz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA 90% al año

REPRODUCCION posturas abundantes

LUGAR 13 kms al S de Duncans

COMENTARIOS forma excelente

ORIGEN DE INFORMACION Conservator of Forests, Kingston, Jamaica

ESPECIE Hibiscus elatus

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 30

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 11 | 23 | 23 | 500 | | |

RENDIMIENTO postes

SITIO

LAT. 18°23'N LONG. 66°55'O ELEV. 200

PRECIPITACION 2040 MESES DE SEQUIA Enero-Marzo

TEMPERATURA PROJEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO aluvial

TEXTURA DEL SUELO arcilla pesada PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO arcilla pesada PROFUNDIDAD 1 +

REACCION 6.0 DRENAJE impedido

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinada, 5% ASPECTO O

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Jamaica

SIEMBRA

PREPARACION cultivo FECHA 1948

ESPACIAMIENTO 2.5 x 2.5 AREA 0.5

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA 30% a los 11 años

CUIDO limpieza

REPRODUCCION arbolitos escasos, retoños abundantes

LUGAR Al norte del Lago Guajataca, P. R.

COMENTARIOS muchos retoños, pastoreo, perjudicado por herbicidas en fincas de caña adyacentes.

ORIGEN DE INFORMACION Tropical Forest Research Center, Box 577, Rio Piedras, P. R.

ESPECIE Ochroma lagopus

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 11

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 2 | 18 | 11 | 914 | 17 | 73 |
| 3 | 23 | 15 | 914 | 30 | 150 |

SITIO

LAT. 17°N LONG. 88°25'O ELEV. 15

PRECIPITACION 2600 MESES DE SEQUIA Febrero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE metamórfica SUELO coluvial

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso arenoso PROFUNDIDAD 1+

REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1956

ESPACIAMIENTO 3 x 3 a los 6 meses AREA 5

MATERIAL semillas

CUIDO 2 limpiezas durante el primer año, 1 anual despues; entresaques semi-mecánicos a los 6 y 18 meses.

REPRODUCCION semillas escasas

LUGAR 8 km al O de la costa de Stann Creek

COMENTARIOS Regeneración natural; subplantadas por siembra directa de Swietenia macrophylla a 9 x 9 m en 1960

ORIGEN DE INFORMACION Estudio 1956 Balsa, Conservator of Forests, Belize, B.H.

ESPECIE Pinus caribaea

GRUPO ECOLOGICO Tropical Húmedo

PAIS British Guiana PLANTACION 12

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 13 | 13 | | 25 | |

SITIO

LAT. 6°20'N LONG. 58°35'O ELEV. 60

PRECIPITACION 2650 MESES DE SEQUIA Febrero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

SUELO marino

TEXTURA DEL SUELO franco arenoso grueso brown

PROFUNDIDAD 20 cm TEXTURA DEL SUBSUELO franco arcilloso arenoso PROFUNDIDAD 60 cm REACCION 5.5

DRENAJE libre ESTADO DEL SUELO poco afectado

TOPOGRAFIA ligeramente ondulada ASPECTO SO

ORIGEN DE SEMILLAS Distrito Cayo, Honduras Británica, 1700 mm y 600 m

SIEMBRA

PREPARACION tumba y quema FECHA 1955

ESPACIAMIENTO 1.8 x 2.7 AREA 1

MATERIAL de vivero en potes SUPERVIVENCIA 90% a los 5 años

CUIDO 2 limpiezas anuales durante 2 años, luego según era necesario

REPRODUCCION flores escasas

LUGAR 2.4 Km al S de Bartica, detras del arboretum

COMENTARIOS Kudzu tropical sembrado el mismo año causó un gran problema, pero ahora esta controlado

ORIGEN DE INFORMACION Conservator of Forests, Georgetown, B. G.

ESPECIE Pinus caribaea

GRUPO ECOLOGICO Tropical Húmedo

PAIS Trinidad, B.W.I. PLANTACION 13

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTÂREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL |
| 6 | 14 | 11 | 1074 | | |

SITIO

LAT. 10°N LONG. 61°O ELEV. 100

PRECIPITACION (2400) MESES DE SEQUIA Enero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE variable SUELO residual

TEXTURA DEL SUELO arcilloso arenoso REACCION 5.0

DRENAJE libre ESTADO DEL SUELO degradado

TOPOGRAFIA pendientes hasta 60%

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Honduras Británica

SIEMBRA

PREPARACION tumba y quema FECHA 1953

ESPACIAMIENTO 1.8 x 1.8 AREA 140

MATERIAL de vivero en potes, 20-40 cm

SUPERVIVENCIA 85% al año

CUIDO una limpieza el primer año, 2 veces al año los próximos 2 años

REPRODUCCION semillas escasas

COMENTARIOS Se siembra tambien en Bosque Tropical Seco

ORIGEN DE INFORMACION Conservator of Forests, Port of Spain, Trinidad

ESPECIE Pinus caribaea

GRUPO ECOLOGICO Tropical Húmedo

PAIS British Honduras PLANTACION 33

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 17 | 8 | 670 | 23 | 35 |
| 8 | 18 | 10 | 670 | 28 | 48 |

SITIO

LAT. 17°N LONG. 88°20'O ELEV. 15

PRECIPITACION 2015 MESES DE SEQUIA Febrero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO franco arcilloso arenoso

PROFUNDIDAD 1+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA levemente inclinada ASPECTO SE

CONDICION ANTES DE LA SIEMBRA bosque cortado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1951

ESPACIAMIENTO 3.1 x 3.1 AREA 38

MATERIAL de vivero en potes, 10 cm HERRAMIENTAS azada

SUPERVIVENCIA (75% a los 7 años)

CUIDO limpieza anual

REPRODUCCION flores escasas

LUGAR 8 km al O de la costa de Stann Creek

ORIGEN DE INFORMACION 1951 Pine, Conservator of Forests, Belize, B. H.

ESPECIE Pinus caribaea

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 34

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL |
| 11 | 20 | 12 | 740 | 15 | 74 |
| 12 | 21 | 14 | 740 | 18 | 99 |

RENDIMIENTO 19 $m^3$ a los 11 años

SITIO

LAT. 17°N LONG. 8°20'O ELEV. 15

PRECIPITACION 2015 MESES DE SEQUIA Febrero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO franco arcilloso arenoso

PROFUNDIDAD 1+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA levemente inclinada ASPECTO E

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1947

ESPACIAMIENTO 3.1 x 3.1 AREA 37

MATERIAL de vivero en potes, 10 cm HERRAMIENTAS azada

SUPERVIVENCIA (83% a los 12 años)

CUIDO 1 limpieza anual durante 8 años

REPRODUCCION flores escasas

LUGAR 8 km al O de la costa de Stann Creek

ORIGEN DE INFORMACION 1947 Pine, Conservator of Forests, Belize, B.H.

ESPECIE Pinus caribaea

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 35

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 16 | 10 | 1360 | 18 | 86 |
| 14 | 18 | 13 | 890 | 20 | 110 |

SITIO

LAT. 17°N LONG. 88°20'O ELEV. 15

PRECIPITACION 2160 MESES DE SEQUIA Febrero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO franco arenoso compacto PROFUNDIDAD 1

REACCION 6.0 DRENAJE (impedido)

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA valle poco profundo ASPECTO E-O

CONDICION ANTES DE LA SIEMBRA bosque cortado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1944

ESPACIAMIENTO 2.5 x 2.5 AREA 14

MATERIAL de vivero en potes, 10 cm HERRAMIENTAS azada

SUPERVIVENCIA (56% a los 14 años)

CUIDO limpieza anual durante 8 años, aclareo a los 13 años

REPRODUCCION flores abundantes

LUGAR 8 km al O de la costa de Stann Creek

COMENTARIOS fuego a los 11 años mató muchos árboles

ORIGEN DE INFORMACION Estudio 1944 Pine, Conservator of Forests, Belize, B. H.

ESPECIE Pinus caribaea

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 262

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 10 | 6 | (1142) | 5 | 80 |

SITIO

LAT. 16°15'N LONG. 89°0 ELEV. 15

PRECIPITACION 3200 MESES DE SEQUIA Marzo - Mayo

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO medianamente arcilloso

PROFUNDIDAD 20 cm TEXTURA DEL SUBSUELO arcilloso pesado

PROFUNDIDAD 1+ REACCION ácida

DRENAJE impedido ESTADO DEL SUELO poco afectado

TOPOGRAFIA 1% inclinación ASPECTO SE

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1954

ESPACIAMIENTO 2.5 x 2.5 AREA 13

SUPERVIVENCIA 54% a los 2 años

CUIDO 2 limpiezas el primer año, anualmente despues

LUGAR 21 km NO de Punta Gorda, por carretera de Punta Gorda-San Antonio

ORIGEN DE INFORMACION Conservator of Forests, Belize, B. H.

ESPECIE Pinus caribaea

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 139

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 13 | 19 | 11 | 741 | | |

SITIO

LAT. 16°15' LONG. 89°0 ELEV. 15

PRECIPITACION 3200 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO medianamente arcilloso PROFUNDIDAD 20 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 1+

REACCION ácida DRENAJE impedido

ESTADO DEL SUELO poco afectado TOPOGRAFIA inclinada 1%

ASPECTO NO

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1947

ESPACIAMIENTO 2.5 x 2.5 AREA 1.5

MATERIAL de vivero en potes, 10-15 cm

SUPERVIVENCIA (44% a los 13 años)

CUIDO 2 limpiezas el primer año, anualmente despues; aclareo a los 12 años

REPRODUCCION semillones escasos

LUGAR Plantación Machaca, NO de Punta Gorda

ORIGEN DE INFORMACION Conservator of Forests, Belize, B. H.

ESPECIE Pinus caribaea

GRUPO ECOLOGICO Tropical Húmedo

PAIS Jamaica PLANTACION 140

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 13 | 11 | 1590 | | |

SITIO

LAT. 18°N LONG. 77°O ELEV. 900

PRECIPITACION 2560 TEMPERATURA PROMEDIO 25°

HELADAS ninguna ROCA MADRE pizarra

SUELO residual TEXTURA DEL SUELO franco arcilloso

PROFUNDIDAD 8 cm

TEXTURA DEL SUBSUELO franco arcilloso pesado

REACCION 5.5 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA pendiente mas cercana a la cumbre, 20%

ASPECTO N CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Honduras Británica

SIEMBRA

PREPARACION limpieza FECHA 1954

ESPACIAMIENTO 2.5 x 2.5 AREA 0.5

MATERIAL de vivero en potes, 25 cm

SUPERVIVENCIA 95% a los 6 años

CUIDO 2 limpiezas anuales por tres años

ORIGEN DE INFORMACION Conservator of Forests, Kingston, Jamaica

ESPECIE Pinus occidentalis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Jamaica PLANTACION 14

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 5 | 15 | 11 |

SITIO

LAT. 18°N LONG. 77°O ELEV. 610

PRECIPITACION 3800 MESES DE SEQUIA Enero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO friable PROFUNDIDAD 46 cm

TEXTURA DEL SUBSUELO arcilloso REACCION 5.0

DRENAJE libre ESTADO DEL SUELO severamente degradado

TOPOGRAFIA montañosa

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Haiti, 1230 m

SIEMBRA

PREPARACION limpieza FECHA 1953

ESPACIAMIENTO 2.5 x 2.5 MATERIAL de vivero en potes, 30 cm

SUPERVIVENCIA 98% a los 6 meses; 96% a los 5 años

CUIDO limpieza segun requerido; poda a 2/3 de altura a los 3 años

REPRODUCCION flores escasas

COMENTARIOS especie prometedora; semilla difícil de obtener

ORIGEN DE INFORMACION Conservator of Forests, Kingston, Jamaica

ESPECIE Pinus oocarpa

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras PLANTACION 141

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 11 | 22 | 20 | 1682 | 55 | |

SITIO

LAT. 15°40'N LONG. 87° ELEV. 6

PRECIPITACION 3084 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 27° HELADAS ninguna

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO arcilloso pesado PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 1+

REACCION 5.5 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinada, 40% ASPECTO E

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local, Valle Quimistan

SIEMBRA

PREPARACION corta total FECHA 1949

ESPACIAMIENTO 2 x 2 AREA 0.8

MATERIAL de vivero en potes, 30 cm

SUPERVIVENCIA 90% el primer año (67% a los 11 años)

CUIDO 3 limpiezas anuales durante 5 años

REPRODUCCION semillas

LUGAR Lancetilla Garden, 6 km SE de Tela; Lote 10

ORIGEN DE INFORMACION P. J. Shank, United Fruit Co., La Lima, Hond.

ESPECIE Simaruba amara

GRUPO ECOLOGICO Tropical Húmedo

PAIS Trinidad PLANTACION 142

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 16 | 30 | 28 | | 19 | |

SITIO

LAT. 10°30'N LONG. 61°0 ELEV. 50

PRECIPITACION 2500 MESES DE SEQUIA Enero-Mayo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

SUELO marino TEXTURA DEL SUELO muy franco arenoso

PROFUNDIDAD 1 cm TEXTURA DEL SUBSUELO muy franco arenoso

PROFUNDIDAD 60 cm+ REACCION 6.0

DRENAJE libre ESTADO DEL SUELO poco afectado

TOPOGRAFIA ondulada ASPECTO NO

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS Grenada

SIEMBRA

PREPARACION azadonar FECHA 1944

REPRODUCCION flores ausentes

LUGAR Arena Research Plot 3, 32 Km de Port-of-Spain

ORIGEN DE INFORMACION Conservator of Forests, Port-of-Spain, Trinidad

ESPECIE Swietenia humilis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Costa Rica PLANTACION 143

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
| --- | --- | --- |
| 20 | 49 | |

SITIO

LAT. 10°N LONG. 85°O ELEV. 825

PRECIPITACION 2002 MESES DE SEQUIA Enero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS Ninguna

ROCA MADRE volcánica SUELO coluvial

TEXTURA DEL SUELO franco arenoso fino PROFUNDIDAD 20

TEXTURA DEL SUBSUELO franco arcilloso arenoso

PROFUNDIDAD 1+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinada 10%

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Provincia de Guanacaste

SIEMBRA

PREPARACION corte de maleza FECHA 1938

ESPACIAMIENTO irregular

MATERIAL de vivero a raíz desnuda

CUIDO limpiezas ocasionales

REPRODUCCION semillas abundantes

LUGAR Ingenio La Argentina, 50 km O de San José

COMENTARIOS zona de transición

ORIGEN DE INFORMACION Carlos Lizano, Sec. Forestal, Dpto. Bosques, Min. de Agricultura, San José, C. R.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 15

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 4 | 5 | 4 | 1037 | | |
| 23 | 30 | | 589 | 28 | |
| 26 | 33 | | 562 | 33 | |

RENDIMIENTO 170 $m^3$ de las entresacas a los 27 años

SITIO

LAT. 18°20'N LONG. 65°50'O ELEV. 200

PRECIPITACION 2286 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA pendiente mediana, 10% ASPECTO O

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS St. Croix, V.I.; fuente original desconocida

SIEMBRA

PREPARACION cultivado FECHA 1931

ESPACIAMIENTO 2.5 x 2.5 MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico

CUIDO limpieza; aclareo hasta 23 $m^2$ área basimétrica a los 21 años, hasta 24 $m^2$ a los 27 años

REPRODUCCION arbolillos abundantes

LUGAR Bosque Experimental de Luquillo

ORIGEN DE INFORMACION FMR Study 1924L, Tropical Forest Research Center, Box 577, Rio Piedras, P. R.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 16

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 13 | | 1818 | 14 | |
| 15 | 23 | | 760 | 22 | |

SITIO

LAT. 18°17'N LONG. 65°45'O ELEV. 200

PRECIPITACION 3429 MESES DE SEQUIA Febrero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO arcilloso pedregoso

PROFUNDIDAD 2+ REACCION 5.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA inclinada 50%

ASPECTO O CONDICION ANTES DE LA SIEMBRA sombra de café

ORIGEN DE SEMILLAS Venezuela; 10°N, 70°O

SIEMBRA

PREPARACION limpieza del soto bosque FECHA 1939

ESPACIAMIENTO 2.5 x 2.5 MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico

CUIDO aclareo por lo bajo a los 10 y 15 años

REPRODUCCION ninguna

LUGAR Camino Bisley, Bosque Experimental de Luquillo

COMENTARIOS huracán del 1956 tumbó el 30% de los árboles

ORIGEN DE INFORMACION FMR Estudio 2068L, Tropical Forest Research Center, Box 577, Rio Piedras, P. R.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 20

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 17 | 11 | 550 | 20 | |

SITIO

LAT. 16°55'N LONG. 88°25'O ELEV. 15

PRECIPITACION 2160 MESES DE SEQUIA Febrero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE metamórfica SUELO aluvial

TEXTURA DEL SUELO franco arcilloso arenoso

PROFUNDIDAD 5 cm TEXTURA DEL SUBSUELO franco arcilloso

PROFUNDIDAD 1+ REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1947

ESPACIAMIENTO 4.3 x 4.3 AREA 8

MATERIAL semilla SUPERVIVENCIA 75% a los 10 años

CUIDO 1 limpieza anual durante 8 años, despues en años alternados

REPRODUCCION ninguna

LUGAR 8 km O de la costa de Stann Creek

ORIGEN DE INFORMACION 1947 Mahogany; Conservator of Forests, Belize, B. H.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 144

CRECIMIENTO

| DOMINANTES Y CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 11 | 14 | 9 | 684 | | |

SITIO

LAT. 16°13'N LONG. 88°40'O ELEV. 350

HELADAS ninguna ROCA MADRE caliza

SUELO residual TEXTURA DEL SUELO arcilloso pesado

PROFUNDIDAD 13 cm TEXTURA DEL SUBSUELO arcilloso pesado

PROFUNDIDAD 1+ DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA inclinación 16%

ASPECTO E CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1948

ESPACIAMIENTO 3.6 x 3.6 AREA 8

MATERIAL semillas SUPERVIVENCIA 41% a los 11 años

CUIDO limpieza anual

REPRODUCCION semillas escasas

LUGAR 5 km al E de Guatemala cerca de tributario del Rio Moho

ORIGEN DE INFORMACION Conservator of Forests, Belize, B. H.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Martinica PLANTACION 145

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 36 | 52 | 30 | | | 40 |

SITIO

LAT. 14°40'N LONG. 61°0 ELEV. 480

PRECIPITACION 3990 TEMPERATURA PROMEDIO 25°

HELADAS ninguna SUELO residual

TEXTURA DEL SUELO franco arcilloso friable

PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO franco arcilloso friable

PROFUNDIDAD 1+ REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA abra ASPECTO NE

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación de Martinica

SIEMBRA

FECHA 1924 ESPACIAMIENTO 5 x 5

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 75% al año

CUIDO limpieza durante 5 años

REPRODUCCION semillones escasos

LUGAR Balata, 6.8 km N de Ft. de France

ORIGEN DE INFORMACION Directeur des Eaux et Forets, Jardin Desclieux, Ft. de France, Martinique

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Martinica PLANTACION 146

CRECIMIENTO

| DOMINANTES Y CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 16 | 30 | 24 | | | 35 |

SITIO

LAT. 14°40'N LONG. 61°0 ELEV. 515

PRECIPITACION 3990 TEMPERATURA PROMEDIO 25°

HELADAS ninguna ROCA MADRE granito

SUELO residual TEXTURA DEL SUELO franco arcilloso arenoso

PROFUNDIDAD 36 cm TEXTURA DEL SUBSUELO arcilloso arenoso

PROFUNDIDAD 60+ cm REACCION 7.0

DRENAJE libre ESTADO DEL SUELO poco afectado

TOPOGRAFIA abra ASPECTO SE

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS plantación de Martinica

SIEMBRA

PREPARACION tumba FECHA 1944

ESPACIAMIENTO 2 x 2 AREA 2

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 50% a los 15 años

CUIDO 2 limpiezas anuales durante 3 años; anualmente 2 años

REPRODUCCION semillones abundantes

LUGAR Alma; 13 km al N de Fort de France

ORIGEN DE INFORMACION Directeur des Eaux et Forets, Jardín Desclieux, Fort de France, Mart.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Martinica PLANTACION 147

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 17 | 18 | 27 | | 32 | |
| 32 | 50 | 31 | | 32 | |

RENDIMIENTO
10 madera para carbón y
15 postes para casas

SITIO
LAT. 14°45'N LONG. 61°0 ELEV. 200

PRECIPITACION 3000 TEMPERATURA PROMEDIO 26°

HELADAS ninguna ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO franco arcilloso arenoso

PROFUNDIDAD 40 cm TEXTURA DEL SUBSUELO franco arenoso

PROFUNDIDAD 60 cm REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 30% inclinada & pantanosa ASPECTO N

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS Honduras Británica

SIEMBRA
PREPARACION limpieza completa FECHA 1928

ESPACIAMIENTO 2 x 3 AREA 16

MATERIAL de vivero en potes SUPERVIVENCIA 80% al año

CUIDO 2 limpiezas anuales por 4 años; aclareo 25% a los 10 y 15 años

REPRODUCCION semillones abundantes

LUGAR Fourniols

COMENTARIOS "Poda natural excelente a 2mx2m; ramoso a 5 x 5; árboles siempre mas ramosos en el lado de barlovento"--M. Marie

ORIGEN DE INFORMACION Directeur des Eaux et Forets, Jardin Desclieux, Fort de France, Mart.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 148

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 22 | 14 | 180 | 6 | |

SITIO

LAT. 12°N LONG. 84°O ELEV. 15

PRECIPITACION 3200 MESES DE SEQUIA Febrero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO aluvial

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 2+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Nicaragua & Honduras, mezclado

SIEMBRA

PREPARACION limpieza FECHA 1950

ESPACIAMIENTO 4.5 x 9 AREA 20

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA (72% a los 10 años)

CUIDO 3 limpiezas el primer año; 2 anuales por 3 años; despues anualmente

REPRODUCCION semillones escasos

LUGAR Alejandrina, Río Escondido

COMENTARIOS Ataques del taladrador del tallo; bolo limpio 4-6m; mejores árboles en dique natural, inferiores en sitio pantanoso más lejos del río.

ORIGEN DE INFORMACION Carl Thomson, Cukra Development Co., Bluefields, Nic.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 149

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD: | DAP cm : | ALTURA m | NUM.ARBOLES: | AREA BASIMETRICA: | VOL. |
| 9 | 18 | | | | |
| 13 | 25 | 18 | 178 | 9 | |

SITIO

LAT. 12°N LONG. 84°O ELEV. 15

PRECIPITACION 3200 MESES DE SEQUIA Febrero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO aluvial

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 20 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 2+

REACCION 6.0 ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

ORIGEN DE SEMILLAS Nicaragua & Honduras, mezclada

SIEMBRA

PREPARACION desmonte de calles FECHA 1947

ESPACIAMIENTO 4.5 x 9 AREA 25

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA (72% a los 13 años)

CUIDO 3 limpiezas el primer año; 2 anuales por 3 años; 1 anual despues

REPRODUCCION semillas escasas

LUGAR Dominion, Rio Escondido, al O de Bluefields

COMENTARIOS algunos ataques del taladrador del tallo; bolo limpio 5 - 6 m

ORIGEN DE INFORMACION Carl Thomson, Cukra Development Co., Bluefields, Nic.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 150

CRECIMIENTO

| DOMINANTES Y CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 25 | | | | |
| 12 | 30 | 15 | 190 | 12 | |

SITIO

LAT. 12°N LONG. 84°O ELEV. 15

PRECIPITACION 3200 MESES DE SEQUIA Febrero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO aluvial

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 2+

REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

ORIGEN DE SEMILLAS Nicaragua y Honduras, mezclada

SIEMBRA

PREPARACION limpieza FECHA 1948

ESPACIAMIENTO 4.5 x 9 AREA 5

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA (76% a los 12 años)

CUIDO 3 limpiezas el primer año; 2 anuales durante 3 años; despues anualmente

REPRODUCCION semillas escasas

LUGAR Los Angeles, Rio Escondido al O de Bluefields

COMENTARIOS Copas ramosas; bolos limpios 3 - 5.5 m

ORIGEN DE INFORMACION Carl Thomson, Cukra Development Co., Bluefields, Nic.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 151

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 8 | 10 | (2375) | | |

SITIO

LAT. 12°N LONG. 84°O ELEV. 15

PRECIPITACION 3000 MESES DE SEQUIA Marzo-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

SUELO aluvial TEXTURA DEL SUELO franco limoso

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

TOPOGRAFIA ondulada

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba FECHA 1947

ESPACIAMIENTO 2 x 2 AREA 0.3

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 95% a los 6 meses

CUIDO 2 limpiezas anuales; una poda

REPRODUCCION flores escasas

LUGAR Lotes 13C, E, G; 10 km al O de Ciudad Rama

ORIGEN DE INFORMACION Moisés Berrios, Técnico Forestal,

El Recreo, Bluefields, Nic.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 152

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 11 | 10 | (594) | | |

SITIO

LAT. 12°N LONG. 84°O ELEV. 15

PRECIPITACION 3000 MESES DE SEQUIA Marzo-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

SUELO aluvial TEXTURA DEL SUELO arcilloso arenoso

PROFUNDIDAD 10 cm TEXTURA DEL SUBSUELO arcilloso arenoso

PROFUNDIDAD 1+ REACCION 6.0 DRENAJE libre

TOPOGRAFIA montañosa

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba FECHA 1947

ESPACIAMIENTO 4 x 4 MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 95% a los 6 meses

CUIDO 2 limpiezas anuales; 1 poda anual

REPRODUCCION ninguna

LUGAR Lote 13B, 10 km al O de Ciudad Rama, Río Escondido

ORIGEN DE INFORMACION Moisés Berrios, Técnico Forestal,

El Recreo, Bluefields, Nic.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 153

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 13 | 20 | 15 | (296) | 6 | |

SITIO

LAT. 12°N LONG. 85°O ELEV. 6

PRECIPITACION 3000 MESES DE SEQUIA Marzo-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba FECHA 1944

ESPACIAMIENTO 4 x 8 AREA 0.4

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 95% a los 6 meses

CUIDO 2 limpiezas por año; 1 poda anual

LUGAR Lotes 14A, B, C, D; 3 km del Pueblo Cukra Hill

ORIGEN DE INFORMACION Moisés Berrios, Técnico Forestal,

El Recreo, Bluefields, Nic.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 154

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 13 | 11 | 2400 | 20 | |

SITIO

LAT. 12°N LONG. 84°O ELEV. 15

PRECIPITACION 3000 MESES DE SEQUIA Marzo-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

SUELO aluvial TEXTURA DEL SUELO arcilloso limoso

PROFUNDIDAD 60 cm TEXTURA DEL SUBSUELO arcilloso

PROFUNDIDAD 1 REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA ondulada

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba FECHA 1947

ESPACIAMIENTO 2 x 2 AREA 0.1

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA (96% a los 9 años)

CUIDO 2 limpiezas y un aclareo anual

REPRODUCCION flores ausentes

LUGAR Lotes 11D, 12C, E & G; 10 km al O de Ciudad Rama

ORIGEN DE INFORMACION Moisés Berrios, Técnico Forestal,

El Recreo, Bluefields, Nic.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 155

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 10 | 11 | (594) | | |

SITIO

LAT. 12°N LONG. 84°O ELEV. 15

PRECIPITACION 3000 MESES DE SEQUIA Marzo-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO aluvial

TEXTURA DEL SUELO arcilloso limoso PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 60 cm

REACCION 5.4 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA ondulada

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba FECHA 1947

ESPACIAMIENTO 4 x 4 AREA 0.1

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 95% a los 6 meses

CUIDO 2 limpiezas y 1 poda anual

REPRODUCCION flores ausentes

LUGAR Lote 12Dñ 10 km al O de Ciudad Rama

ORIGEN DE INFORMACION Moisés Berrios, Técnico Forestal, El Recreo, Bluefields, Nic.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Panamá PLANTACION 156

CRECIMIENTO
DOMINANTES & CODOMINANTES
EDAD : DAP cm : ALTURA m
11 22 15

SITIO
LAT. 8°20'N LONG. 83°0 ELEV. 8

PRECIPITACION 2600 MESES DE SEQUIA Enero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO franco arcilloso friable

PROFUNDIDAD 12 cm TEXTURA DEL SUBSUELO franco arcilloso

PROFUNDIDAD 3+ DRENAJE libre

ESTADO DEL SUELO moderadamente degradado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivado 7 años

ORIGEN DE SEMILLAS Honduras

SIEMBRA
PREPARACION limpieza FECHA 1949

ESPACIAMIENTO 4.5 x 9.2 AREA 2.5

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 80% al año; 75% a los 11 años

CUIDO 2 limpiezas

REPRODUCCION flores ausentes

LUGAR Finca Higuito, 9 km al N de Puerto Armuelles

COMENTARIOS bolo limpio 5 - 8m, atacado por el taladrador de tallos

ORIGEN DE INFORMACION Chiriqui Land Co., Puerto Armuelles, Pan.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Perú PLANTACION 157

CRECIMIENTO
DOMINANTES & CODOMINANTES
EDAD : DAP cm : ALTURA m
20 40

SITIO
LAT. 3°44'S LONG. 73°7'O ELEV. 106

PRECIPITACION 2494 TEMPERATURA PROMEDIO 31°

ROCA MADRE mezclada SUELO aluvial

TEXTURA DEL SUELO arcilloso arenoso PROFUNDIDAD 50 cm

TEXTURA DEL SUBSUELO arcilloso arenoso REACCION 6.5

DRENAJE libre TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivo por 6 años

ORIGEN DE SEMILLAS Rio Pachitea & Rio Memón

SIEMBRA
FECHA 1936 ESPACIAMIENTO 4 x 4 AREA 7

MATERIAL de vivero a raíz desnuda, 1 - 2 m

HERRAMIENTAS pala

SUPERVIVENCIA 90% a los 6 meses; 65% a los 20 años

CUIDO frecuentes limpiezas por 10 años, despues anualmente;
podas anuales

REPRODUCCION algunos semillones

LUGAR Loretana 2.5 km al N de Iquitos

COMENTARIOS se talaron varios árboles para madera durante el 1956.
Plantación está abandonada.

ORIGEN DE INFORMACION Jacob Guerrero Mora, Intendente Forestal de
Iquitos, Casilla 472, Iquitos, Perú.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 17

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 20 | 36 | 24 | 300 | 23 | |

SITIO

LAT. 18°20'N LONG. 65°50'O ELEV. 180

PRECIPITACION 2286 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 7 cm

TEXTURA DEL SUBSUELO arcilloso pedregoso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 10% inclinación ASPECTO O

CONDICION ANTES DE LA SIEMBRA sombra de café

ORIGEN DE SEMILLAS Venezuela

SIEMBRA

PREPARACION limpieza de sotobosque FECHA 1939

ESPACIAMIENTO irregular AREA 1

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA 30% a los 20 años

CUIDO liberado a los 3 años

REPRODUCCION ninguna

LUGAR Cienaga Alta, Bosque Experimental de Luquillo

COMENTARIOS aparentemente resistente al viento

ORIGEN DE INFORMACION Tropical Forest Research Center,

Box 577, Rio Piedras, P. R.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 38

CRECIMIENTO
DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 24 | 48 | 30 |

SITIO
LAT. 18°22'N LONG. 66°55'O ELEV. 200

PRECIPITACION 2020 MESES DE SEQUIA Enero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO aluvial

TEXTURA DEL SUELO arcilloso pesado PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 1+

REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA ondulada 5% ASPECTO NE

CONDICION ANTES DE LA SIEMBRA maleza

ORIGEN DE SEMILLAS desconocido

SIEMBRA
PREPARACION desmonte FECHA 1935

ESPACIAMIENTO desconocido MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico

CUIDO 4 limpiezas el primer año, 3 el segundo año

REPRODUCCION semillones abundantes, pocos arbolillos

LUGAR Km 18.5 Carretera Camuy-San Sebastían; lado S Lago Guajataca,P.R.

COMENTARIOS rodal mezclado; algunos árboles quebrados por huracán del 1956, pero no tumbados

ORIGEN DE INFORMACION Tropical Forest Research Center, Rio Piedras, P. R.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 39

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 11 | 13 | 15 | 1817 | 20 | 91 |
| 16 | 23 | | 928 | 23 | 102 |

SITIO

LAT. 18°20'N LONG. 66°45'O ELEV. 250

PRECIPITACION 2020 MESES DE SEQUIA Enero - Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO franco limoso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO franco arcilloso limoso

PROFUNDIDAD 1+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana, hoya

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Venezuela

SIEMBRA

PREPARACION limpieza FECHA 1939

ESPACIAMIENTO 2.3 x 2.3 MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA 50% a los 16 años

CUIDO limpiezas los primeros años; aclareo desde abajo a los 11 años

REPRODUCCION ninguna

LUGAR Quebrada los Puercos, Bosque Río Abajo, P. R.

ORIGEN DE INFORMACION FMR Study 1921 Ra, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 95

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 12 | | 2242 | 26 | |
| 14 | 16 | 23 | 1185 | 23 | |
| 17 | 21 | | 997 | 22 | |

SITIO

LAT. 18°17'N LONG. 65°45'O ELEV. 250

PRECIPITACION 3000 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO arcilloso REACCION 5.5

DRENAJE libre ESTADO DEL SUELO poco afectado

TOPOGRAFIA quebrada, inclinación 70% ASPECTO NE

CONDICION ANTES DE LA SIEMBRA sombra de café

ORIGEN DE SEMILLAS Zona del Canal de Panamá

SIEMBRA

PREPARACION corte por lo bajo FECHA 1937-38

ESPACIAMIENTO 1.8 x 2.4 MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico

CUIDO limpieza 3-4 veces anuales por 3 años; liberación y aclareo desde abajo a los 11 años

REPRODUCCION ninguna

LUGAR Valle Coca, Bosque Experimental de Luquillo, P. R.

COMENTARIOS rodal casi completamente eliminado por huracán a los 20 años

ORIGEN DE INFORMACION FMR Study 2067L, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 18

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 13 | 23 | | 1210 | 20 | |
| 17 | 30 | | 766 | 24 | 53 |

SITIO

LAT. 16°55'N LONG. 88°25'O ELEV. 15

PRECIPITACION 2160 MESES DE SEQUIA Febrero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE metamórfica SUELO aluvial

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso arenoso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1941

ESPACIAMIENTO 3 x 3 AREA 4 MATERIAL semilla

CUIDO limpieza anual durante 8 años, despues en años alternados; aclareo a los 17 años

REPRODUCCION flores ausentes

LUGAR 8 km al O de la costa de Stann Creek

ORIGEN DE INFORMACION 1941 Mahogany, Conservator of Forests, Belize, B. H.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 19

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 20 | 24 | | 670 | 16 | |
| 30 | 36 | | 495 | 16 | |

SITIO

LAT. 16°55'N LONG. 88°25'O ELEV. 15

PRECIPITACION 2160 MESES DE SEQUIA Febrero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE metamórfica SUELO aluvial

TEXTURA DEL SUELO franco arcilloso

TEXTURA DEL SUBSUELO franco arcilloso limoso

PROFUNDIDAD 1+ REACCION 5.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1928

ESPACIAMIENTO 3 x 3 AREA 2 MATERIAL semilla

SUPERVIVENCIA 45% a los 30 años

CUIDO limpieza durante 4 años, despues a los 7 y 10 años; aclareos a los 13 y 20 años; poda a los 16 años

REPRODUCCION semillas escasas

LUGAR 8 km O de la costa de Stann Creek, B. H.

ORIGEN DE INFORMACION 1928 Mahogany, Conservator of Forests, Belize, B. H.

ESPECIE Tabebuia heterophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 21

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 11 | 13 | 14 | | 20 | |

SITIO

LAT. 18°20'N LONG. 65°45'O ELEV. 300

PRECIPITACION 3048 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 5% inclinación ASPECTO 0

CONDICION ANTES DE LA SIEMBRA pasto

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION abrir calles FECHA 1948

ESPACIAMIENTO 2.5 x 3 AREA 15

MATERIAL arbolitos silvestres a raíz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA 85% a los 11 años

CUIDO limpiezas frecuentes durante 3 años

REPRODUCCION semillones abundantes

LUGAR Km 4.8, P.R. 191

COMENTARIOS invasión de Didymopanax morototoni

ORIGEN DE INFORMACION FMR Study 2363-01; Tropical Forest Research Center, Rio Piedras, P. R.

ESPECIE Tabebuia heterophylla

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 22

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 14 | 13 | 14 | 1000 | 18 | |

SITIO

LAT. 18°20'N LONG. 65°50'O ELEV. 250

PRECIPITACION 2540 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO arcilloso pedregoso PROFUNDIDAD 1+

REACCION 5.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 15% inclinada ASPECTO NO

CONDICION ANTES DE LA SIEMBRA pasto

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION limpieza de calles FECHA 1944

ESPACIAMIENTO 2 x 2 AREA 5

MATERIAL arbolitos silvestres a raíz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA 40% a los 14 años

CUIDO limpiezas ocasionales

REPRODUCCION semillones abundantes

COMENTARIOS árboles bien formados

ORIGEN DE INFORMACION FMR Study 2363-02, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 23

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 3 | 9 | 7 | | | |
| 4 | 10 | | 2250 | 8 | |

SITIO

LAT. 16°44'N LONG. 88°25'O ELEV. 15

PRECIPITACION 2160 MESES DE SEQUIA Febrero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE metamórfica SUELO aluvial

TEXTURA DEL SUELO franco PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 1+

REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION tumba y quema FECHA 1954

ESPACIAMIENTO 1.8 x 1.8 AREA 2

MATERIAL tocones HERRAMIENTAS azada

SUPERVIVENCIA (73% a los 4 años)

CUIDO limpieza

REPRODUCCION flores escasas

LUGAR 8 km al O de la costa de Stann Creek, B. H.

ORIGEN DE INFORMACION Conservator of Forests, Belize, B. H.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 24

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA: VOL. |
| 6 | 15 | 11 | 2960 | 20 |
| 7 | 16 | 13 | 1700 | 15 |

SITIO

LAT. 16°55'N LONG. 88°25'O ELEV. 15

PRECIPITACION 2160 MESES DE SEQUIA Febrero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE metamórfica SUELO aluvial

TEXTURA DEL SUELO franco PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 1+

REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS plantacion local

SIEMBRA

PREPARACION tumba y quema FECHA 1951

ESPACIAMIENTO 1.8 x 1.8 AREA 0.1 MATERIAL tocones

HERRAMIENTAS azada SUPERVIVENCIA (5% a los 7 años)

CUIDO limpieza; aclareo a los 6 años

REPRODUCCION flores abundantes

LUGAR 8 km O de la costa de Stann Creek, B.H.

ORIGEN DE INFORMACION 1951 Teak; Conservator of Forests, Belize, B. H.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras Británica PLANTACION 158

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA: VOL. |
| 13 | 26 | 20 | 480 | 22 |

RENDIMIENTO 10 años - postes de teléfono

SITIO

LAT. 17°N LONG. 88°O ELEV. 15

PRECIPITACION 2160 MESES DE SEQUIA Febrero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE metamórfica SUELO aluvial

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso arenoso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION tumba y quema FECHA 1947

ESPACIAMIENTO 1.5 x 1.5 AREA 0.4

MATERIAL tocones HERRAMIENTAS azada

SUPERVIVENCIA 60% a los 10 años

CUIDO limpiezas ocasionalmente; aclareo a los 10 años

REPRODUCCION semillas abundantes

LUGAR 8 km al O de la costa de Stann Creek, B. H.

ORIGEN DE INFORMACION Conservator of Forests, Belize, B. H.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Trinidad PLANTACION 48

CRECIMIENTO

| DOMINANTES Y CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 10 | 19 | 1432 | | 35 |
| 10 | 14 | 16 | 766 | | 110 |
| 15 | 19 | 19 | 492 | | 154 |

RENDIMIENTO

5 años 9 $m^3$/HA )
10 40 ) entresaques para postes, madera para pisos
15 9 )

SITIO

LAT. 10°N LONG. 60°O ELEV. 140

PRECIPITACION 2432 MESES DE SEQUIA Enero-Mayo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE varias SUELO residual & aluvial

TEXTURA DEL SUELO franco arenoso

TEXTURA DEL SUBSUELO arcilloso REACCION 5.5

DRENAJE libre ESTADO DEL SUELO poco afectado

TOPOGRAFIA levemente inclinada

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Tenasserin, Burma

SIEMBRA

PREPARACION tumba y quema FECHA 1945

ESPACIAMIENTO 1.8 x 1.8 AREA 300

MATERIAL tocones SUPERVIVENCIA 70 a 90% al año

CUIDO 3 limpiezas anuales durante 2 años; aclareo cada 5 años

REPRODUCCION semillas abundantes

COMENTARIOS Siembra de teca comenzó el 1913, 5000 HA en total en 1960

ORIGEN DE INFORMACION Conservator of Forests, Port of Spain, Trinidad

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Puerto Rico PLANTACION 55

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m. | NUM. ARBOLES | AREA BASIMETRICA: VOL. |
| 13 | 16 | | 1442 | 20 |
| 21 | 21 | 22 | 790 | 23 |

RENDIMIENTO postes & postes de cerca de los aclareos

SITIO

LAT. 18°20'N LONG. 66°45'O ELEV. 350

PRECIPITACION 2100 MESES DE SEQUIA Enero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO arcilloso friable PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 10% inclinación ASPECTO SO

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION cultivado FECHA 1938

ESPACIAMIENTO 2 x 2.5 AREA 10 MATERIAL tocones

HERRAMIENTAS zapapico SUPERVIVENCIA 72% a los 13 años

CUIDO limpieza en los primeros años; aclareos a los 13, 16, y 21 años

REPRODUCCION semillas y retoños abundantes

LUGAR Camino Santa Rosa, Bosque Río Abajo, P. R.

ORIGEN DE INFORMACION FMR Study 2070 Ra, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras PLANTACION 51

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA: VOL. |
| 8 | 19 | 14 | 833 | 27 |
| 12 | 22 | 17 | 765 | 29 |

SITIO

LAT. 15°45'N LONG. 87°30'O ELEV. 8

PRECIPITACION 2400 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE granito SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO franco arenoso grueso

PROFUNDIDAD 3+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDIDION ANTES DE LA SIEMBRA cultivado

SIEMBRA

PREPARACION cultivo FECHA 1946

ESPACIAMIENTO 3 x 3 MATERIAL de vivero a raíz desnuda 25cm

HERRAMIENTAS barra SUPERVIVENCIA 75% a los 2 años

CUIDO limpieza cada 4 meses durante 2 años; aclareos a los 5 y 10 años; podas a los 2 y 6 años

REPRODUCCION semillas abundantes

LUGAR 12 km SO del Puerto de Tela, Hond. (San Alejo)

ORIGEN DE INFORMACION P. J. Shank, Tela RR Co., Progreso, Hond.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras PLANTACION 52

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m. | NUM. ARBOLES | AREA BASIMETRICA: VOL. |
| 8 | 17 | 14 | 2241 | 12 |
| 12 | 24 | 18 | 1976 | 20 |

RENDIMIENTO ninguno

SITIO

LAT. 15°45'N LONG. 87°30'O ELEV. 8

PRECIPITACION 2400 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE granito SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO franco arenoso grueso

PROFUNDIDAD 3+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA 1% inclinación

ASPECTO NO

CONDICION ANTES DE LA SIEMBRA 10 años de cultivo

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION cultivo FECHA 1946

ESPACIAMIENTO 2 x 2 AREA 902

MATERIAL de vivero a raíz desnuda HERRAMIENTAS barra

SUPERVIVENCIA 75% a los 2 años

CUIDO limpieza cada 4 meses durante 2 años; aclareo a los 5 y 10 años; poda a los 2 y 6 años

REPRODUCCION semillas abundantes

LUGAR 12 km al SO del Puerto de Tela, Hond.

ORIGEN DE INFORMACION P. J. Shank, Tela RR Co., Progreso, Hond.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras PLANTACION 159

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 18 | 14 | 2241 | 13 | |
| 12 | 24 | 17 | 1976 | 20 | |

SITIO

LAT. 15°N LONG. 88°O ELEV. 8

PRECIPITACION 2001 MESES DE SEQUIA Marzo-Junio

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE granito SUELO aluvial

TEXTURA DEL SUELO franco arenoso

TEXTURA DEL SUBSUELO franco arenoso grueso PROFUNDIDAD 2+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivado 10 años

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

FECHA 1947 ESPACIAMIENTO 2 x 2

MATERIAL de vivero a raíz desnuda HERRAMIENTAS barra

SUPERVIVENCIA 75% a los 2 años

CUIDO limpieza cada 4 meses durante 2 años; aclareos a los 5 y 10 años; podas a los 2 y 6 años

REPRODUCCION semillas abundantes

LUGAR Finca San Alejo, 12 km SO de Tela, Hond.

ORIGEN DE INFORMACION P. J. Shank, United Fruit Co., La Lima, Hond.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras PLANTACION 160

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 14 | 33 | 22 | 260 | [illegible] 25 | |

RENDIMIENTO 8-14 años postes

SITIO

LAT. 15°N LONG. 88°O ELEV. 20

PRECIPITACION 2400 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE granito SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO arenoso PROFUNDIDAD 2+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION tumba y quema FECHA 1946

ESPACIAMIENTO 5.3 x 5.3 AREA 54

MATERIAL tocones

SUPERVIVENCIA 90% al año; (73% a los 14 años)

CUIDO 3 limpiezas el primer año, 2 limpiezas durante 2 años; 4 aclareos ligeros

REPRODUCCION semillas abundantes

LUGAR km 8 Camp. Finca San Alejo, 15 km al O de Tela

COMENTARIOS Se necesitan mas podas que con un espaciamiento más unido, casi todos los bolos con 5 m de bolo limpio

ORIGEN DE INFORMACION P. J. Shank, United Fruit Co., La Lima, Hond.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras PLANTACION 161

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA:VOL. |
| 8 | 20 | 15 | 862 | 23 |
| 12 | 23 | 18 | 765 | 30 |

RENDIMIENTO 6-8 años postes

SITIO

LAT. 15°N LONG. 88°O ELEV. 20

PRECIPITACION 2400 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE granito SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO arenoso fino PROFUNDIDAD 2

REACCION 6.5 DRENAJE libre TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION tumba y quema FECHA 1952

ESPACIAMIENTO 3 x 3 AREA 48 MATERIAL tocones

SUPERVIVENCIA 98% al año

CUIDO 2 limpiezas anuales por 4 años; 3 aclareos ligeros

REPRODUCCION semillas abundantes

LUGAR Ulvita, 15 km al O de Tela

COMENTARIOS bolos limpios, pero requiere entresaque

ORIGEN DE INFORMACION P. J. Shank, United Fruit Co., La Lima Hond.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 162

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 32 | 16 | 222 | 18 | |

SITIO

LAT. 12°N LONG. 84°O ELEV. 15

PRECIPITACION 3200 MESES DE SEQUIA Febrero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 20 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 6.0 ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Honduras - Trinidad - Burma

SIEMBRA

PREPARACION tumba FECHA 1948

ESPACIAMIENTO 4.5 x 9 AREA 50

MATERIAL tocones HERRAMIENTAS pala

SUPERVIVENCIA (89% a los 12 años)

CUIDO 3 limpiezas el primer año, 2 anuales por 3 años,

1 anual despues

REPRODUCCION semillas abundantes

LUGAR Dominión, Río Escondido, al O de Bluefields

ORIGEN DE INFORMACION Carl Thomson, Cukra Development,

Bluefields, Nic.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 163

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 8 | 18 | 16 |

SITIO

LAT. 12° N LONG. 84° O ELEV. 15

PRECIPITACION 3000 MESES DE SEQUIA Marzo-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO aluvial

TEXTURA DEL SUELO arcilloso liviano PROFUNDIDAD 60 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 1

REACCION 6.0 ESTADO DEL SUELO poco afectado

TOPOGRAFIA ondulada

CONDICION ANTES DE LA SIEMBRA bosque secundario

SIEMBRA

PREPARACION tumba FECHA 1949

ESPACIAMIENTO 2 x 2 AREA 0.1 MATERIAL tocones

HERRAMIENTAS barra SUPERVIVENCIA 90% a los 6 meses

CUIDO 2 limpiezas y 1 poda anuales; aclareo a los 9 años

REPRODUCCION semillas y renuevos abundantes

LUGAR Lote 31C, 10 km al O de Ciudad Rama

ORIGEN DE INFORMACION Moisés Berrios, Técnico Forestal,

El Recreo, Bluefields, Nic.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 164

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 29 | 20 | 400 | | |

SITIO

LAT. 12°N LONG. 84°O ELEV. 15

PRECIPITACION 3000 MESES DE SEQUIA Febrero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO aluvial

TEXTURA DEL SUELO arcilloso liviano PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO arcilloso compacto

PROFUNDIDAD 60 cm REACCION 5.4

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA ondulada

CONDICION ANTES DE LA SIEMBRA bosque secundario

SIEMBRA

PREPARACION tumba FECHA 1946

ESPACIAMIENTO 4 x 4 AREA 0.1

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 90% a los 6 meses

CUIDO 2 limpiezas anuales; 1 aclareo a los 9 años; 1 poda anual

REPRODUCCION semillas y retoños abundantes

LUGAR Lote 31B, 10 km al O de Ciudad Rama

ORIGEN DE INFORMACION Moisés Berrios, Técnico Forestal,

El Recreo, Bluefields, Nic.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Nicaragua PLANTACION 165

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 30 | 21 | 790 | | |

SITIO

LAT. 12°N LONG. 84°O ELEV. 15

PRECIPITACION 3000 MESES DE SEQUIA Marzo-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE andesita SUELO aluvial

TEXTURA DEL SUELO franco PROFUNDIDAD 20 cm

TEXTURA DEL SUBSUELO arenoso arcilloso PROFUNDIDAD 1+

REACCION 5.4 DRENAJE libre

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

SIEMBRA

PREPARACION tumba FECHA 1946

ESPACIAMIENTO 8 x 8 AREA 0.1

MATERIAL tocones SUPERVIVENCIA 90% a los 6 meses

CUIDO 2 limpiezas al año; 1 poda al año

REPRODUCCION semillas y renuevos abundantes

LUGAR Lote 31A, 10 km al O de Ciudad Rama

COMENTARIOS supervivencia pobre en espaciamiento amplio

ORIGEN DE INFORMACION Moisés Berrios, Técnico Forestal,

El Recreo, Bluefields, Nic.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Costa Rica PLANTACION 166

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 23 | 18 | 746 | 20 | |

SITIO

LAT. 9°20'N LONG. 84°20'O ELEV. 8

PRECIPITACION 3000 MESES DE SEQUIA Enero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE volcánica SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Summit Gardens, Canal Zone

SIEMBRA

PREPARACION tumba FECHA 1952

ESPACIAMIENTO 3.6 x 3.6 AREA 20

MATERIAL tocones HERRAMIENTAS pala

CUIDO 5 limpiezas el primer año; 4 veces el segundo año; aclareo a los 7 años

REPRODUCCION semillas abundantes

LUGAR 6 km al N de Quepos

COMENTARIOS terreno bananero de segunda clase

ORIGEN DE INFORMACION Tom Grieve, Cia. Bananera de Costa Rica, Quepos, C. R.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Panamá PLANTACION 167

CRECIMIENTO

DOMINANTES & CODOMINANTES DENSIDAD POR HECTAREA

EDAD : DAP cm : ALTURA m NUM.ARBOLES:AREA BASIMETRICA:VOL.

SITIO

LAT. 8°20'N LONG. 83°0 ELEV. 8

PRECIPITACION 2600 MESES DE SEQUIA Enero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 8 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 3+

REACCION 7.0 DRENAJE libre

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA guineos 1938

ORIGEN DE SEMILLAS Summit Garden, Canal Zone

SIEMBRA

PREPARACION corte de guineos y malezas FECHA 1947

ESPACIAMIENTO 5 x 10 AREA 150

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS pala

SUPERVIVENCIA 98% al año; 80% a los 12 años

CUIDO 2 limpiezas anuales durante 2 años; 1 poda anual durante 2 años

REPRODUCCION semillas abundantes

LUGAR (Finca Olivo) Plantación Malagueto, 9 km al NE Puerto Armuelles

COMENTARIOS algo ramoso, 1 troza buena de 5m, espaciamiento demasiado amplio

ORIGEN DE INFORMACION Chiriquí Land Co., Puerto Armuelles, Panamá

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Húmedo

PAIS Panamá PLANTACION 168

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 11 | 30 | 20 | 479 | 35 | |

SITIO

LAT. 8°20'N LONG. 83°0 ELEV. 8

PRECIPITACION 2600 MESES DE SEQUIA Enero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 7 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 3+

REACCION 7.0 DRENAJE libre

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivo de guineos por 10 años

ORIGEN DE SEMILLAS Summit Garden, Canal Zone

SIEMBRA

PREPARACION tumbar guineos y maleza FECHA 1949

ESPACIAMIENTO 5 x 5 AREA 115

MATERIAL de vivero a raíz desnuda HERRAMIENTAS pala

SUPERVIVENCIA 90% al año, 80% a los 12 años

CUIDO 2 limpiezas el primer año solamente; 2 podas el primer y segundo año

REPRODUCCION semillas abundantes

LUGAR Finca Caraña, 10 km al NE de Puerto Armuelles

COMENTARIOS uno y medio a dos trozas de 16 pies; mejor espaciamiento que en la Finca Olivo

ORIGEN DE INFORMACION Chirique Land Co., Puerto Arnuelles, Panamá

ESPECIE Terminalia superba

GRUPO ECOLOGICO Tropical Húmedo

PAIS Honduras PLANTACION 169

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 30 | 20 | 220 | 14 | |

SITIO

LAT. 15°40'N LONG. 87°0 ELEV. 20

PRECIPITACION 3084 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 5.5 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Africa

SIEMBRA

PREPARACION tumba FECHA 1951

ESPACIAMIENTO 4.5 x 9 AREA 0.1

MATERIAL de vivero en potes, 2m

SUPERVIVENCIA 85% a los 9 meses

CUIDO 3 limpiezas anuales durante 5 años

REPRODUCCION ninguna

LUGAR Lancetilla Garden, 6 km al SE de Tela

ORIGEN DE INFORMACION P. J. Shank, United Fruit Co.,

La Lima, Hond.

SPECIES Swietenia macrophylla

ECOLOGICAL GROUP Tropical Moist

COUNTRY Peru PLANTATION 323

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 44 | 53 | 21 | 110 | | |

SITE

LAT. 5°S LONG. 75°W ELEV. 150

ANNUAL RAINFALL 3000 DRY MONTHS August - September

AV. TEMPERATURE 26° FROST none

PARENT ROCK mixed alluvial SOIL alluvial

TOPSOIL TEXTURE silt loam DEPTH 1 m

SUBSOIL TEXTURE silt clay DEPTH 2

REACTION 6.0 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY flat

CONDITION AT PLANTING cultivated

SEED ORIGIN natural stand in Peru

PLANTING

PREPARATION cultivated DATE 1929

SPACING 10 x 10 AREA 1

STOCK nursery with ball of earth

SURVIVAL 50% after 44 years

CARE cleaned with cacao plantation

REPRODUCTION seeds abundant

LOCATION Hamburgo Viejo, Rio Samiria

COMMENTS planted with cacao by Narciso Sanchez of Iquitos

SOURCE F. B. Lamb, U. S. Plywood

SPECIES Swietenia macrophylla

ECOLOGICAL GROUP Tropical Moist

COUNTRY Peru PLANTATION 324

GROWTH
DOMINANTS & CODOMINANTS

| AGE | DBH cm | HEIGHT m |
|---|---|---|
| 24 | 33 | 21 |

YIELD 20 yrs. - 30 of largest trees cut (51 cm) good quality lumber produced

SITE
LAT. 3°45' S LONG. 73°15' W ELEV. 100

ANNUAL RAINFALL 3000 DRY MONTHS July - September

AV. TEMPERATURE 25° FROST none

PARENT ROCK mixed SOIL alluvial

TOPSOIL TEXTURE silt loam DEPTH 1 m

SUBSOIL TEXTURE silt loam DEPTH 3

REACTION 6.0 DRAINAGE free

SOIL STATE little disturbed

TOPOGRAPHY flat - river bank levee

CONDITION AT PLANTING cultivated 5 years

SEED ORIGIN natural stand, Rio Pachitea

PLANTING
PREPARATION cleaned with machete DATE 1937

SPACING 4.5 x 4.5 AREA 5+

STOCK bareroot nursery SURVIVAL 50% after 20 years

CARE cleaned with machete for 10 years

REPRODUCTION seed abundant

LOCATION La Loretana, 0.5 km N of Iquitos

COMMENTS the 51 cm trees cut in 1957 produced good quality wood. Dominant trees well formed. Trees planted at the same time at Astoria mill have failed on heavy clay soil - surviving trees exist only on well drained creek bank.

SOURCE F. B. Lamb, U. S. Plywood

SPECIES Pinus caribaea

ECOLOGICAL GROUP Tropical Moist

COUNTRY Trinidad PLANTATION 333

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 9 | 17 | 13.7 | | 18 | |

SITE

LAT. 10°3 ' N LONG. 61°20' ELEV. 20

ANNUAL RAINFALL 2160 DRY MONTHS January-May

PARENT ROCK volcanic SOIL alluvial

TOPSOIL TEXTURE very fine sand DEPTH deep

REACTION 5.0 DRAINAGE impeded

SOIL STATE severely degraded TOPOGRAPHY flat

CONDITION AT PLANTING pasture

SEED ORIGIN natural stand - British Honduras

PLANTING

PREPARATION graded & plowed DATE 1952

SPACING 1 x 3 AREA 1.2

STOCK nursery with ball of earth TOOLS machete

SURVIVAL 90% after 9 years

CARE cleaned frequently - 3 yrs. Thinning-reduced to 2 x 3 in early years.

REPRODUCTION seed and flowers scarce

LOCATION Piarco Plantation, Caroni North Bank Road

COMMENTS good form, pruning slowly. At least 2 fires - no scars.

SOURCE W. S. Chalmers, Forest Department, Port-of-Spain, Trinidad

SPECIES Pinus caribaea

ECOLOGICAL GROUP Tropical Moist

COUNTRY Trinidad PLANTATION 334

GROWTH

DOMINANTS & CODOMINANTS / STAND PER HECTARE

| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
|---|---|---|---|---|---|
| 13 | 26 | 20 | 247 | 11 | |

SITE

LAT. 10°35' N LONG. 61°15' W ELEV. 30

ANNUAL RAINFALL 2438 DRY MONTHS March-April

FROST none PARENT ROCK sandstone

SOIL alluvial TOPSOIL TEXTURE fine sand

SUBSOIL TEXTURE sandy clay DEPTH deep

REACTION 4.5 DRAINAGE impeded

SOIL STATE moderately degraded TOPOGRAPHY flat

CONDITION AT PLANTING selectively cut forest

SEED ORIGIN natural stand - bought from Forest Dept. - British Honduras

PLANTING

PREPARATION taungya DATE 1948

SPACING 3.6 x 3.7 AREA 0.4

STOCK nursery with ball of earth SURVIVAL 50% after 13 yrs.

CARE liberated at 2 yrs. - cleaned annually ± to 10 yrs.

REPRODUCTION seed and flowers abundant

LOCATION Arena 1948. Exp. Plot, NE corner Arena Reserve

COMMENTS form excellent, relatively open grown

SOURCE David Moore, Conservator of Forests, Trinidad

SPECIES Pinus caribaea

ECOLOGICAL GROUP Tropical Moist

COUNTRY Trinidad PLANTATION 335

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 7 | 18 | 18 | | 30 | |

SITE

LAT. 10°45' N LONG. 61°20" W ELEV. 488

ANNUAL RAINFALL 3048 DRY MONTHS March - April

FROST none PARENT ROCK volcanic

SOIL residual TOPSOIL TEXTURE fine sandy loam

DEPTH 10 cm SUBSOIL TEXTURE yellow clay

DEPTH deep REACTION 5.5 DRAINAGE free

SOIL STATE little disturbed

TOPOGRAPHY protected, slope 10% ASPECT SE

CONDITION AT PLANTING selectively cut forest

SEED ORIGIN British Honduras

PLANTING

PREPARATION forest cleared DATE 1954

SPACING 1.8 x 1.8 AREA 0.05

STOCK nursery TOOLS machete

CARE cleaned 2 - 3 years.

REPRODUCTION seed scarce, seedlings absent

LOCATION 9 mile post Blanchisseuse Road, Northern Range Reserve

COMMENTS Long nodes, fine needles - one tree to 30' without nodes

SOURCE W. S. Chalmers, Forest Department, Port-of-Spain, Trinidad

SPECIES Simaruba amara

ECOLOGICAL GROUP Tropical Moist

COUNTRY Trinidad PLANTATION 336

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 7 | 15 | 18 | 711 | 10 | 70 |
| 12 | 27 | 24 | 207 | 10 | 90 |
| 17 | 36 | 29 | | 15 | |

YIELD 7 yrs. - 28 $m^3$/HA 10 yrs. - 53 $m^3$/HA
8 " 16 " 12 " 54 "

SITE
LAT. 10°35' N LONG. 61°15' W ELEV. 53

ANNUAL RAINFALL 2438 DRY MONTHS March-April

PARENT ROCK sandstone SOIL residual

TOPSOIL TEXTURE sand DEPTH deep

SUBSOIL TEXTURE sand DEPTH no profile

REACTION 5.0 DRAINAGE free

SOIL STATE little disturbed

TOPOGRAPHY protected, 10% slope ASPECT N

CONDITION AT PLANTING secondary forest

SEED ORIGIN natural stand - Grenada

PLANTING
PREPARATION not taungya DATE 1944
SPACING 2 x 2 AREA 0.2
STOCK direct seeded TOOLS machete

CARE thinning 2 yrs

REPRODUCTION seed, seedlings and flowers abundant

LOCATION Sample Plot No. R3, 1944 Coupe alongside Porcupine Ride
F 76, Arena Reserve

COMMENTS excellent form

SOURCE David Moore, Conservator of Forests, Trinidad

SPECIES Tectona grandis

ECOLOGICAL GROUP Tropical Moist

COUNTRY Trinidad PLANTATION 337

GROWTH

| ALL TREES | | | STAND PER HECTARE | | | |
|---|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOL. | M.A.I. |
| 5 | 12 | 16 | 1416 | 13 | 40 | 9 |
| 10 | 22 | 21 | 494 | 14 | 81 | 13 |
| 17 | 37 | 27 | | 14 | | |

YIELD 4 $m^3$/HA - 5 yrs.
22 " 7 "
26 " 10 "

SITE

LAT. 10°30' LONG. 61°05' ELEV. 61

ANNUAL RAINFALL 2845 DRY MONTHS March - April

PARENT ROCK granite SOIL residual

TOPSOIL TEXTURE yellow clay DEPTH 5 cm

SUBSOIL TEXTURE yellow clay DEPTH deep

REACTION 6.0 DRAINAGE impeded

SOIL STATE little disturbed

TOPOGRAPHY protected, 25% slope ASPECT W

CONDITION AT PLANTING Virgin forest

SEED ORIGIN plantation - Trinidad

PLANTING

PREPARATION taungya DATE 1934
SPACING 2.1 x 2.1 AREA ~~0.3~~ 6.0
STOCK barerooted nursery

CARE cleared for 1 year after taungya, thinning - 3 yrs.

REPRODUCTION seed and flowers abundant

LOCATION Sample Plot #27, 1934 Coupe, Subcompartment 33a, Mt. Harris, Central Range Reserve

COMMENTS excellent form, superior trees

SOURCE David Moorse, Conservator of Forests, Trinidad

SPECIES Tectona grandis

ECOLOGICAL GROUP Tropical Moist

COUNTRY Trinidad PLANTATION 338

GROWTH

| ALL TREES | | | STAND PER HECTARE | | | |
|---|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME | M.A.I. |
| 15 | 19 | 22 | 603 | 14 | 83 | 109 |
| 30 | 30 | 28 | 208 | 12 | 96 | 105 |
| 44 | 36 | 32 | 148 | 12 | 119 | 78 |
| 48 | 50 | 36 | | 14 | | |

YIELD 468 cu. ft. poles - 15 yrs.
1293 " " 30 "
389 " " 44 "

SITE

LAT. 10°30' N LONG. 61°05' ELEV. 76

ANNUAL RAINFALL 2845 DRY MONTHS March-April

PARENT ROCK granite SOIL residual

TOPSOIL TEXTURE stiff clay DEPTH 15 cm

SUBSOIL TEXTURE gravelly clay DEPTH deep

REACTION 5.0 DRAINAGE impeded

SOIL STATE little disturbed

TOPOGRAPHY sheltered, 20% slope ASPECT N

CONDITION AT PLANTING virgin forest

SEED ORIGIN natural stand - Burma

PLANTING

PREPARATION not taungya DATE 1913
SPACING 3 x 3 AREA 0.5
STOCK nursery, barerooted TOOLS machete

CARE thinning every 5 yrs.

REPRODUCTION seed and flowers abundant

LOCATION Mt. Harris Teak Plot #1, Central Range Reserve

COMMENTS excellent form, well maintained

SOURCE David Moore, Conservator of Forests, Trinidad

SPECIES Manilkara bidentata

ECOLOGICAL GROUP Tropical Moist

COUNTRY Trinidad PLANTATION 339

GROWTH

| ALL TREES | | | STAND PER HECTARE | | | |
|---|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME | M.A.I. |
| 21 | 17 | 18 | 146 | 28 | 42 | 2 |
| 26 | 21 | 21 | 146 | 45 | 77 | 3 |
| 49 | 37 | 28 | | 40 | | |

YIELD 21 yrs. - 7 $m^3$/HA poles

SITE

LAT. 10°30' N LONG. 61°05' ELEV. 198

ANNUAL RAINFALL 2845 DRY MONTHS March-April

PARENT ROCK granite SOIL residual

TOPSOIL TEXTURE sandy loam DEPTH 8 cm

SUBSOIL TEXTURE clay DEPTH deep REACTION 4.5

DRAINAGE impeded SOIL STATE little disturbed

TOPOGRAPHY protected, slope 20% ASPECT SW

CONDITION AT PLANTING virgin forest

SEED ORIGIN natural forest - Trinidad

PLANTING

PREPARATION not taungya DATE 1912

SPACING 3 x 3 AREA ~~0.2~~ 8.1

STOCK direct seeded TOOLS machete

CARE allowed to be suppressed by neighboring trees. Thinning every 10 years.

REPRODUCTION seed and flowers scarce

LOCATION Plantation #2, W of Bungalow, Mt. Harris, Central Range Reserve

COMMENTS good form, broad crowns

SOURCE David Moore, Conservator of Forests, Trinidad

SPECIES Calophyllum brasiliense

ECOLOGICAL GROUP Tropical Moist

COUNTRY Trinidad

PLANTATION 340

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | | |
|---|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME[1/] | M.A.I. |
| 9 | 10 | 11 | 620 | 46 | 37 | 5 |
| 14 | 14 | 16 | 304 | 42 | 60 | 8 |
| 19 | 18 | 19 | 186 | 40 | 61 | 8 |
| 31 | 34 | 31 | | 50 | | |

YIELD 9 yrs. - 2 $m^3$/HA    14 yrs. - 8 $m^3$/HA
12 " 4 "    19 " 19 "

SITE

LAT. 10°35'N    LONG. 61°15' W    ELEV. 46

ANNUAL RAINFALL 2438    DRY MONTHS March-April

PARENT ROCK sandstone    SOIL residual

TOPSOIL TEXTURE fine sand & silt    DEPTH 5

SUBSOIL TEXTURE fine sand & silt    DEPTH deep

REACTION 4.5    DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY slope, 10%    ASPECT E

CONDITION AT PLANTING selectively cut forest

SEED ORIGIN Trinidad

PLANTING Preparation clearfelled; Taungya system;
DATE 1927    AREA 0.15 (plot)
STOCK ball of earth    TOOLS machete
Spacing 1.5 x 1.5

REPRODUCTION seed, seedlings, and flowers scarce

LOCATION S.P. No. 19, adjoining Arena Road

COMMENTS Good form. Undergrowth dense.

SOURCE David Moore, Conservator of Forests, Trinidad.

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1/ After thinning.

SPECIES Cedrela mexicana

ECOLOGICAL GROUP Tropical Moist

COUNTRY Trinidad PLANTATION 341

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | | |
|---|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME | M.A.I. |
| 14 | | | 361 | 14 | 129 | 9 |
| 15 | 32 | 23 | | | | |

YIELD 14 years - 21 $m^3$/HA

SITE

LAT. 10°30' N LONG. 61°05' W ELEV. 91

ANNUAL RAINFALL 2414 DRY MONTHS February-April

FROST none PARENT ROCK limestone

SOIL residual TOPSOIL TEXTURE clay loam

DEPTH 8 SUBSOIL TEXTURE yellow clay DEPTH 0.6

REACTION 7.0 - 8.0 DRAINAGE free

SOIL STATE little disturbed

TOPOGRAPHY lower slope, 20% ASPECT SE

CONDITION AT PLANTING secondary forest

SEED ORIGIN natural stand - Trinidad

PLANTING

DATE 1946 STOCK bareroot nursery

CARE 1 thinning

REPRODUCTION flowers and seed scarce

LOCATION Sample Plot S1, Brigand Hill, 1946 Coupe

COMMENTS excellent form

SOURCE W. S. Chalmers, Forest Department, Port-of-Spain, Trinidad

3 - 82

SPECIES Cordia alliodora

ECOLOGICAL GROUP Tropical Moist

COUNTRY Trinidad PLANTATION 342

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | | |
|---|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME | M.A.I. |
| 12 | 26 | 23 | 256 | 11 | 85 | 8 |

YIELD 12 yrs. - 21 $m^3$/HA.

SITE

LAT. 10° 30' N LONG. 61° 05'W ELEV. 152

ANNUAL RAINFALL 2414 DRY MONTHS February-April

FROST none PARENT ROCK limestone

SOIL residual TOPSOIL TEXTURE heavy clay

DEPTH 5 SUBSOIL TEXTURE clay DEPTH 15

REACTION 8.0 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY ridge-exposed, 10%

ASPECT NE CONDITION AT PLANTING virgin forest

SEED ORIGIN plantation in Trinidad

PLANTING Preparation clearfelled;

DATE 1948 STOCK bareroot nursery

Spacing 2.4 x 2.4 Area 2.5

TOOS cutlass

CARE thinning in 1951

REPRODUCTION seed and flowers abundant

LOCATION Sample Plot No. 52, 1948 Coupe, Brigand Hill

COMMENTS good form - to 32 ft. clear.

SOURCE W. S. Chalmers, Forest Department, Port-of-Spain, Trinidad

ESPECIE Casuarina cuadrivalvis
& C. equisetifolia

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 25

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 20 | 5 | 1000 | | |

SITIO

LAT. 19°N LONG. 96°O ELEV. 0

PRECIPITACION 1300 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE caliza SUELO playa

TEXTURA DEL SUELO arenoso PROFUNDIDAD 1 m

TEXTURA DEL SUBSUELO arenoso REACCION alcalina

DRENAJE libre ESTADO DEL SUELO poco afectado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA dunas de arena

ORIGEN DE SEMILLAS plantación local

SIEMBRA

FECHA (1954) ESPACIAMIENTO 2 x 3 AREA 35

MATERIAL de vivero en potes, 60 cm

HERRAMIENTAS pala

SUPERVIVENCIA 80% al año; 60% a los 5 años

CUIDO limpieza

REPRODUCCION semilla abundante

LUGAR playa al N del Río Vergara, Punta Gorda

COMENTARIOS sembrado para controlar las dunas

ORIGEN DE INFORMACION Porfirio Guanalo Guevara, Delegación Forestal, Vera Cruz, Mex.

ESPECIE Casuarina equisetifolia

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 170

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DBH cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 22 | 17 | 20 | 2396 | 44 | |

SITIO

LAT. 19°N LONG. 96°O ELEV. 5

PRECIPITACION 1615 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 25° SUELO playa

TEXTURA DEL SUELO arena PROFUNDIDAD 2.5 cm

TEXTURA DEL SUBSUELO arena PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA dunas baldías

ORIGEN DE SEMILLAS desconocido

SIEMBRA

FECHA 1938 ESPACIAMIENTO 1.9 x 1.9

AREA 35 MATERIAL semillones de 30 cm con bola de tierra

HERRAMIENTAS pala recta SUPERVIVENCIA 85% despues de 22 años

CUIDO riego durante el primer año

REPRODUCCION semillas viables, semillones ausentes

LUGAR Playa Norte, Vera Cruz

COMENTARIOS 90 m del mar; poda natural pobre

ORIGEN DE INFORMACION Jesus Olvera Sanchez, Avenida Allende 122,

Vera Cruz, Mex.

ESPECIE Casuarina equisetifolia

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 171

CRECIMIENTO

| DOMINANTES & CODOMIANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 12 | 16 | 6050 | 34 | |

SITIO

LAT. 19°N LONG. 96°O ELEV. 2

PRECIPITACION 1615 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 25° SUELO arena de playa

TEXTURA DEL SUELO arena PROFUNDIDAD 2.5 cm

TEXTURA DEL SUBSUELO arena PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA dunas de arena

ORIGEN DE SEMILLAS plantación cercana de origen desconodico

SIEMBRA

PREPARACION ninguna FECHA 1948

ESPACIAMIENTO 1.3 x 1.3 AREA 5+

MATERIAL semillones en potes, 30 cm

HERRAMIENTAS pala recta SUPERVIVENCIA 90% a los 12 años

CUIDO ninguno

REPRODUCCION flores ausentes

LUGAR Playa Norte, Vera Cruz

COMENTARIOS 200 m del mar, mas cerca del mar la altura va disminuyendo, poda natural pobre

ORIGEN DE INFORMACION Jesus Olvera Sanchez, Av. Allende 122, Vera Cruz, Mex.

ESPECIE Casuarina equisetifolia

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 172

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 14 | 18 | 1885 | 23 | |

SITIO

LAT. 19°N LONG. 96°O ELEV. 3

PRECIPITACION 1615 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 25° SUELO playa

TEXTURA DEL SUELO arena PROFUNDIDAD 2.5 cm

TEXTURA DEL SUBSUELO arena PROFUNDIDAD 1+

REACCION 7.0 TOPOGRAFIA pendiente baja

CONDICION ANTES DE LA SIEMBRA dunas de arena

ORIGEN DE SEMILLAS plantación cercana de origen desconocido

SIEMBRA

PREPARACION ninguna FECHA 1954

ESPACIAMIENTO 1.75 x 1.75 AREA 3

MATERIAL semillones en potes, 30 cm de altura

HERRAMIENTAS pala recta SUPERVIVENCIA 65% a los 6 años

CUIDO ninguno

REPRODUCCION flores ausentes

LUGAR Vera Cruz

COMENTARIOS 300 m del mar; protegido por una plantación mas vieja

ORIGEN DE INFORMACION Jesus Olvera Sanchez, Av. Allende 122,

Vera Cruz, Mex.

ESPECIE Cedrela mexicana

GRUPO ECOLOGICO Tropical Seco

PAIS Puerto Rico PLANTACION 26

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 15 | 17 | |
| 24 | 22 | 12 |

SITIO

LAT. 18°20'N LONG. 66°35'O ELEV. 100

PRECIPITACION 1780 MESES DE SEQUIA Enero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso pedregoso

PROFUNDIDAD 2 cm TEXTURA DEL SUBSUELO arcilloso duro

PROFUNDIDAD 1 REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinación más baja, 15% ASPECTO E

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION tumba FECHA 1935

ESPACIAMIENTO 3 x 3 MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA 50% a los 24 años

CUIDO limpieza durante 2 años

REPRODUCCION ninguna

LUGAR Sabana Hoyos

ORIGEN DE INFORMACION Tropical Forest Research Center,

Box 577, Río Piedras, P. R.

ESPECIE Cedrela mexicana

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 173

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 11 | 6 | 1075 | | |

SITIO

LAT. 21°10'N LONG. 87°40'O ELEV. 10

PRECIPITACION 1128 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso pesado PROFUNDIDAD 20 cm

TEXTURA DEL SUBSUELO arcilloso pedregoso

PROFUNDIDAD en bolsillos 1m

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION limpiar área en forma de círculo Fecha 1952

ESPACIAMIENTO 3 x 3 AREA 40

MATERIAL de vivero en potes, 30 cm

HERRAMIENTAS pico y pala SUPERVIVENCIA 23% a los 5 años

CUIDO 1 limpieza

REPRODUCCION ninguna

LUGAR Zona Experimental 16, Colonia Yucatán

COMENTARIOS Quemadura por el sol y ataques de insectos han causado una alta mortalidad. Experimentos de siembra directa son prometedores.

ORIGEN DE INFORMACION José M. Zapata, Colonia Yucatán, Via Mérida, Yuc., Mex.

ESPECIE Cedrela mexicana

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 174

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 12 | 10 | 3700 | 18 | |

SITIO

LAT. 20°N LONG. 90°O ELEV. 30

PRECIPITACION 1170 MESES DE SEQUIA Noviembre-Mayo

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso pesado PROFUNDIDAD +1 uniforme

TEXTURA DEL SUBSUELO arcilloso pesado REACCION 8.0

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS local

SIEMBRA

FECHA 1952 ESPACIAMIENTO 0.5 x 0.5 AREA 0.02

MATERIAL semillas

CUIDO limpieza anual, 40% de las plantas removidas para siembra, poda durante los 4to, 5to y 6to años

REPRODUCCION ninguna

LUGAR Lote #3, Cayal Campo Experimental, 45 km SE de Campeche

COMENTARIOS vivero reducido de 4000 plantas a 60 durante tercer y cuarto año

ORIGEN DE INFORMACION Avel López Caballero, Agencia Geral. de Agricultura, Campeche, Campeche, Mex.

ESPECIE Cedrela mexicana

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras PLANTACION 175

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 13 | 28 | 15 | 175 | | |

SITIO

LAT. 15°N LONG. 88°O ELEV. 200

PRECIPITACION 1800 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza & volcánica SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 1

REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION desmonte de calles FECHA 1947

ESPACIAMIENTO 4.5 x 9 AREA 12

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 80% a los 13 años

CUIDO 2 limpiezas por año durante 10 años; aclareo a los 11 años

REPRODUCCION flores ausentes

LUGAR Botones Camp, Amapa, 50 km al S de La Lima

ORIGEN DE INFORMACION Paul Shank, United Fruit Co., La Lima, Hond.

ESPECIE Cedrela odorata

GRUPO ECOLOGICO Tropical Seco

PAIS Ecuador PLANTACION 176

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD : | DAP cm : | ALTURA m | NUM. ARBOLES: | AREA BASIMETRICA: | VOL. |
| 18-20 | 50 | 25 | 173 | 32 | |

SITIO

LAT. 2°S LONG. 80°O ELEV. 25

PRECIPITACION 1200 MESES DE SEQUIA Mayo & Diciembre

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE varias SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 4 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA plantación de cacao

ORIGEN DE SEMILLAS Cuba

SIEMBRA

PREPARACION corte de hierbas FECHA 1940

ESPACIAMIENTO 9 x 9 AREA 4

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS pala SUPERVIVENCIA 50% a los 8 años

CUIDO 2 limpiezas anuales durante 4 años; aclareo 5/HA

REPRODUCCION semillas abundantes

LUGAR Hacienda La Mina, 25 km al E de Guayaquil

COMENTARIOS inundaciones cada 3 - 4 años; sombra para café y cacao

ORIGEN DE INFORMACION José Ubilla, Subdirector de Agricultura y Bosques, Ministerio de Fomento, Guayaquil, Ec.

ESPECIE Cedrela odorata

GRUPO ECOLOGICO Tropical Seco

PAIS Ecuador PLANTACION 177

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 24 | 18 | (1125) | 31 | |

SITIO

LAT. 2°S LONG. 80°O ELEV. 25

PRECIPITACION 1200 MESES DE SEQUIA Mayo & Diciembre

TEMPERATURA PROMEDIO 26° HELADAS ninguna

SUELO aluvial TEXTURA DEL SUELO franco arenoso

PROFUNDIDAD 4 cm TEXTURA DEL SUBSUELO franco arenoso

PROFUNDIDAD 2+ REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Cuba

SIEMBRA

PREPARACION corte de hierbas FECHA 1954

ESPACIAMIENTO 2 x 4 AREA 8

MATERIAL de vivero a raíz desnuda HERRAMIENTAS pala

SUPERVIVENCIA 90% a los 6 años

CUIDO 2 limpiezas anuales durante 3 años; poda a los 3 años

REPRODUCCION flores ausentes

LUGAR Hacienda La Mina, 25 km al E de Guayaquil

COMENTARIOS necesita aclareo

ORIGEN DE INFORMACION José Ubilla, Subdirector de Agricultura y Bosques, Ministerio de Fomento, Guayaquil, Ec.

ESPECIE Ceiba sp.

GRUPO ECOLOGICO Tropical Seco

PAIS Ecuador PLANTACION 178

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 13 | 18 | 11 | (844) | 22 | |

SITIO

LAT. 2°S LONG. 80°O ELEV. 17

PRECIPITACION 1001 MESES DE SEQUIA Mayo & Diciembre

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE pizarra SUELO residual

TEXTURA DEL SUELO arcilloso pesado PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso muy pesado

PROFUNDIDAD 1+ REACCION 6.5 DRENAJE libre

TOPOGRAFIA plana CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Java

SIEMBRA

FECHA 1947 ESPACIAMIENTO 3.1 x 3.1 AREA 1

MATERIAL de vivero HERRAMIENTAS pico & pala

SUPERVIVENCIA 95% a los 13 años

CUIDO limpieza anual durante 8 años

REPRODUCCION semillas abundantes

LUGAR Hacienda Barcelona, 12 km al NE de Guayaquil

ORIGEN DE INFORMACION José Ubilla, Subdirector de Agricultura y Bosques, Ministerio de Fomento, Guayaquil, Ec.

ESPECIE Cybistax donnell-smithii

GRUPO ECOLOGICO Tropical Seco

PAIS Puerto Rico PLANTACION 27

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 8 | 8 | 10 |

SITIO

LAT. 18°25'N LONG. 66°40'O ELEV. 60

PRECIPITACION 1433 MESES DE SEQUIA Marzo-Abril, Junio-Julio

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 1 cm

TEXTURA DEL SUBSUELO franco arcilloso pedregoso

PROFUNDIDAD 15-30 REACCION 8.0

DRENAJE libre ESTADO DEL SUELO poco afectado

TOPOGRAFIA inclinacion baja, 5% ASPECTO 0

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Guatemala, vertientes del Pacífico

SIEMBRA

PREPARACION abrir calles FECHA 1951

ESPACIAMIENTO 2.5 x 3.6

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA 85% a los 8 años

CUIDO desyerbo varias veces durante 3 años, dosel aclarado

REPRODUCCION ninguna

LUGAR Bosque de Cambalache

ORIGEN DE INFORMACION FMR Study 2365, Tropical Forest Research Center, Box 577, Rio Piedras, P. R.

ESPECIE Cybistax donnell-smithii

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 181

CRECIMIENTO
DOMINANTES & CODOMINANTES
EDAD : DAP cm : ALTURA m
11 9 12

SITIO
LAT. 19°N LONG. 88°O ELEV. 14

PRECIPITACION 1200 MESES DE SEQUIA Enero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso pegajoso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO piedra caliza PROFUNDIDAD 1+

REACCION 7.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA vivero

ORIGEN DE SEMILLAS Chiapas, bosque natural, 2000 mm precipitación, 150 m elev.

SIEMBRA
PREPARACION cultivo de vivero FECHA 1949

ESPACIAMIENTO irregular AREA 70 árboles

MATERIAL semillas

SUPERVIVENCIA 60% al año, 10% a los 10 años

CUIDO 2 limpiezas durante 2 años; aclareo al segundo o tercer año y al noveno

REPRODUCCION ninguna

LUGAR Laguna San Felipe, Cuartel #3, 50 km al O de Chetumal, Quintana Roo, Mexico

COMENTARIOS árboles bien desarrollados

ORIGEN DE INFORMACION Armando Cuevas, Agencia General de Agricultura, Chetumal, Quintana Roo, Mexico

ESPECIE Cybistax donnell-smithii

GRUPO ECOLOGICO Tropical Seco

PAIS GUATEMALA PLANTACION 29

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 24 | 8 | | | |
| 19 | 36 | 23 | | | |
| 21 | 40 | 23 | 504 | 21 | 148 |

SITIO

LAT. 14°10'N LONG. 91°0 ELEV. 75

PRECIPITACION 1375 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE volcánica SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 6.5 DRENAJE libre, nivel freático alto

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1938

ESPACIAMIENTO 3 x 3 AREA 800

MATERIAL de vivero a raíz desnuda

CUIDO limpieza durante 2 años;

REPRODUCCION escasa

LUGAR Hacienda La Selva, Sección Los Cocos, 30 km al S de Siquinala, Esquintla, Guatemala

COMENTARIOS Inundaciones durante periodos de mucha lluvia han causado la muerte de muchos árboles. Plantaciones subplantadas en bosques han fracasado. Buen drenaje y claridad son esenciales.

ORIGEN DE INFORMACION J.B. Kinlock unpub. report 1946. F.B. Lamb unpub. report 1957. Eliseo Matos, Escuela de Capacitación Forestal, Amatitlán, Guatemala.

ESPECIE Cybistax donnell-smithii

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras PLANTACION 180

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 13 | 30 | 20 | 335 | | |

SITIO

LAT. 15°N LONG. 88°O ELEV. 200

PRECIPITACION 1800 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza & volcánica SUELO aluvial

TEXTURA DEL SUELO arcilloso liviano PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1947

ESPACIAMIENTO 4.5 x 4.5 AREA 0.4

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 70% despues de 13 años

CUIDO 2 limpiezas durante 2 años; aclareo muy ligero

REPRODUCCION flores abundantes, semillas escasas

LUGAR Botones Camp, Amapa, 50 km al S de La Lima

COMENTARIOS flores a los 12 años, especie fracasa en sitios con drenaje pobre

ORIGEN DE INFORMACION Paul Shank, United Fruit Co., La Lima, Hond.

ESPECIE Cybistax donnell-smithii

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras PLANTACION 179

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 36 | 23 | 250 | 25 | |

SITIO

LAT. 15°45'N LONG. 87°30'O ELEV. 8

PRECIPITACION 1990 MESES DE SEQUIA Marzo-Junio

TEMPERATURA PROMEDIO 28° HELADAS ninguna

ROCA MADRE granito SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO franco arenoso grueso

PROFUNDIDAD 3+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivado por 10 años

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION talar y alinear FECHA 1949

ESPACIAMIENTO 5 x 5 AREA 60

MATERIAL de vivero, 60 cm HERRAMIENTAS pala y machete

SUPERVIVENCIA (62% a los 10 años)

CUIDO limpieza, talar hileras cada 5 meses despues de la siembra

REPRODUCCION semillas abundantes, semillones escasos

LUGAR San Alejo, 12 km al S del Puerto de Tela

COMENTARIOS En 1960 se haran estudios sobre crecimiento. Requiere sitios con buen drenaje.

ORIGEN DE INFORMACION Paul Shank, In Charge Forest Operations, United Fruit Co., La Lima, Hond.

ESPECIE Eucalyptus naudiniana (Syn: deglupta)

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras PLANTACION 182

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 26 | 27 | 480 | | |

SITIO

LAT. 15°N LONG. 88°O ELEV. 200

PRECIPITACION 1800 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza y vólcánica SUELO aluvial

TEXTURA DEL SUELO arcilloso liviano PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 8.0 TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Trinidad

SIEMBRA

PREPARACION tumba y quema FECHA 1952

ESPACIAMIENTO 4.5 x 4.5 MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 98% a los 8 años

CUIDO 2 limpiezas durante 2 años

REPRODUCCION flores ausentes

LUGAR Botones Camp, Amapa, 50 km al S de La Lima

COMENTARIOS crecimiento excepcional

ORIGEN DE INFORMACION Paul Shank, United Fruit Co., La Lima, Hond.

ESPECIE Hibiscus elatus

GRUPO ECOLOGICO Tropical Seco

PAIS Puerto Rico PLANTACION 31

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 14 | 14 | 22 |

SITIO

LAT. 18°25'N LONG. 66°40'O ELEV. 60

PRECIPITACION 1433

MESES DE SEQUIA Marzo-Abril, Junio-Julio

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO franco arcilloso pedregoso

PROFUNDIDAD 13-50 REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 10% inclinación ASPECTO O

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Dr. Chardon, Jamaica, Lat. 18°N., Long. 77°O

SIEMBRA

PREPARACION abrir vegetación FECHA 1945

ESPACIAMIENTO 1.8 x 2.5 MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA 75% a los 14 años

CUIDO varios desyerbos durante 3 años

REPRODUCCION ninguna

LUGAR Bosque de Cambalache

ORIGEN DE INFORMACION FMR Study 2366, Tropical Forest Research Center, Box 577, Rio Piedras, Puerto Rico

ESPECIE Jacaranda copaia

GRUPO ECOLOGICO Tropical Seco

PAIS Brazil PLANTACION 183

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 2 | 7 | 6 |

SITIO

LAT. 2°33'S LONG. 54°8'O ELEV. 70

PRECIPITACION 1600 MESES DE SEQUIA Agosot-Noviembre

TEMPERATURA PROMEDIO 30° ROCA MADRE arena cuaternaria

SUELO aluvial TEXTURA DEL SUELO franco arenoso

PROFUNDIDAD 3 cm TEXTURA DEL SUBSUELO franco arenoso

PROFUNDIDAD 60+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA de nivel hasta levemente inclinada

ASPECTO N CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba, quema y arranque de tocones para nivelacion de carretera

FECHA 1958 ESPACIAMIENTO 2.5 x 2.5

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS excavador de hoyos

SUPERVIVENCIA 52% despues de los 2 años

CUIDO 3 limpiezas y acolchado en 1959; poda - corte de troncos multiples cuando necesario

REPRODUCCION flores ausentes

LUGAR KM 5, Curuá, Jacaranda

ORIGEN DE INFORMACION John Pitt, FAO Forestry Unit, Belém, Brazil

ESPECIE Khaya nyasica

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras PLANTACION 184

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 11 | 13 | 15 | 1600 | 20 | |

SITIO

LAT. 15° N LONG. 88° O ELEV. 200

PRECIPITACION 1800 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza & volcánica SUELO aluvial

TEXTURA DEL SUELO arcilloso liviano PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Cuba - Northern Rhodesia

SIEMBRA

PREPARACION tumba y quema FECHA 1949

ESPACIAMIENTO 2.5 x 2.5 AREA 0.4

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 98% al año, 80% a los 11 años

CUIDO 2 limpiezas durante 2 años; entresaque de árboles mal formados; 1 poda

REPRODUCCION flores ausentes

LUGAR Botones Camp, Amapa, 50 km al S de La Lima

COMENTARIOS troncos enfermos en algunos árboles, espaciamiento muy estrecho

ORIGEN DE INFORMACION Paul Shank, United Fruit Co., La Lima, Hond.

ESPECIE Simaruba amara

GRUPO ECOLOGICO Tropical Seco

PAIS Brazil PLANTACION 185

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 2 | 5 | 6 |

SITIO

LAT. 2°33'S LONG. 54°8'0 ELEV. 70

PRECIPITACION 1700 MESES DE SEQUIA Agosto-Noviembre

TEMPERATURA PROMEDIO 30° SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 60+

REACCION 5.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA desde al nivel a ligeramente ondulada

ASPECTO N by E

CONDICION ANTES DE LA SIEMBRA bosque vírgen

ORIGEN DE SEMILLAS Mácapá, Brazil

SIEMBRA

PREPARACION tumba FECHA 1958

ESPACIAMIENTO 2.5 x 2.5 MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 83% a los 2 años

CUIDO 3 limpiezas y acolchado; poda de troncos múltiples

REPRODUCCION flores ausentes

LUGAR Km 5, Curuá

ORIGEN DE INFORMACION J. Pitt, FAO, Forestry Mission, Belem, Brazil

ESPECIE Swietenia humilis

GRUPO ECOLOGICO Tropical Seco

PAIS Guatemala PLANTACION 37

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 21 | 26 | | 345 | 18 | 136 |

SITIO

LAT. 14°10'N LONG. 91°0 ELEV. 75

PRECIPITACION 1375 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE volcánica SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2

DRENAJE libre, nivel freático alto

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRE cultivado

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1938

ESPACIAMIENTO 3 x 3 MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 50% a los 20 años

CUIDO limpieza por 2 años

REPRODUCCION escasa

LUGAR Hacienda La Selva, Sección Los Cocos, 30 km al S. de Siquinala, Esquintla, Guatemala

ORIGEN DE INFORMACION J. B. Kinloch y F. B. Lamb, informes sin publicar. Eliseo Matos, Escuela de Capacitación Forestal, Amatitlan, Guatemala

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Seco

PAIS St. Croix

CRECIMIENTO

DOMINANTES Y CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 52 | 44 | 9 |

SITIO

LAT. 17°45'N LONG. 65°O ELEV. nivel del mar

PRECIPITACION 1373 MESES DE SEQUIA Marzo-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE lava SUELO aluvial

TEXTURA DEL SUELO arcilloso friable

TEXTURA DEL SUBSUELO arcilloso REACCION alcalina

DRENAJE libre ESTADO DEL SUELO poco afectado

TOPOGRAFIA levemente inclinada, de 0 a 2% ASPECTO N

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS desconocido

SIEMBRA

FECHA 1907 ESPACIAMIENTO 3 x 4.5 AREA 0.5

MATERIAL semillas SUPERVIVENCIA 28% a los 52 años

REPRODUCCION arbolillos abundantes

LUGAR Bosque de W. M. Canaday, Davis Bay, costa N de St. Croix, Islas Vírgenes

COMENTARIOS Unica plantación de caoba Hondureña en Islas Vírgenes sembrada durante la administración Danesa. Area ha sido usada para pasto de ganado.

ORIGEN DE INFORMACION R. W. Nobles, U. S. Forest Service, Virgin Islands

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 186

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 6 | 6 | 816 | | |

RENDIMIENTO ninguno

SITIO

LAT. 21°10'N LONG. 87°40'O ELEV. 10

PRECIPITACION 1128 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso pesado PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO arcilloso rocoso

PROFUNDIDAD en bolsillos 1 m

REACCION 7.5 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA plana con hoyas

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS Laguna Zoh

SIEMBRA

PREPARACION abrir brechas FECHA 1952-53

ESPACIAMIENTO 5 x 3 MATERIAL de vivero en potes, 30 cm

HERRAMIENTAS pico & pala SUPERVIVENCIA 71% a los 5 años

CUIDO 1 limpieza anual por 4 años; en 1958 se eliminó la competencia

REPRODUCCION flores ausentes

LUGAR Zona Experimental 5, Colonia Yucatan 3 km al N de Colonia

COMENTARIOS Dueño de Colonia Yucatan

ORIGEN DE INFORMACION José M. Zapata, Colonia Yucatan, Via Mérida, Yuc., Mexico

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 187

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA:VOL. |
| 8 | 5 | 8 | 10,000 | 32 |

SITIO

LAT. 20°N LONG. 90°O ELEV. 30

PRECIPITACION 1170 MESES DE SEQUIA Noviembre-Mayo

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso pesado PROFUNDIDAD 1+

TEXTURA DEL SUBSUELO arcilloso pesado REACCION 8.0

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Escarcega, Campeche

SIEMBRA

PREPARACION vivero FECHA 1952

ESPACIAMIENTO 0.5 x 0.5 AREA 0.02 MATERIAL semilla

CUIDO limpieza anual, 40% de las plantas fueron arrancadas durante el primer año; poda a los 4, 5, y 6 años

REPRODUCCION ninguna

LUGAR Lote 1, Cayal Campo Experimental, 45 km al SE de Ciudad Campeche

COMENTARIOS vivero de 224 $m^2$ reducido de 7000 plantas a 300 plantas durante el tercer y cuarto año, necesita mas aclareo

ORIGEN DE INFORMACION Avel López Caballero, Agencia Geral. de Agricultura, Campeche, Campeche, Mexico

ESPECIE Swietenia macrophylla

PAIS Mexico PLANTACION 188

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 8 | 8 | 5000 | 19 | |

SITIO

LAT. 20°N LONG. 90°O ELEV. 30

PRECIPITACION 1170 MESES DE SEQUIA Noviembre-Mayo

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso pesado PROFUNDIDAD 1

TEXTURA DEL SUBSUELO arcilloso pesado REACCION 8.0

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Escarcega, Campeche; precipitación 1350, 200 m

SIEMBRA

PREPARACION vivero FECHA 1952

ESPACIAMIENTO 0.5 x 0.5 AREA 0.02

MATERIAL semilla

CUIDO limpieza anual, 40% de las plantas arrancadas el primer año; podas durante los 4, 5 y 6 años

REPRODUCCION flores ausentes

LUGAR Lote #2, Cayal, Campo Experimental, 45 km SE de Campeche City

COMENTARIOS vivero de 189 m$^2$ reducido de 5000 a 100 plantas durante el tercer y cuarto año, ahora necesita aclareo

ORIGEN DE INFORMACION Avel Lopez Caballero, Agencia Geral. de Agricultura, Campeche, Campeche, Mexico

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 189

CRECIMIENTO

DOMINANTES Y CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 12 | 6 | 8 |

SITIO

LAT. 18°30'N LONG. 90°30'O ELEV. 100

PRECIPITACION 1800 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso pedregoso PROFUNDIDAD 5-40 cm

TEXTURA DEL SUBSUELO arcilloso pedregoso PROFUNDIDAD 1

REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION abrir calles 1 m de ancho a través del bosque

FECHA 1948 ESPACIAMIENTO 3.5 x 10 AREA 100

MATERIAL de vivero en potes, 50 cm

HERRAMIENTAS machete, pico

SUPERVIVENCIA 50% a los 6 meses; 10% a los 11 años

CUIDO limpieza durante el 4to y octavo año

REPRODUCCION flores ausentes

LUGAR Km 20, Escarcega, carretera hacia Chetumal

COMENTARIOS bosque cortado selectivamente pero no abierto lo suficiente para que entrara la luz requerida por la caoba. Despues de 2 resiembras la supervivencia no pasó de 20%

ORIGEN DE INFORMACION Alberto López Suárez, Agencia Geral. de Agricultura, Campeche, Mexico

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 190

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 9 | 6 | 6000 | 25 | |

SITIO

LAT. 18°30'N LONG. 90°40'O ELEV. 100

PRECIPITACION 1800 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD 50 cm

TEXTURA DEL SUBSUELO rocoso PROFUNDIDAD 1

REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION vivero FECHA 1948

ESPACIAMIENTO 0.5 x 0.5 AREA 0.4 MATERIAL semilla

CUIDO 1 limpieza anual, aclareo 30% a los 4 meses, 40% a los cuatro años, 60% a los 10 años, poda al mismo tiempo que los aclareos

REPRODUCCION ninguna

LUGAR La Chiquita Lote 2, Escarcega, Campeche

COMENTARIOS Plantas que dejaron en el vivero se entresacaron para formar una parcela para medir crecimiento.

ORIGEN DE INFORMACION Alberto Lopez Suarez, Agencia Geral. de Agricultura, Campeche, México

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Seco

PAIS Mexico PLANTACION 191

CRECIMIENTO
DOMINANTES & CODOMINANTES
EDAD : DAP cm : ALTURA m
10 5 6

SITIO
LAT. 19°N LONG. 88°O ELEV. 14

PRECIPITACION 1200 MESES DE SEQUIA Enero-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso pegajoso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO rocoso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA
PREPARACION abrir brechas a través del bosque FECHA 1949

ESPACIAMIENTO 5 x 10 AREA 3000

MATERIAL de vivero en potes HERRAMIENTAS pala

SUPERVIVENCIA 40% al año, 10% a los 10 años

CUIDO limpieza anual durante 4 años

REPRODUCCION ninguna

LUGAR Laguna San Felipe, Lote #1, Anexo #1, Cuartel #3,

58 km al NO de Chetumal

COMENTARIOS Fuegos durante 1952-53 y 58 han afectado 2500 Ha.
El bosque aqui ha producido buena calidad de caoba.

ORIGEN DE INFORMACION Armando Cuevas, Agencia Geral. de Agricultura, Chetumal, Quintana Roo, Mexico

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras Británica PLANTACION 41

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 3 | 3 | 45 | | |

SITIO

LAT. 17°N LONG. 89°O ELEV. 300

PRECIPITACION 1544 MESES DE SEQUIA Diciembre-Mayo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso pesado PROFUNDIDAD 25 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA 2% inclinada

ASPECTO O CONDICION ANTES DE LA SIEMBRA bosque vírgen

ORIGEN DE SEMILLAS local, Cubetas

SIEMBRA

PREPARACION corte de maleza y se subplantó FECHA 1954

ESPACIAMIENTO 3.6 x 3.6 AREA 1.5

MATERIAL de vivero a raíz desnuda HERRAMIENTAS azada

SUPERVIVENCIA 50% a los 5 años

CUIDO limpieza anual

REPRODUCCION ninguna

LUGAR Cubetas, British Honduras

COMENTARIOS Como el dosel era excesivo para un crecimiento bueno, durante el 1959 se eliminó anillado de los árboles. Según observaciones en abril, 1960, la caoba esta creciendo rápidamente como resultado de la liberación de la sombra.

ORIGEN DE INFORMACION Conservator of Forests, Box 181, Belize, British Honduras. Study U.P. 54 C.F.R.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras Británica PLANTACION 192

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 11 | 11 | 10 | 370 | | |

SITIO

LAT. 17°N LONG. 85°O ELEV. 300

PRECIPITACION 1500 MESES DE SEQUIA Febrero-Mayo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 1+

REACCION 7.5 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA levemente inclinada

CONDICION ANTES DE LA SIEMBRA area quemada en 1945

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION corta y quema ligera del sotobosque FECHA 1949

ESPACIAMIENTO 3.6 x 3.6 AREA 12

MATERIA semillas SUPERVIVENCIA 50% a los 11 años

CUIDO limpieza ligera a los 9 años

REPRODUCCION flores ausentes

LUGAR UP 41 Maria Camp, 8 km al SO de Mtn. Pine Ridge

COMENTARIOS area quemada en 1945, cubierta forestal ligera sobre plantación

ORIGEN DE INFORMACION Conservator of Forests, Box 181, Belize, British Honduras.

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras Británica PLANTACION 193

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 11 | 9 | 10 | 2900 | | |

SITIO

LAT. 17°N LONG. 89°O ELEV. 300

PRECIPITACION 1500 MESES DE SEQUIA Febrero-Mayo

TEMPERATURA PROMEDIO 25° ROCA MADRE caliza

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso rocoso PROFUNDIDAD 12

REACCION 7.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION cultivado FECHA 1949

ESPACIAMIENTO 1.8 x 1.8 MATERIAL semillas

SUPERVIVENCIA 50% a los 11 años

CUIDO 1 limpieza anual durante 3 años; aclareo de la mitad a los 9 años

REPRODUCCION flores ausentes

COMENTARIOS estos árboles se dejaron en el vivero viejo, necesitan aclareo

ORIGEN DE INFORMACION Conservator of Forests, Box 181, Belize, British Honduras

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras PLANTACION 194

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 13 | 21 | 15 | 175 | | |

SITIO

LAT. 15°N LONG. 88°O ELEV. 200

PRECIPITACION 1800 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza & volcánica SUELO aluvial

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD 13 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 1+

REACCION 7.5 ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION desmonte de calles FECHA 1947

ESPACIAMIENTO 4.5 x 9 AREA 25

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 80% a los 13 años

CUIDO 1 limpieza cada año

REPRODUCCION flores ausentes

LUGAR Botones Camp, Amapa, 50 km al S. de La Lima

ORIGEN DE INFORMACION Paul Shank, United Fruit Co., La Lima, Honduras

ESPECIE Swietenia mahagoni

GRUPO ECOLOGICO Tropical Seco

PAIS Puerto Rico PLANTACION 42

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 15 | 16 | 13 | 938 | 14 | |

SITIO

LAT. 18°5'N LONG. 66°55'O ELEV. 150

PRECIPITACION 1520 MESES DE SEQUIA Dic.-Abril, Junio

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE serpentina SUELO aluvial

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso pedregoso PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinación baja, 10% ASPECTO S

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION cultivo FECHA 1940

ESPACIAMIENTO 2.5 x 2.5 AREA 2

MATERIAL de vivero en potes, 15-30 cm

HERRAMIENTAS zapapico SUPERVIVENCIA 55% a los 19 años

CUIDO varios desyerbos durante 2 años

REPRODUCCION semillas escasas, semillones abundantes, pocos renuevos

LUGAR Bosque Susua

COMENTARIOS árboles empezando a mostrar ramas secas

ORIGEN DE INFORMACION FMR Study 136 Su, Tropical Forest Research Center, Box 577, Río Piedras, P. R.

ESPECIE Swietenia mahagoni

GRUPO ECOLOGICO Tropical Seco

PAIS Puerto Rico PLANTACION 44

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA |
|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES: AREA BASIMETRICA. VOL. |
| 20 | 17 | | 1076 |
| 25 | 19 | 16 | |

SITIO

LAT. 18°15'N LONG. 67°13'O ELEV. 125

PRECIPITACION 1680 MESES DE SEQUIA Diciembre-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE serpentina SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO arcilloso pedregoso

PROFUNDIDAD 1+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 50% inclinación ASPECTO N

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS desconocido

SIEMBRA

FECHA 1931 ESPACIAMIENTO 3 x 3

MATERIAL vivero SUPERVIVENCIA 70% a los 28 años

CUIDO desyerbo

REPRODUCCION arbolillos abundantes

LUGAR Universidad Inter Americana, San Germán, Puerto Rico

COMENTARIOS Ramas secas y aun algunos árboles muertos debido a enfermedad de origen desconocido.

ORIGEN DE INFORMACION FMR Study 1934, Tropical Forest Research Center, Box 577, Río Piedras, P. R.

ESPECIE Swietenia mahagoni

GRUPO ECOLOGICO Tropical Seco

PAIS Puerto Rico PLANTACION 45

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 28 | 18 | 10 | 999 | 16 | |

SITIO

LAT. 18°5'N LONG. 67°3'0 ELEV. 125

PRECIPITACION 1680 MESES DE SEQUIA Diciembre-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE serpentina SUELO residual

TEXTURA DEL SUELO arcilloso pedregoso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso pedregoso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA cumbre de cerro

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION preparar hoyos FECHA 1931

ESPACIAMIENTO 3 x 3 AREA 3

MATERIAL de vivero SUPERVIVENCIA 90% a los 28 años

CUIDO desyerbo

REPRODUCCION semillones abundantes

LUGAR Universidad Inter Americana, San Germán, Puerto Rico

COMENTARIOS condiciones en la cumbre del cerro son más adversas que las de la plantación 4 - 36 situada en la ladera

ORIGEN DE INFORMACION FMR Study 1934, parcela de afuera, Tropical Forest Research Center, Box 577, Río Piedras, P. R.

ESPECIE Swietenia mahagoni

GRUPO ECOLOGICO Tropical Seco

PAIS Puerto Rico PLANTACION 46

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 12 | 9 | 1076 | 3 | |
| 17 | 17 | 15 | 1076 | 16 | |

SITIO

LAT. 18°5'N LONG. 66°45'O ELEV. 250

PRECIPITACION 1832 MESES DE SEQUIA Enero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE pizarras tufáceas SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 7 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 30 cm

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA inclinación baja, 40% ASPECTO E

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION cortar pasto en lugares para la siembra

FECHA 1942 ESPACIAMIENTO 3 x 3 AREA 10

MATERIAL de vivero a raíz desnuda

CUIDO desyerbo y poda

REPRODUCCION semillones abundantes, arbolillos escasos

LUGAR Quebrada Honda, Guayanilla, Puerto Rico

COMENTARIOS Varios árboles de forma buena, árboles en fruto.

ORIGEN DE INFORMACION Estudio 177 de plantación privada, Tropical Forest Research Center, Box 577, Río Piedras, P. R.

GRUPO ECOLOGICO Tropical Seco

PAIS Puerto Rico PLANTACION 195

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 35 | 17 | 9 | 540 | 15 | |

SITIO

ELEV. 100 PRECIPITACION 1020

MESES DE SEQUIA Febrero-Abril TEMPERATURA PROMEDIO 25°

HELADAS ninguna ROCA MADRE caliza

SUELO residual TEXTURA DEL SUELO franco arenoso

PROFUNDIDAD 3 cm TEXTURA DEL SUBSUELO pedregoso

PROFUNDIDAD 20 cm REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 40% inclinación ASPECTO N

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS desconocido

SIEMBRA

FECHA 1925 ESPACIAMIENTO 3 x 3 AREA 3

MATERIAL de vivero a raiz desnuda

CUIDO 2 limpiezas anuales por 4 años

REPRODUCCION semillones abundantes

LUGAR El Vigía, lado N de Ponce

ORIGEN DE INFORMACION Carlos Purcell, Servicio de Extensión Agrícola, Ponce, P. R.

ESPECIE Swietenia mahagoni

GRUPO ECOLOGICO Tropical Seco

PAIS St. Croix, V. I. PLANTACION 43

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD : | DAP cm : | ALTURA m | NUM. ARBOLES: | AREA BASIMETRICA: | VOL. |
| 35 | 16 | | 400 | 8 | |

Rendimiento 35 años - postes

SITIO

LAT. 17°45'N LONG. 64°45'O ELEV. 52

PRECIPITACION 1106 MESES DE SEQUIA Febrero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso friable PROFUNDIDAD 13-50 cm

TEXTURA DEL SUBSUELO arcilloso friable PROFUNDIDAD 0-2

REACCION alcalina DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinación de 2 a 10%

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación local

SIEMBRA

FECHA 1923 ESPACIAMIENTO 1.8 x 3.6 AREA 0.5

MATERIAL de vivero a raíz desnuda 30 cm

HERRAMIENTAS zapapico SUPERVIVENCIA 43% a los 35 años

CUIDO usado para pastoreo, a los troncos bajos se les removieron las ramas grandes

REPRODUCCION semillones abundantes

LUGAR Parte N de la Hacienda de Ana Hope, St. Croix, U.S. Virgin Islands

COMENTARIOS existen 260 de los 600 árboles originales, la información de arriba es sobre 150 árboles aglomerados en el centro de la plantacion, hay pastoreo excesivo por ovejas y cabras

ORIGEN DE INFORMACION R. W. Nobles, U.S. Forest Service, Virgin Islands Corporation, St. Croix, Virgin Islands

4 = 40

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Seco

PAIS Puerto Rico PLANTACION 54

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 10 | 8 | 1630 | | |

RENDIMIENTO postes pequeños

SITIO

LAT. 18°25'N LONG. 66°40'O ELEV. 60

PRECIPITACION 1433 MESES DE SEQUIA Marzo-Abril, Junio-Julio

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION desyerbo alrededor de los hoyos FECHA 1950

ESPACIAMIENTO 2.5 x 2.5 AREA 16

MATERIAL de vivero a raíz desnuda HERRAMIENTAS zapapico

CUIDO varias limpiezas durante 2 años; aclareo a los 8 años

REPRODUCCION semillones y renuevos abundantes

LUGAR Bosque Cambalache

COMENTARIOS corteza estropeada durante el huracán pero cicatrizando rápidamente, crecimiento lento debido a la aglomeración

ORIGEN DE INFORMACION FMR Study 1398 Cm, Tropical Forest Research Center, Box 577, Rio Piedras, P. R.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Seco

PAIS St. Lucia PLANTACION 196

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 14 | 15 | 18 |

SITIO

LAT. 14°N LONG. 65°O ELEV. 151

PRECIPITACION 1500 MESES DE SEQUIA Enero-Mayo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arenoso DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA inclinación empinada ASPECTO O

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION limpiar pastos FECHA 1946

ESPACIAMIENTO 1.8 x 1.8 AREA 1.5

MATERIAL tocones HERRAMIENTAS barra

SUPERVIVENCIA 85% al año

CUIDO limpieza anual por 2 años; aclareo ligero cada 4 años

REPRODUCCION semillas abundantes

LUGAR detrás del Edificio del Gobierno, Castries

ORIGEN DE INFORMACION W. G. Lang, Forest Supervisor, St. Lucia, B.W.I.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Seco

PAIS Guatemala PLANTACION 197

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 28 | 22 | 536 | 22 | |

SITIO

LAT. 15°N LONG. 89°O ELEV. 33

PRECIPITACION 1830 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO franco limoso PROFUNDIDAD 8 cm

TEXTURA DEL SUBSUELO franco limoso PROFUNDIDAD 2+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivado con guineos

ORIGEN DE SEMILLAS Honduras - Trinidad - Burma

SIEMBRA

PREPARACION cortar maleza con machete FECHA 1951

ESPACIAMIENTO 3 x 6 AREA 5 MATERIAL tocones

HERRAMIENTAS pala SUPERVIVENCIA 95% a los 9 años

CUIDO 3 limpiezas durante 4 años

REPRODUCCION semillas abundantes

LUGAR Hulera Bobos West 1951, Km 9.5 al E de Bananera

COMENTARIOS alto nivel freático provee agua en abundancia

ORIGEN DE INFORMACION P. J. Shank, United Fruit Co., La Lima, Honduras

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras PLANTACION 49

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA: VOL. |
| 10 | 26 | 22 | 605 | 32 |

SITIO

LAT. 15°3'N LONG. 87°58'O ELEV. 35

PRECIPITACION 1778 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 50 cm

TEXTURA DEL SUBSUELO arcilloso liviano PROFUNDIDAD 1

REACCION 5.5 DRENAJE libre, una porción impedida

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 2% inclinación ASPECTO NE

CONDICION ANTES DE LA SIEMBRA cultivado por 5 años

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION cultivado para maíz FECHA 1946

ESPACIAMIENTO 3 x 3 AREA 31 MATERIAL tocones

HERRAMIENTAS barra, pala & machete

SUPERVIVENCIA 75% a los 2 años

CUIDO limpieza cada 4 meses durante 2 años; aclareo a los 5 y 10 años; poda a los 2 y 6 años

REPRODUCCION semillas abundantes

LUGAR Plantación Amapa, 107 km al S de Puerto Cortez

ORIGEN DE INFORMACION P. J. Shank, Tela Railroad Co., Progreso, Hond.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras PLANTACION 50

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 15 | 36 | 21 | 188 | 19 | |

SITIO

LAT. 15°28'N LONG. 87°54'O ELEV. 29

PRECIPITACION 1750 MESES DE SEQUIA Marzo-Mayo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO franco limoso PROFUNDIDAD 50 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 6

REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION cultivo FECHA 1943

ESPACIAMIENTO 5 x 5 AREA 1.7

MATERIAL de vivero en potes HERRAMIENTAS barra, pala y machete

SUPERVIVENCIA 57% a los 15 años

CUIDO limpiezas a intervalos de 4 meses por 2 años; aclareos a los 5 y 10 años; podas a los 2 y 6 años

REPRODUCCION flores y semillas abundantes

LUGAR Plantación Zapote

ORIGEN DE INFORMACION P. J. Shank, Tela Railroad Co., Progreso, Hond.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras PLANTACION 198

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 26 | 28 | 605 | 32 | |

SITIO

LAT. 15°N LONG. 88°O ELEV. 35

PRECIPITACION 1778 MESES DE SEQUIA Marzo-Junio

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza & lava SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 50 cm

TEXTURA DEL SUBSUELO arcilloso liviano PROFUNDIDAD 1

REACCION 5.5 DRENAJE libre

ESTADO DEL SUELO poco afectado

CONDICION ANTES DE LA SIEMBRA cultivado durante 5 años

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION tumba, quema y siembra de maíz por 1 año

FECHA 1949 ESPACIAMIENTO 3 x 3 AREA 31

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS barra, pala y machete

SUPERVIVENCIA 80% a los 8 meses; 75% a los 2 años

CUIDO limpieza 3 meses despues de la siembra y cada 4 meses hasta los 2 años; aclareos a los 5 y 10 años; poda a los 2 y 6 años

REPRODUCCION semillas abundantes

LUGAR Botones Camp, Amapa, a 50 km al S de La Lima

COMENTARIOS Planes de experimentos y estudios de rendimiento para determinar los productos mas valiosos a obtenerse de estos árboles

ORIGEN DE INFORMACION P. J. Shank, United Fruit Co., La Lima, Hond.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras PLANTACION 199

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 4 | 22 | 15 | | | |
| 12 | 30 | 21 | 380 | | |

RENDIMIENTO 7 años - postes

SITIO

LAT. 15°N LONG. 88°O ELEV. 200

PRECIPITACION 1800 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza & volcánica SUELO aluvial

TEXTURA DEL SUELO arcilloso liviano PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1

REACCION 8.0 DRENAJE libre TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION tumba y quema FECHA 1948

ESPACIAMIENTO 4.5 x 4.5 MATERIAL tocones

SUPERVIVENCIA 98% al año; 80% a los 12 años

CUIDO 2 limpiezas en 2 años; 2 aclareos de árboles mal formados; 3 podas

REPRODUCCION semillas abundantes

LUGAR Botones Camp, Amapa, 50 km al S de La Lima

COMENTARIOS nivel freático suficientemente alto para mantener crecimiento durante temporada de sequía

ORIGEN DE INFORMACION P. J. Shank, United Fruit Co., La Lima, Hond.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Seco

PAIS Honduras PLANTACION 200

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 20 | 15 | 480 | | |

SITIO

LAT. 15°N LONG. 88°O ELEV. 200

PRECIPITACION 1800 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE caliza & volcánica SUELO aluvial

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION tumba y quema FECHA 1953

ESPACIAMIENTO 4.5 x 4.5 AREA 40

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 95% a los 7 años

CUIDO 2 limpiezas hasta el 1959; 2 podas

REPRODUCCION semillas abundantes

LUGAR Amapa, Botones Camp, a 50 km al S de La Lima

ORIGEN DE INFORMACION P. J. Shank, United Fruit Co., La Lima, Hond.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Tropical Seco

PAIS Panamá PLANTACION 201

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 25 | 24 | 18 | 2900 | 21 | |

SITIO

LAT. 9°N LONG. 79°O ELEV. 110

PRECIPITACION 1650 MESES DE SEQUIA Enero-Marzo

TEMPERATURA PROMEDIO 25° HELADAS ninguna

ROCA MADRE basalto SUELO residual

TEXTURA DEL SUELO arcilloso pesado PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO arcilloso rocoso pesado

PROFUNDIDAD 75 cm REACCION 5.5 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 20% inclinación ASPECTO E

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Ceylon (1926)

SIEMBRA

PREPARACION cortar yerba FECHA 1935

ESPACIAMIENTO 1.8 x 1.8 AREA 0.7

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 90% a los 2 años

CUIDO 2 limpiezas el primer año; aclareo a los 6 años

REPRODUCCION semillas abundantes

LUGAR Huerto de Mangos, a 5 km al N de Balboa, Canal Zone

COMENTARIOS La plantación necesita aclareo. Varios cientos de libras de semillas han sido distribuídos en la América Latina de esta fuente.

ORIGEN DE INFORMACION Walter Lindsey, Summit Garden, Canal Zone, Panamá

ESPECIE Eucalyptus saligna

GRUPO ECOLOGICO Tropical Seco

PAIS Cuba PLANTACION 243

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 5 | 12 | 20 |

SITIO

LAT. 22°15'N LONG. 84°0 ELEV. 150

PRECIPITACION 1800 MESES DE SEQUIA 4

TEMPERATURA PROMEDIO 25° ROCA MADRE serpentina

SUELO aluvial TEXTURA DEL SUELO franco arenoso

TOPOGRAFIA plana CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación en Pinar del Río; 22°10'N, 83°50'0; 100 m; 1600 mm

SIEMBRA

PREPARACION limpieza FECHA 1949

ESPACIAMIENTO 1.8 x 2.4 AREA 20

MATERIAL de vivero en potes, 40 cm

CUIDO limpieza solamente

LUGAR 200 km al O de Habana, Matahambre

COMENTARIOS Especie prometedora, tamaño máximo de 32 cm x 29 m a los 7 años.

ORIGEN DE INFORMACION Gerardo Budowski, Depto. Recursos Renovables, IICA, Turrialba, C. R.

SPECIES Eucalyptus saligna

ECOLOGICAL GROUP Tropical Dry

COUNTRY Cuba PLANTATION 243

GROWTH

DOMINANTS & CODOMINANTS

| AGE | DBH cm | HEIGHT m |
|---|---|---|
| 5 | 12 | 20 |

SITE

LAT. 22°15' N LONG. 84°W ELEV. 150

ANNUAL RAINFALL 1800 DRY MONTHS 4

AV. TEMPERATURE 25° PARENT ROCK serpentine

SOIL alluvial TOPSOIL TEXTURE sandy loam

TOPOGRAPHY flat CONDITION AT PLANTING pasture

SEED ORIGIN plantation at Pinar del Río; 22°10'N, 83°50'W;
100 m; 1600 mm

PLANTING

PREPARATION cleaned DATE 1949

SPACING 1.8 x 2.4 AREA 20

STOCK potted nursery, 40 cm

CARE cleaned only

LOCATION 200 km W of Havana, Matahambre

COMMENTS promising species; maximum size 32 cm x 29 m at 7 years

SOURCE Gerardo Budowski, Depto. Recursos Renovables, IICA, Turrialba, C. R.

SPECIES Calophylla brasiliense

ECOLOGICAL GROUP Tropical Dry

COUNTRY Trinidad PLANTATION 343

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | | |
|---|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME | M.A.I. |
| 8 | 11 | 11 | 1349 | 10 | 36 | 5 |
| 14 | 15 | 16 | 823 | 12 | 70 | 7 |
| 25 | 24 | 20 | 311 | 11 | 82 | 7 |
| 34 | 33 | 22 | | 14 | | |

YIELD 6 $m^3$/HA - 8 yrs. 30 $m^3$/HA - 17 yrs.
12 " 11 " 35 " 25 "
13 " 14

SITE

LAT. 10°05' N LONG. 61°35' W ELEV. 35

ANNUAL RAINFALL 1651 DRY MONTHS January-May

PARENT ROCK volcanic SOIL residual

TOPSOIL TEXTURE fine sandy DEPTH 10 cm

SUBSOIL TEXTURE sandy DEPTH deep REACTION 5.5

DRAINAGE free SOIL STATE little disturbed

TOPOGRAPHY rolling - 10% upper slope ASPECT E

CONDITION AT PLANTING virgin forest

SEED ORIGIN natural stand, Trinidad

PLANTING
PREPARATION taungya DATE 1927 SPACING 2 x 2
AREA 1 STOCK nursery with ball of earth
TOOLS machete

CARE taungya, weeded at 6 mo. for 3 yrs; 3 thinnings - 3yrs.

REPRODUCTION flowers and seed abundant

LOCATION Sample Plot #3, Southern Watershed Reserve, Sub.Copt. 14, 1927 Coupe. Teak Conversion Working Circle, P.B.I. Trinidad

COMMENTS good form - scattered. At least one serious fire less than 10 yrs ago - some basal wounds.

SOURCE David Moore, Conservator of Forests, Trinidad

SPECIES Tectona grandis

ECOLOGICAL GROUP Tropical Dry

COUNTRY Trinidad PLANTATION 344

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | | |
|---|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOL. | M.A.I. |
| 25 | 27 | 24 | 311 | 14 | 112 | 10 |
| 39 | 35 | 26 | 188 | 14 | 122 | 6 |
| 48 | 42 | 27 | | | | |

YIELD 28 $m^3$/HA - 14 yrs. 28 $m^3$/HA - 30 yrs.
9 " 18 " 30 " 39 "
49 " 25 "

SITE

LAT. 10°05' N LONG. 61°35' W ELEV. 46

ANNUAL RAINFALL 1651 DRY MONTHS January - May

PARENT ROCK volcanic SOIL residual

TOPSOIL TEXTURE fine sandy loam DEPTH 30 cm

REACTION 6.0 DRAINAGE free

SOIL STATE little disturbed

TOPOGRAPHY sheltered, 20% ASPECT SW

CONDITION AT PLANTING selectively cut forest

SEED ORIGIN natural forest, Burma

PLANTING

PREPARATION cut forest DATE 1913
SPACING 3 x 3 AREA ~~0.2~~ 2.9
STOCK direct seeded TOOLS machete

CARE clean 3 yrs. - twice/yr. Three thinnings.

REPRODUCTION seed and flowers abundant

LOCATION Old plantation #7, Southern Watershed Reserve

COMMENTS Form fair. Merchantable 60% of total.
Not taungya - originally mixed plantation.

SOURCE David Moore, Conservator of Forests, Trinidad

SPECIES Tectona grandis

ECOLOGICAL GROUP Tropical Dry

COUNTRY Trinidad PLANTATION 345

GROWTH

| ALL TREES | | | STAND PER HECTARE | | | |
|---|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME | M.A.I. |
| 20 | 27 | 23 | 227 | 11 | 83 | 6 |
| DOMINANTS & CODOMINANTS | | | | | | |
| 21 | 30 | 24 | | 15 | | |

YIELD 4, 8, 15 yrs. - volume unknown 20 yrs. - 30 $m^3$/HA

SITE LAT. 10°08' N LONG. 16°22' W ELEV. 61

ANNUAL RAINFALL 1651 DRY MONTHS January - May

PARENT ROCK limestone SOIL residual

TOPSOIL TEXTURE heavy clay DEPTH 15 cm

REACTION 5.0 - 7 surface; 7-8 below DRAINAGE free

SOIL STATE little disturbed

TOPOGRAPHY protected, slope 10% ASPECT NW

CONDITION AT PLANTING selectively cut forest

SEED ORIGIN plantation - Trinidad

PLANTING
PREPARATION taungya DATE 1940
SPACING 1.8 x 1.8 AREA 120
STOCK direct seeded TOOLS machete

CARE weeded to 3 yrs. after taungya

REPRODUCTION seed, flowers and seedlings abundant

LOCATION 1940 Coupe, S.P. 141, Marac, Southern Watershed Reserve

COMMENTS Considered some of best in Trinidad, both ht. & diam. pH of soil (deeply cracked) variable - nearby pH 7.5 at surface and 6.0 at 15 cm. Underlain with calcareous sandstone.

SOURCE W. S. Chalmers, Forest Department, Port-of-Spain, Trinidad

SPECIES Pinus caribaea

ECOLOGICAL GROUP Tropical Dry

COUNTRY Trinidad PLANTATION 346

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 9 | 17 | 12 | | 14 | |

SITE

LAT. 10°08' N LONG. 61°42' W ELEV. 15

ANNUAL RAINFALL 1524 DRY MONTHS January-April

PARENT ROCK volcanic SOIL residual

TOPSOIL TEXTURE silty clay DEPTH 8

SUBSOIL TEXTURE yellow clay DEPTH deep

REACTION 4.0 - 5.0 DRAINAGE free

SOIL STATE severely degraded

TOPOGRAPHY rolling - slope 20% ASPECT SE

CONDITION AT PLANTING cultivated 2 yrs.

SEED ORIGIN natural stand - British Honduras

PLANTING

PREPARATION taungya DATE 1952

SPACING 2 x 3 AREA 0.4

STOCK nursery with ball of earth TOOLS machete

CARE two cleanings first yr., annually to 4th year.

REPRODUCTION flowers scarce

LOCATION Pine Plot beside Southern Main Road & Salazar Trail, Cap de Ville Forest Reserve

COMMENTS Form good, light branching. Spacing irregular due to low survival. One or more fires.

SOURCE A. F. A. Lamb, Silvicultural Advisor, B.W.I. Federation, Trinidad

ESPECIE Cedrela mexicana

GRUPO ECOLOGICO Tropical Muy Seco

PAIS Mexico PLANTACION 202

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 8 | 6 | | | 20 |

SITIO

LAT. 21°30'N LONG. 89°0 ELEV. 5

PRECIPITACION 900

MESES DE SEQUIA Julio-Agosto, Febrero-Abril

TEMPERATURA PROMEDIO 28° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO franco arcilloso arenoso

PROFUNDIDAD 5 cm TEXTURA DEL SUBSUELO rocoso

PROFUNDIDAD bolsillos REACCION 8.0

DRENAJE muy libre ESTADO DEL SUELO severamente degradado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Buctzotz Yucatán 30 km SE

SIEMBRA

PREPARACION vivero FECHA 1948 ESPACIAMIENTO 1 x 1

AREA 80 árboles MATERIAL semillas

SUPERVIVENCIA 50% a los 12 años

CUIDO plantas que quedaron creciendo en el vivero abandonado; se regaron durante el primer año

REPRODUCCION semillones abundantes

LUGAR Finca Santa Tereza, Dzilam Bravo, Yucatán

COMENTARIOS condiciones de crecimiento muy adversas

ORIGEN DE INFORMACION Dean Chandler, Maderas Laminadas, S.A., Mérida, Yucatán, Mex.

ESPECIE Prosopis inermis

GRUPO ECOLOGICO Tropical Muy Seco

PAIS Ecuador PLANTACION 203

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 16 | 8 | (148) | 4 | |

SITIO

LAT. 3°S LONG. 80°O ELEV. 50

PRECIPITACION 800 MESES DE SEQUIA Mayo & Diciembre

TEMPERATURA PROMEDIO 26° HELADAS ninguna

ROCA MADRE pizarra SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 4 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

TOPOGRAFIA 5% inclinación ASPECTO N

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS local

SIEMBRA

FECHA 1949 ESPACIAMIENTO 8 x 8 AREA 2

MATERIAL arbolitos silvestres a raíz desnuda

HERRAMIENTAS pala SUPERVIVENCIA 95% a los 10 años

CUIDO 2 limpiezas el primer año

REPRODUCCION semillas abundantes

LUGAR Hacienda Fernando, 41 km al NO de Guayaquil

COMENTARIOS árboles sembrados para alimento de reses

ORIGEN DE INFORMACION José Ubilla, Subdirector de Agricultura y Bosques, Ministerio de Fomento, Guayaquil, Ec.

ESPECIE Swietenia mahagoni

GRUPO ECOLOGICO Tropical Muy Seco

PAIS Puerto Rico PLANTACION 56

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 20 | 14 | | 1111 | 22 | |
| 25 | 16 | | | | |

SITIO

LAT. 17°55'N LONG. 66°53'O ELEV. 60

PRECIPITACION 770

MESES DE SEQUIA 2 meses solamente con más de 0.10

TEMPERATURA PROMEDIO 24° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO franco arcilloso suelto PROFUNDIDAD 15cm

TEXTURA DEL SUBSUELO arcilloso pedregoso PROFUNDIDAD 1+

REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinación baja, 10% ASPECTO E

CONDICION ANTES DE LA SIEMBRA pasto y maleza

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION abrir calles entre pastos y maleza FECHA 1931

ESPACIAMIENTO 1.8 x 3.6 AREA 2 MATERIAL vivero

SUPERVIVENCIA 60% a los 28 años

CUIDO muchas limpiezas, 1 poda antes de los 10 años

REPRODUCCION arbolillos abundantes

LUGAR Parcela L, Bosque de Guánica del Estado Libre Asociado de P. R.

COMENTARIOS Lugar muy adverso; empezó a producir fruto como a los 20 años

ORIGEN DE INFORMACION FMR Study 1942 Gn, Tropical Forest Research Center, Box 577, Río Piedras, P. R.

ESPECIE Hibiscus elatus

GRUPO ECOLOGICO Subtropical Pluvial

PAIS Jamaica PLANTACION 109

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 24 | 14 | 1679 | | |
| 15 | 30 | 18 | | | |

RENDIMIENTO 8 años - postes; 15 años - cuartones

SITIO

LAT. 18°N LONG. 77°O ELEV. 1150

PRECIPITACION 5080

MESES DE SEQUIA Enero-Abril, Julio-Septiembre (?)

TEMPERATURA PROMEDIO 20° HELADAS ninguna

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 60 cm

REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA laderas empinadas ASPECTO N

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Jamaica, Elev. 1000 m, Precipitación 3810 mm

SIEMBRA

PREPARACION abrir calles FECHA 1944

ESPACIAMIENTO 2.5 x 2.5 AREA 40

MATERIAL de vivero a raíz desnuda, 76 cm

SUPERVIVENCIA 80% a los 5 años

CUIDO desyerbo circular dos veces el primer año; aclareo al año y a los 9 años

REPRODUCCION semillas abundantes, semillones escasos

LUGAR Greenhills, Jamaica

COMENTARIOS plantación prometedora, suelo ha sido protegido por bosque secundario

ORIGEN DE INFORMACION Conservator of Forests, Box 472, Kingston, Jamaica

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Subtropical Pluvial

PAIS Jamaica PLANTACION 1

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 15 | 10 | 1679 | | |

RENDIMIENTO postes a los 10 años

SITIO

LAT. 18°N LONG. 77°O ELEV. 600

PRECIPITACION 5000 MESES DE SEQUIA Enero-Abril, Julio-Agto.(?)

TEMPERATURA PROMEDIO 22° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso duro PROFUNDIDAD 46 cm

REACCION 5.0 DRENAJE impedido

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA montañosa, levemente inclinada ASPECTO S

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Honduras Británica, Elev. 300 m, Precipitación 4000 mm, Lat. 15°N

SIEMBRA

PREPARACION desmonte completo FECHA 1950

ESPACIAMIENTO 2.5 x 2.5 AREA 40

MATERIAL de vivero a raíz desnuda 1m

SUPERVIVENCIA 95% a los 3 meses, 90% a los 8 años

CUIDO 2 desyerbos durante 3 años; aclareo a los 10 años

LUGAR no especificado

COMENTARIOS especie prometedora, de crecimiento rápido y adaptada a varios sitios

ORIGEN DE INFORMACION Conservator of Forests, Box 472, Kingston, Jamaica

ESPECIE Acacia decurrens

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Colombia PLANTACION 58

CRECIMIENTO
DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 6 | 12 | 12 |

SITIO
LAT. 5°4'N LONG. 75°32'O ELEV. 2700

PRECIPITACION 2200 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 13° HELADAS ninguna

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 48 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 5.6 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 30% inclinación

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS plantación local

SIEMBRA
PREPARACION limpieza FECHA 1953

ESPACIAMIENTO 2 x 3 AREA 3

MATERIAL de vivero a raíz desnuda, 30-40 cm

HERRAMIENTAS azada SUPERVIVENCIA 94% a los 2 años

CUIDO limpieza; poda cada 2 años

REPRODUCCION semillones escasos

LUGAR Manizales, Col.

ORIGEN DE INFORMACION C. Gomez, Supervisor Forestal, Empresas Municipales, Manizales, Col.

ESPECIE Agathis australis

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Puerto Rico PLANTACION 204

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 10 | 10 | |
| 23 | 26 | |

SITIO

LAT. 18°10'N LONG. 67°0 ELEV. 630

PRECIPITACION 2667 MESES DE SEQUIA Diciembre-Febrero

TEMPERATURA PROMEDIO 21° HELADAS ninguna

ROCA MADRE serpentina SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 1 cm

TEXTURA DEL SUBSUELO arcilloso REACCION ácida

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinación ASPECTO S

ORIGEN DE SEMILLAS Australia

SIEMBRA

PREPARACION desmonte FECHA 1940

ESPACIAMIENTO irregular AREA esparcidos

REPRODUCCION semillas escasas

LUGAR Bosque Insular de Maricao, División de Bosques, P. R.

COMENTARIOS Sitio muy pobre con informes sobre fracaso de muchas especies

ORIGEN DE INFORMACION FMR Study 2383-06, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Alnus ferruginea

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Colombia PLANTACION 59

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 13 | 12 | | 8 | |
| 16 | 29 | 17 | | 39 | |

SITIO

LAT. 5°4'N LONG. 75°33'O ELEV. 2820

PRECIPITACION 2200 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 14° HELADAS ninguna

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 48 cm

TEXTURA DEL SUBSUELO arenoso lómico PROFUNDIDAD 2+

REACCION 5.6 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA accidentada, 20-100% inclinación

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION limpiar con machete FECHA 1943

ESPACIAMIENTO 4 x 4 AREA 5

MATERIAL arbolitos silvestres a raíz desnuda, 40-50 cm

HERRAMIENTAS azada SUPERVIVENCIA 98% a los 3 años

CUIDO limpieza anual; poda con tijeras y serrucho cada 2 años hasta los 7 años

LUGAR Lote Pinares y Las Delicias, a 12 km de la cuenca hidrográfica de Nizales del Acueducto de Manizales

ORIGEN DE INFORMACION Conrado Gómez, Director of Reforestation, Empresas Municipales, Administración Delegada, Manizales, Colombia

ESPECIE Alnus jorullensis

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Costa Rica PLANTACION 205

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 12 | 40 | 30 |

RENDIMIENTO postes, 8 años

SITIO

LAT. 10°N LONG. 84°O ELEV. 1550

PRECIPITACION 3090 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 15° HELADAS ninguna

ROCA MADRE volcánica SUELO coluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 10% inclinación ASPECTO S

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS local

SIEMBRA

FECHA 1948 ESPACIAMIENTO 6 x 6 AREA 0.2

MATERIAL arbolitos silvestres a raíz desnuda

HERRAMIENTAS pala

SUPERVIVENCIA 50% a los 12 años

CUIDO mantenido para pastoreo, aclareo de 50% del original

REPRODUCCION semillas abundantes

LUGAR Finca Luise Uribe, 10 km al N. de San José

ORIGEN DE INFORMACION Carlos Lizano, Sec. Forestal, Depto. Bosques, Min. de Agric. e Industrias, San José, Costa Rica

ESPECIE Alnus jorullensis

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Costa Rica PLANTACION 206

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 18 | | | | |
| 8 | 29 | | | | |
| 10 | 32 | 18 | 202 | 19 | |

SITIO

LAT. 10°N LONG. 84°O ELEV. 1550

PRECIPITACION 3097 MESES DE SEQUIA ninguno menos de 21 mm

TEMPERATURA PROMEDIO 15° HELADAS ninguna

ROCA MADRE lava SUELO coluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 5% inclinación ASPECTO O

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS local

SIEMBRA

ESPACIAMIENTO 7 x 7 MATERIAL arbolitos silvestres a raíz desnuda

SUPERVIVENCIA (99% a los 10 años)

CUIDO mantenido para pastos

LOCAL Lote Volito

COMENTARIOS Se sembró yerba para pastoreo, usada para cajas

ORIGEN DE INFORMACION Carlos Lizano, Sec. Forestal, Depto. Bosques, Ministerio de Agric. e Industrias, San José, Costa Rica

ESPECIE Anacardium excelsum

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Costa Rica PLANTACION 81

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 10 | 12 | (1575) | | |

SITIO

LAT. 9°56'N LONG. 83°65'O ELEV. 610

PRECIPITACION 2639 MESES DE SEQUIA 2

TEMPERATURA PROMEDIO 23° HELADAS ninguna

SUELO residual TEXTURAL DEL SUELO arcilloso suelto

REACCION 6.0 DRENAJE libre

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION desconocida FECHA 1949

ESPACIAMIENTO 2 x 2 AREA 0.02

SUPERVIVENCIA 63% a los 10 años

CUIDO 1 limpieza anual; poda

LUGAR Turrialba, Costa Rica

ORIGEN DE INFORMACION G. Budowski, Interamerican Institute of Agricultural Sciences, Turrialba, Costa Rica

ESPECIE Bombacopsis quinatum

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Costa Rica PLANTACION 82

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 13 | 10 | 50 | (400) | | |

SITIO

LAT. 9°56'N LONG. 83°65'O ELEV. 590

PRECIPITACION 2639 MESES DE SEQUIA 2

TEMPERATURA PROMEDIO 23° SUELO aluvial

TEXTURA DEL SUELO franco arcilloso REACCION 6.0

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA plana CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS local

SIEMBRA

FECHA 1946 ESPACIAMIENTO 5 x 5 AREA 0.1

MATERIAL de vivero SUPERVIVENCIA 100% a los 13 años

CUIDO limpieza anual; 3 podas durante los últimos 6 años

REPRODUCCION flores escasas

LUGAR Pochote, El Chino, 70 km al O de San José, por carretera

COMENTARIOS Debido al amplio espaciamiento la forma es mala. Las ramas gruesas fueron podadas y cicatrizaron muy bien.

ORIGEN DE INFORMACION Gerardo Budowski, IICA, Turrialba, Costa Rica

ESPECIE Calophyllum brasiliense

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Puerto Rico PLANTACION 83

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD : | DAP cm : | ALTURA m | NUM.ARBOLES: | AREA BASIMETRICA: | VOL. |
| 22 | 15 | 15 | 922 | 20 | |

SITIO

LAT. 18°20'N LONG. 64°50'O ELEV. 450

PRECIPITACION 3048 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 23° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO arcilloso pesado PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 5.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 20% inclinación ASPECTO N

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Bosque natural, costa norte de Puerto Rico, al nivel del mar, 1500 mm precipitación

SIEMBRA

PREPARACION cultivado FECHA 1937

ESPACIAMIENTO 2.5 x 2.5 AREA 20 MATERIAL semillas

CUIDO limpieza durante los primeros 3 años; aclareo a los 17 años de 22m$^2$/HA área basimétrica o de 1800 árboles/HA a 1158 árboles/HA

REPRODUCCION arbolillos abundantes

LUGAR Km 9.5 Carretera Cienaga Alta, Bosque Experimental de Luquillo, Puerto Rico

ORIGEN DE INFORMACION FMR Study 2065L, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Calophyllum brasiliense

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Puerto Rico PLANTACION 84

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 25 | 14 | 17 | 1296 | 21 | 315 |
| 33 | 23 | 21 | 1000 | 21 | |

RENDIMIENTO $175 m^3$/HA para carbón a los 25 años

SITIO

LAT. 18°10'N LONG. 67°0 ELEV. 630

PRECIPITACION 2667 MESES DE SEQUIA Diciembre-Febrero

TEMPERATURA PROMEDIO 21° HELADAS ninguna

ROCA MADRE serpentina SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 15% inclinación ASPECTO S

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Costa N de Puerto Rico

SIEMBRA

PREPARACION limpiar calles a traves de pastos y malezas

FECHA 1924 ESPACIAMIENTO irregular AREA 2

MATERIAL semillas

CUIDO limpieza con machete hasta despejarla; a los 20 años aclareo desde abajo de $42 m^2$/HA hasta $24 m^2$/HA área basimétrica; a los 25 años aclareo desde abajo de $44 m^2$/HA a $21 m^2$/HA área basimétrica; 33 años aclareo desde abajo de $25 m^2$/HA a $22 m^2$/HA área basimétrica

REPRODUCCION arbolillos abundantes

COMENTARIOS el número de árboles indicado bajo el Area Basimétrica se figuró despues de los aclareos

ORIGEN DE INFORMACION FMR Study 2307 MR, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Cedrela odorata

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Jamaica PLANTACION 5

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 8 | | 300 | | |

SITIO

LAT. 18°N LONG. 77°O ELEV. 450 - 750

PRECIPITACION 2540 MESES DE SEQUIA Enero-Abril, Agto.-Sept.

TEMPERATURA PROMEDIO 22° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso liviano PROFUNDIDAD 30cm

TEXTURA DEL SUBSUELO medianamente arcilloso

PROFUNDIDAD 55 REACCION 4.5-6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA montañosa, 15% inclinación

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Jamaica, bosque natural, varios sitios, Elev. 300-500 m, Precipitación 1800-2500 mm

SIEMBRA

PREPARACION limpiar calles 6 m ancho FECHA 1952-1955

ESPACIAMIENTO 2.5m en calles AREA 500

MATERIAL de vivero a raíz desnuda ±1 m

SUPERVIVENCIA 90% a los 3 meses, 80% a los 5 años

CUIDO entresaque de árboles de sombra según era necesario

REPRODUCCION ninguna

COMENTARIOS difícil de producir en plantaciones, susceptible al ataque del taladrador del tallo Hypsipyla grandella

ORIGEN DE INFORMACION Conservator of Forests, Box 472, Kingston, Jamaica

ESPECIE Cupressus lindleyi

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS El Salvador PLANTACION 64

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 38 | 33 | 30 | 700 | | 549 |

SITIO

LAT. 14°N LONG. 89°O ELEV. 1400

PRECIPITACION 2001 MESES DE SEQUIA 6

TEMPERATURA PROMEDIO 17° HELADAS ninguna

ROCA MADRE volcanica SUELO residual

TEXTURA DEL SUELO arenoso

TEXTURA DEL SUBSUELO rocoso DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 40% inclinación ASPECTO N

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION limpieza FECHA 1920

ESPACIAMIENTO 3.3 x 3.3 AREA 15

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 80% a los 38 años

CUIDO 3 limpiezas anuales por 3 años; poda a los 15 y 25 años

REPRODUCCION semillas abundantes

LUGAR a 75 km de San Salvador. Selva Negra, Antonio Reyes, dueño

COMENTARIOS Transición a Bosque Subtropical Húmedo. Crecimiento estimado de $14.4 m^3$/HA por año

ORIGEN DE INFORMACION T. F. Burgers, (FAO), Casa Clark, 7a Calle de Oriente No. 12, San Salvador, El Salvador

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Puerto Rico PLANTACION 85

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 9 | 6 | 1500 | | |

SITIO

LAT. 18°10'N LONG. 66°30'O ELEV. 750

PRECIPITACION 2210

MESES DE SEQUIA ninguno menos de 10 mm

TEMPERATURA PROMEDIO 21° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO arcilloso limoso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 2

REACCION 4.5 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA loma baja, 30% inclinación ASPECTO SO

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS montañas de Guatemala, Lat. 14°50'N, Long. 91°O

SIEMBRA

PREPARACION limpieza con machete por partes FECHA 1952

ESPACIAMIENTO 2.5 x 2.5 AREA 0.1

MATERIAL de vivero a raíz desnuda, 46 cm

HERRAMIENTAS zapapico SUPERVIVENCIA 94% a los 8 años

CUIDO 2 desyerbos anuales por 2 años; poda hasta 2 m a los 5 años

REPRODUCCION flores, semillas, semillones abundantes

LUGAR lado E del Lago Matrullas, Bosque de Toro Negro

COMENTARIOS menos árboles caídos que en 7 - 13

ORIGEN DE INFORMACION FMR Study 1584T, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Puerto Rico PLANTACION 86

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 17 | 15 | 1000 | | |

SITIO

LAT. 18°10'N LONG. 66°30'O ELEV. 750

PRECIPITACION 2210

MESES DE SEQUIA ninguno menos de 10 mm

TEMPERATURA PROMEDIO 21° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO arcilloso limoso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 2

REACCION 5.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA ladera baja, 30% ASPECTO NO

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Montañas de Guatemala, Lat. 14°50'N, Long. 91°O

SIEMBRA

PREPARACION limpieza por partes con machete FECHA 1952
ESPACIAMIENTO 2.5 x 2.5 AREA 0.1
MATERIAL de vivero a raíz desnuda, 46 cm
HERRAMIENTAS zapapico SUPERVIVENCIA 62% a los 8 años

CUIDO 2 desyerbos anuales por 2 años; poda hasta 2 m a los 5 años

REPRODUCCION semillones abundantes

LUGAR Lado E del Lago Matrullas, Bosque de Toro Negro

COMENTARIOS Perjudicado severamente por el viento a los 4.5 años; árboles sostenidos con estacas pero 90% inclinados ahora y algunos caídos. Copas densas y persistentes, no se forma hojarasca

ORIGEN DE INFORMACION FMR Study 1584T, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Puerto Rico PLANTACION 87

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 20 | 15 | 963 | 29 | |

SITIO

LAT. 18°07'N LONG. 66°35'O ELEV. 1000

PRECIPITACION 2525 MESES DE SEQUIA ninguno menos de 10mm

TEMPERATURA PROMEDIO 20° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 2+cm

TEXTURA DEL SUBSUELO franco arcilloso pedregoso

PROFUNDIDAD 1+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 50% inclinada ASPECTO SE

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Montañas de Guatemala, Lat. 14°30'N, Long. 91°O

SIEMBRA

PREPARACION limpiar maleza cerca de la plantación

FECHA 1949 ESPACIAMIENTO 2.5 x 2.5 AREA 1

MATERIAL de vivero HERRAMIENTAS zapapico

SUPERVIVENCIA 60% a los 10 años

CUIDO copas liberadas dos veces al año durante 2 años

REPRODUCCION semillas abundantes, semillones escasos

LUGAR Bosque de Toro Negro, 1/2 milla al S del Pico Maravilla

COMENTARIOS 5% de árboles caídos, 20% inclinados; poda natural lenta

ORIGEN DE INFORMACION FMR Study 2027T, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Puerto Rico PLANTACION 88

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 8 | 4 | 2390 | | |

RENDIMIENTO ninguno

SITIO

LAT. 18°10'N LONG. 67°0 ELEV. 650

PRECIPITACION 2667 MESES DE SEQUIA Dic.-Feb.

TEMPERATURA PROMEDIO 21° HELADAS ninguna

ROCA MADRE serpentina SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado TOPOGRAFIA llana

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS montañas de Guatemala, Lat. 14°50'N, Long. 91°0

SIEMBRA

PREPARACION cortar fajas a través de pastos FECHA 1951

ESPACIAMIENTO 1.8 x 1.8 AREA 0.8

MATERIAL de vivero en potes, 30 - 46 cm

HERRAMIENTAS zapapico SUPERVIVENCIA 86% a los 2 años; 80% a los 7 años; claros resembrados en 1953

CUIDO liberar copas de malezas, competidores arrancados a los 7 años

REPRODUCCION semillas escasas

LUGAR Bosque de Maricao, a lo largo del Camino Rosario

COMENTARIOS Copas ralas para esta especie, follaje interior de las ramas se torna color castaño antes de tiempo para esta especie

ORIGEN DE INFORMACION FMR Study 1749 Mr, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Costa Rica PLANTACION 107

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 21 | | | 810 | 29 | 1550 |

SITIO

LAT. 9°24'N LONG. 83°45'O ELEV. 740

PRECIPITACION 2100 MESES DE SEQUIA Enero-Febrero

TEMPERATURA PROMEDIO 22° HELADAS ninguna

ROCA MADRE sedimentaria SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 0-50 cm

REACCION 7.1 DRENAJE libre

TOPOGRAFIA 25% inclinación

CONDICION ANTES DE LA SIEMBRA pastos

SIEMBRA

Fecha 1933 ? ESPACIAMIENTO 2 x 8 AREA 0.1

LUGAR Lote 18, San Ramón, San Isidro del General

ORIGEN DE INFORMACION C. L. Lizano, Jefe, Sección Forestal, Dpto. Tierras y Bosques, Ministerio de Agricultura e Industria, San José, C. R.

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Costa Rica PLANTACION 102

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 20 | | | 2153 | | |
| 23 | | | 1857 | | |

SITIO

LAT. 10°5'N LONG. 84°7'O ELEV. 1900

PRECIPITACION 2380 MESES DE SEQUIA Diciembre-Marzo

TEMPERATURA PROMEDIO 20° HELADAS ninguna

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 0-93 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

TOPOGRAFIA ondulada, 28% inclinación

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS local

SIEMBRA

FECHA 1931 ? ESPACIAMIENTO 2 x 2 AREA 0.1

CUIDO ni aclareos ni podas

LUGAR Finca Esmeraldas, 36 km al NE de San José

COMENTARIOS Lote Testigo, parte de una plantación de 3 HA

ORIGEN DE INFORMACION C. L. Lizano, Jefe, Sección Forestal, Dpto. Tierras y Bosques, Ministerio de Agricultura e Industrias, San José, C. R.

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Costa Rica PLANTACION 103

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 20 | 18 | | 1561 | 54 | |
| 26 | 25 | 18 | 1236 | 61 | |

SITIO

LAT. 10°N LONG. 84°O ELEV. 1890

PRECIPITACION 2380 MESES DE SEQUIA Diciembre-Marzo

TEMPERATURA PROMEDIO 20° HELADAS ninguna

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 93 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

TOPOGRAFIA 28% inclinación

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS local

SIEMBRA

FECHA 1931 ESPACIAMIENTO 2 x 2 AREA 3

SUPERVIVENCIA (86% a los 20 años)

CUIDO aclareo a los 20 años de 2156 árboles a 1561 árboles/HA; a los 24 años de 1561 árboles a 1236 árboles/HA.

LUGAR Lote 5, Finca Esmeraldas, 36 km al NE de San José

COMENTARIOS (Los diámetros indicados en la sección de CRECIMIENTO, arriba, son los promedios de todas las clases de los árboles)

ORIGEN DE INFORMACION C. L. Lizano, Jefe, Sección Forestal, Dpto. Tierras y Bosques, Ministerio de Agricultura e Industria, San José, C. R.

ESPECIE Cupressus macrocarpa

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Colombia PLANTACION 60

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 6 | 10 | 7 |

SITIO

LAT. 5°4'N LONG. 75°32'O ELEV. 2700

PRECIPITACION 2200 MESES DE SEQUIA Dic.-Abril

TEMPERATURA PROMEDIO 13° HELADAS ninguna

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 40cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 5.6 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 30+% inclinación

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Bogotá; 2600 m, 2000 mm

SIEMBRA

PREPARACION limpieza FECHA 1953

ESPACIAMIENTO 2 x 4 AREA 5

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS azada SUPERVIVENCIA 80% al mes

CUIDO limpieza cada 6 meses; poda de una tercera parte del follaje vivo cada año hasta los 6 años

LUGAR Lote 4, Las Palomas, 11 km al NE de Manizales

ORIGEN DE INFORMACION C. Gomez, Supervisor Forestal, Empresas Municipales, Administración Delegada, Manizales, Col.

ESPECIE Dalbergia cubilquitzensis

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Costa Rica PLANTACION 89

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 12 | 10 | (1550) | | |

SITIO

LAT. 9°56'N LONG. 83°55'O ELEV. 610

PRECIPITACION 2639 MESES DE SEQUIA 2

TEMPERATURA PROMEDIO 23° HELADAS ninguna

SUELO residual TEXTURA DEL SUELO franco arcilloso

REACCION 6.0 DRENAJE libre

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS desconocido

SIEMBRA

FECHA 1949 ? ESPACIAMIENTO 2 x 2 AREA 0.02

MATERIAL de vivero SUPERVIVENCIA 70% a los 10 años

CUIDO limpieza anualmente

REPRODUCCION semillas abundantes

LUGAR La Isla, Turrialba, C. R.

COMENTARIOS 4 hileras, de forma mala; otras plantaciones con las mismas semillas tienen mejor forma

ORIGEN DE INFORMACION G. Budowski, Inter-American Institute of Agricultural Sciences, Turrialba, C. R.

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Haiti PLANTACION 90

CRECIMIENTO
DOMINANTES & CODOMINANTES

| EDAD : | DAP cm : | ALTURA m |
|---|---|---|
| 21 | 50 | 20 |

SITIO
LAT. 18°24'N LONG. 72°20'0 ELEV. 1500

PRECIPITACION 2221 MESES DE SEQUIA Diciembre-Marzo

TEMPERATURA PROMEDIO 18° ROCA MADRE caliza

SUELO residual TEXTURA DEL SUELO franco arenoso

PROFUNDIDAD 60 cm TEXTURA DEL SUBSUELO arenoso

PROFUNDIDAD 30 cm REACCION 6.2

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 20% inclinación

SIEMBRA
FECHA 1938 ESPACIAMIENTO 2 x 2

REPRODUCCION ninguna

LUGAR Chapelle de Furcy School

ORIGEN DE INFORMACION E. F. Toussaint, Forest Service,

Dept. of Agri., Port au Prince, Haiti

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Haiti PLANTACION 91

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 21 | 39 | 14 |

SITIO

LAT. 18°24'N LONG. 72°20'O ELEV. 1500

PRECIPITACION 2221 MESES DE SEQUIA Dic.-Marzo

TEMPERATURA PROMEDIO 18° ROCA MADRE caliza

SUELO residual TOPOGRAFIA 20% inclinación

SIEMBRA

PREPARACION tumba y quema FECHA 1938

ESPACIAMIENTO 2 x 2 AREA 132 árboles

REPRODUCCION ninguna

LUGAR plantación de Mme. Ziegel

ORIGEN DE INFORMACION E. F. Toussaint, Forest Service, Dept. of Agri., Port au Prince, Haiti

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Costa Rica PLANTACION 207

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 30 | 46 | 46 | | | 55 |

SITIO

LAT. 10°N LONG. 84°30'O ELEV. 1700

PRECIPITACION 3000 MESES DE SEQUIA Enero-Febrero

TEMPERATURA PROMEDIO 15° HELADAS ninguna

ROCA MADRE lava SUELO coluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 5% inclinación ASPECTO E

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION desyerbo FECHA 1930

ESPACIAMIENTO 2 x 2 MATERIAL de vivero a raíz desnuda

CUIDO limpieza durante 4 años

REPRODUCCION semillas abundantes

LUGAR 30 km al NO de San José

COMENTARIOS 40% de los árboles del rodal original son dominantes

ORIGEN DE INFORMACION Carlos Lizano, Secretario Forestal, Dept. de Bosques, Ministerio de Agri. e Industrias, San José, C.R.

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Costa Rica PLANTACION 208

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 38 | 53 | 41 |

SITIO

LAT. 10°N LONG. 84°O ELEV. 2337

PRECIPITACION 3720 MESES DE SEQUIA Enero-Marzo

TEMPERATURA PROMEDIO 15° HELADAS ninguna

ROCA MADRE volcánica SUELO coluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 40 cm

TEXTURA DEL SUBSUELO arena volcánica PROFUNDIDAD 1+

REACCION 6.2 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 7 - 22% inclinación

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación local

SIEMBRA

FECHA 1917 ESPACIAMIENTO 4 x 4

MATERIAL de vivero a raíz desnuda

REPRODUCCION semillas abundantes

LUGAR Sanatorio Durán

ORIGEN DE INFORMACION Carlos Lizano, Secretario Forestal, Dept. de Bosques, Min. de Agri. e Industrias, San José, C. R.

ESPECIE Eucalyptus viminalis

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Colombia PLANTACION 61

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 4 | 14 | 12 | 2000 | 18 | |

SITIO

LAT. 5°4'N LONG. 75°33'O ELEV. 2560

PRECIPITACION 2200 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 14° HELADAS ninguna

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 48 cm

TEXTURA DEL SUBSUELO arenoso lómico PROFUNDIDAD 2+

REACCION 5.6 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 15 - 40% inclinación

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Min. de Agri., Bogotá

SIEMBRA

FECHA 1955 ESPACIAMIENTO 2 x 4 AREA 2

MATERIAL de vivero a raíz desnuda, 40 cm

HERRAMIENTAS azada SUPERVIVENCIA 85% a los 2 años

CUIDO 2 limpiezas el primer año; poda de una tercera parte de las ramas a los 2 y 5 años

LUGAR San Isidro-Las Palomas, 8 km al NE de Manizales

ORIGEN DE INFORMACION Conrado Gomez, Director de Reforestación, Empresas Municipales, Administración Delegada, Manizales, Col.

ESPECIE Hibiscus elatus

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Jamaica PLANTACION 10

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 18 | 9 | (1120) | | |

RENDIMIENTO postes de cerca a los 7 años

SITIO

LAT. 18°N LONG. 77°O ELEV. 460

PRECIPITACION 3048 MESES DE SEQUIA Enero-Abril, Julio-Sept.

TEMPERATURA PROMEDIO 23° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO friable PROFUNDIDAD superficial

TEXTURA DEL SUBSUELO arcilloso pegajoso REACCION 5.0

DRENAJE libre ESTADO DEL SUELO severamente degradado

TOPOGRAFIA montañosa ASPECTO varios

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Jamaica; 300 m, 3040 mm

SIEMBRA

PREPARACION desmonte completo excepto lado de sombra

FECHA 1947 ESPACIAMIENTO 2.5 x 2.5 AREA 500

MATERIAL de vivero a raíz desnuda, 1 m

SUPERVIVENCIA 70% a los 5 años

CUIDO 2 limpiezas por 3 años; aclareo a los 5 años

REPRODUCCION semillones abundantes

LUGAR Mt. Diablo

COMENTARIOS Especie no se adapta en sitios degradados

ORIGEN DE INFORMACION Conservator of Forests, Box 472,
Kingston, Jam.

ESPECIE Hibiscus elatus

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Puerto Rico PLANTACION 93

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 20 | 18 | 800 | 20 | |

SITIO

LAT. 18°15'N LONG. 66°30'O ELEV. 800

PRECIPITACION 2540 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 21° HELADAS ninguna

ROCA MADRE andesita SUELO coluvial

TEXTURA DEL SUELO arcilloso limoso PROFUNDIDAD 7 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 25 cm

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA a lo largo del curso de una quebrada

ASPECTO N CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Jamaica

SIEMBRA

PREPARACION aclareo FECHA 1948

ESPACIAMIENTO 2.5 x 2.5 AREA 0.4

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA alta

CUIDO desyerbo hasta el tercer año; aclareo a los 10 años

REPRODUCCION flores escasas

LUGAR Doña Juana, Bosque de Toro Negro

COMENTARIOS forma del tronco es sobresaliente

ORIGEN DE INFORMACION FMR Study 2366-03, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Montanoa lehmanii

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Colombia PLANTACION 62

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 10 | 12 | (1175) | 12 | |

SITIO

LAT. 5°4'N LONG. 75°33'O ELEV. 2570

PRECIPITACION 2200 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 14° HELADAS ninguna

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 48 cm

TEXTURA DEL SUBSUELO arenoso lómico PROFUNDIDAD 2+

REACCION 5.6 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA accidentada, 40% inclinación

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION limpieza con azada FECHA 1953

ESPACIAMIENTO 2 x 4 AREA 2.5

MATERIAL de vivero a raíz desnuda, 40 cm

HERRAMIENTAS azada SUPERVIVENCIA 94% a los 2 años

CUIDO limpieza anualmente; poda anual por 4 años

REPRODUCCION semillas abundantes

LUGAR Lote 3, Las Palomas, 8 km al NE de Manizales

COMENTARIOS Usado para postes en construcciones rurales y teléfono y líneas eléctricas

ORIGEN DE INFORMACION Conrado Gomez, Director de Reforestación, Empresas Municipales, Manizales, Col.

ESPECIE Pinus pseudostrobus

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Costa Rica PLANTACION 209

CRECIMIENTO
DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 22 | 39 | 27 |

SITIO
LAT. 10°20'N LONG. 84°20'O ELEV. 2000

PRECIPITACION 3476 MESES DE SEQUIA Enero-Febrero

TEMPERATURA PROMEDIO 14° HELADAS ninguna

ROCA MADRE lava SUELO coluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 40 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 1+

REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 10% inclinación ASPECTO N

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Guatemala

SIEMBRA
FECHA 1938 ESPACIAMIENTO 4 x 4

MATERIAL de vivero en potes

SUPERVIVENCIA 50% a los 17 años

CUIDO desyerbo 3 veces al año

REPRODUCCION semillas abundantes

LUGAR Los Cartagos, 35 km al NO de San José

COMENTARIOS parece que esta especie no se adapta bien al sitio

ORIGEN DE INFORMACION Carlos Lizano, Secretario Forestal, Dept. de Bosques, Min. de Agri. e Industrias, San José, C. R.

ESPECIE *Prunus occidentalis*

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Puerto Rico PLANTACION 94

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 14 | 10 | 15 |

SITIO

LAT. 18°15'N LONG. 65°45'O ELEV. 400

PRECIPITACION 3810 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 23° HELADAS ninguna

ROCA MADRE diorita SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 8 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 70% inclinación ASPECTO SO

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Jayuya, P. R.

SIEMBRA

FECHA 1945 ESPACIAMIENTO 3 x 3 AREA 187 árboles

MATERIAL de vivero a raíz desnuda HERRAMIENTAS zapapico

SUPERVIVENCIA 33% a los 6 meses, 5% a los 14 años

REPRODUCCION ninguna

LUGAR Valle Hicaco, Bosque Experimental de Luquillo

COMENTARIOS Sembrado bajo árboles de caoba hondureña, liberados por el huracán de 1956, sobreviven 10 árboles

ORIGEN DE INFORMACION FMR Study 1335 L-B, Tropical Forest Research Center, Río Piedras, P. R.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Puerto Rico PLANTACION 96

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD: | DAP cm : | ALTURA m | NUM.ARBOLES: | AREA BASIMETRICA: | VOL. |
| 21 | 19 | | 1136 | 27 | |

SITIO

LAT. 18°15'N LONG. 65°50'O ELEV. 400

PRECIPITACION 2286 MESES DE SEQUIA Enero-Febrero

TEMPERATURA PROMEDIO 23° HELADAS ninguna

ROCA MADRE andesita SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 3 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 50+

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA loma, 20% inclinación

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION arado FECHA 1938

ESPACIAMIENTO 2 x 2 MATERIAL de vivero a raíz desnuda

HERRAMIENTAS zapapico SUPERVIVENCIA alta

CUIDO limpieza por 3 años

REPRODUCCION semillas abundantes

LUGAR Parcela 105, Bosque Experimental de Luquillo

ORIGEN DE INFORMACION FMR 1970L, Tropical Forest Research Center,

Box 577, Rio Piedras, Puerto Rico

ESPECIE Weinmannia caripense

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Colombia PLANTACION 63

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 8 | 7 | (1536) | 7 | |

SITIO

LAT. 5°4'N LONG. 75°33'O ELEV. 2670

PRECIPITACION 2200 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 14° HELADAS ninguna

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 40 cm

TEXTURA DEL SUBSUELO arenoso lómico PROFUNDIDAD 2+

REACCION 5.6 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA accidentada, 15%+ inclinación

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION limpieza FECHA 1953

ESPACIAMIENTO 2 x 3 AREA 2

MATERIAL arbolitos silvestres a raíz desnuda, 40 cm

HERRAMIENTAS azada SUPERVIVENCIA 92% a los 2 años

CUIDO limpieza anualmente; poda hasta una tercera parte del follaje en años alternados hasta los 7 años

REPRODUCCION semillones abundantes

LUGAR Lote 2, Las Palomas, 8 km al NE de Manizales

COMENTARIOS crecimiento lento; propio para madera, carbón

ORIGEN DE INFORMACION Conrado Gomez, Director de Reforestación, Empresas Municipales, Manizales, Col.

ESPECIE Araucaria spp.

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Ecuador PLANTACION 230

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 15 ? | 24 | 16 | 420 | | 11 |

SITIO

LAT. 0° LONG. 79°0 ELEV. 1000

PRECIPITACION 2200 MESES DE SEQUIA Oct.-Nov.

TEMPERATURA PROMEDIO 19° HELADAS ninguna

SUELO aluvial TEXTURA DEL SUELO arenoso arcilloso

PROFUNDIDAD 4 cm

TEXTURA DEL SUBSUELO arenoso arcilloso pesado

PROFUNDIDAD 2+ REACCION 5.5

DRENAJE libre ESTADO DEL SUELO poco afectado

TOPOGRAFIA 5% inclinación ASPECTO N

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION corte del bosque FECHA 1945 ?

ESPACIAMIENTO 5 x 5 AREA 1.5

MATERIAL de vivero a raíz desnuda

CUIDO 2 limpiezas

REPRODUCCION ausente

LUGAR Hacienda La Favorita, 58 km al O de Quito, 2 km al N de Chiriboga, Prov. Pichincha

COMENTARIOS pastoreo de ganado vacuno

ORIGEN DE INFORMACION Mario Cárdenas, Dept. Forestal, Min. Fomento, Quito, Ecuador

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Muy Húmedo

PAIS Ecuador PLANTACION 231

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 25 ? | 28 | 15 | 2174 | | |

SITIO

LAT. 0° LONG. 79°0 ELEV. 1000

PRECIPITACION 2200 MESES DE SEQUIA Oct.-Nov.

TEMPERATURA PROMEDIO 19° HELADAS ninguna

SUELO aluvial TEXTURA DEL SUELO arenoso arcilloso

PROFUNDIDAD 4 cm TEXTURA DEL SUBSUELO arenoso arcilloso

PROFUNDIDAD 2+ REACCION 5.5

DRENAJE impedido ESTADO DEL SUELO poco afectado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION corte de bosque FECHA 1935 ?

ESPACIAMIENTO 2 x 2 AREA 1.0

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 95% a los 25 años

REPRODUCCION flores y semillas escasas

LUGAR Hacienda La Favorita, 58 km al O de Quito, 2 km al N. de Chiriboga, Prov. Pichincha

COMENTARIOS necesita aclareo

ORIGEN DE INFORMACION Mario Cárdenas, Dept. For., Min. Fomento, Quito, Ecuador

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Guatemala PLANTACION 211

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 64 | 64 | 39 | 120 | 30 | |

SITIO

LAT. 14°30'N LONG. 90°45'O ELEV. 1500

PRECIPITACION 1300 MESES DE SEQUIA Nov.-Mayo

TEMPERATURA PROMEDIO 18° HELADAS 1 en 20 años

ROCA MADRE arena volcánica SUELO aluvial

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO franco arcilloso arenoso

PROFUNDIDAD 1+ REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 20% inclinación ASPECTO N

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION limpieza FECHA ± 1896

ESPACIAMENTO 8 x 8 AREA 43 MATERIAL de vivero

HERRAMIENTAS pala SUPERVIVENCIA (77% a los 64 años)

CUIDO limpieza anual

REPRODUCCION semillas abundantes, semillones escasos

LUGAR Porvenir, Finca San Sebastián, 3 km al O de Dueñas, Sacatepequez

COMENTARIOS 25 HA sembradas en 1959, a 2 x 2 m

ORIGEN DE INFORMACION Julio Rodas, Dirección Forestal, Ministerio de Agricultura, Guatemala, Gua.

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Guatemala PLANTACION 212

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 20 | 26 | 25 | 1098 | 41 | |

SITIO

LAT. 14°45'N LONG. 91°0 ELEV. 1700

PRECIPITACION 1400 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 18° HELADAS ninguna

ROCA MADRE SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 35 cm

TEXTURA DEL SUBSUELO franco arcilloso pedregoso

PROFUNDIDAD 1+ REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA plana CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS local, 2000 m

SIEMBRA

PREPARACION tumba y quema FECHA 1940

ESPACIAMIENTO 2 x 2 MATERIAL de vivero en potes

SUPERVIVENCIA (44% a los 20 años)

REPRODUCCION semillas abundantes, semillones escasos

LUGAR Puente 2, Finca Pampojila, San Lucas, Tolima, Dpto.
Solola; 1 km al S de Pampojila

ORIGEN DE INFORMACION Julio Rodas, Dirección Forestal, Min. de
Agricultura, Guatemala, Gua.

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Costa Rica PLANTACION 104

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 13 | | | 5011 | 42 | 320 |
| 17 | | | 5011 | 46 | 354 |

SITIO

LAT. 10°7'N LONG. 84°17'O ELEV. 1820

PRECIPITACION 1100 MESES DE SEQUIA Diciembre-Marzo

TEMPERATURA PROMEDIO 23° HELADAS ninguna

ROCA MADRE arena volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso fino PROFUNDIDAD 38 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 2

REACCION 4.9 DRENAJE libre

TOPOGRAFIA 16-30% inclinación

CONDICION ANTES DE LA SIEMBRA pastos (?)

ORIGEN DE SEMILLAS posiblemente de árboles aislados de la localidad

SIEMBRA

FECHA 1934 ESPACIAMIENTO 1 x 1 AREA 0.1

MATERIAL de vivero

CUIDO aclareos irregulares

LUGAR Meseta Central Occidental, 80 km al NO de San José

COMENTARIOS Afectado por las cenizas del Volcán Poas - 1955

ORIGEN DE INFORMACION C. L. Lizano, Jefe, Sección Forestal, Dpto. de Tierras y Bosques, Min. de Agricultura e Industrias, San José, C. R.

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Costa Rica PLANTACION 213

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 33 | 30 | 22 | | | 62 |
| 41 | 32 | 30 | | | 48 |

SITIO

LAT. 10°N LONG. 84°O ELEV. 1200

PRECIPITACION 1860 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 20° HELADAS ninguna

ROCA MADRE volcánica SUELO coluvial

TEXTURA DEL SUELO franco arcilloso arenoso PROFUNDIDAD 30

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación local

SIEMBRA

FECHA 1919 ESPACIAMIENTO 3 x 3 AREA 0.5

MATERIAL de vivero a raíz desnuda HERRAMIENTAS pala

CUIDO limpieza ocasional

LUGAR La Paulina, Montes de OCA

COMENTARIOS necesita aclareo

ORIGEN DE INFORMACION C. L. Lizano, Jefe, Sección Forestal, Dpto. de Tierras y Bosques, Min. de Agricultura e Industrias, San José, C.R.

ESPECIE Eucalyptus citriodora

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Venezuela PLANTACION 65

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 7 | 16 | 13 |

SITIO

LAT. 9°N LONG. 71°O ELEV. 2300

PRECIPITACION 1001 TEMPERATURA PROMEDIO 15°

HELADAS ninguna ROCA MADRE granito

SUELO aluvial TEXTURA DEL SUELO arenoso arcilloso

PROFUNDIDAD 40 cm TEXTURA DEL SUBSUELO rocoso

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 10% inclinación ASPECTO SE

SIEMBRA

FECHA 1949 ESPACIAMIENTO 1 x 2 AREA 21 árboles

MATERIAL de vivero en potes

LUGAR Plantación Mucurubá, 40 km al NE de Mérida

ORIGEN DE INFORMACION C. Claverie Rodriguez, a través de G. H. Raets, Instituto Forestal Latino-Americano, Apartado 36, Mérida, Venez.

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Venezuela PLANTACION 66

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 13 | 54 | 23 |

SITIO

LAT. 9°N LONG. 71°O ELEV. 2300

PRECIPITACION 1000 TEMPERATURA PROMEDIO 15°

HELADAS ninguna ROCA MADRE granito

SUELO aluvial TEXTURA DEL SUELO arenoso arcilloso

PROFUNDIDAD 30-50 cm TEXTURA DEL SUBSUELO pedregoso

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 10% inclinación ASPECTO SE

SIEMBRA

FECHA 1943 ESPACIAMIENTO 20 árboles aislados

MATERIAL de vivero en potes

LUGAR Plantación Mucurubá, 40 km al NE de Mérida, Venezuela

ORIGEN DE INFORMACION C. Claverie Rodriguez, a través de G. H. Raets, Instituto Forestal Latino-Americano, Apartado 36, Mérida, Venez.

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Venezuela PLANTACION 105

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 9 | 18 | 16 |

SITIO

LAT. 8°35'N LONG. 71°9'O ELEV. 1600

PRECIPITACION 1316 MESES DE SEQUIA Enero-Febrero

TEMPERATURA PROMEDIO 19° HELADAS ninguna

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD 50 cm

TEXTURA DEL SUBSUELO pedregoso REACCION 6.4

DRENAJE libre ESTADO DEL SUELO poco afectado

TOPOGRAFIA 12% inclinación ASPECTO SO

SIEMBRA

FECHA 1947 ESPACIAMIENTO 1 x 2

MATERIAL de vivero

REPRODUCCION ninguna

LUGAR Zona Suburbana, al NO de Mérida, Venezuela

ORIGEN DE INFORMACION Carlos C. Rodríguez, a través de G. H. Raets, Instituto Forestal Latino-Americano, Apartado 36, Mérida, Venezuela

ESPECIE Gmelina arborea

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Honduras Británica PLANTACION 220

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 16 | 10 | 1490 | 16 | |

SITIO

LAT. 17°N LONG. 89°O ELEV. 450

PRECIPITACION 1600 MESES DE SEQUIA Diciembre-Mayo

TEMPERATURA PROMEDIO 23° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 8 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 1+

REACCION 6.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA 2% inclinación

ASPECTO S CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS Plantación de Africa

SIEMBRA

PREPARACION tumba y quema FECHA 1954

ESPACIAMIENTO 1.5 x 1.5 AREA 0.4

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 50% a los 6 años

CUIDO aclareo a los 3 y 4 años; poda a los 3 años

REPRODUCCION ninguna

LUGAR al O de Augustine

COMENTARIOS En Africa la madera se usa para combustible y tambien para mejorar sitios , para secar sitios muy húmedos.

ORIGEN DE INFORMACION Conservator of Forests, Box 181, Belize, British Honduras

ESPECIE Grevillea robusta

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Guatemala

PLANTACION 221

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA: VOL. |
| 12 | 23 | 15 | (278) | 21 |
| 14 | 28 | 16 | 198 | 12 |

RENDIMIENTO leña a los 12 años

SITIO

LAT. 14° 30'N LONG. 90° 45'O ELEV. 1500

PRECIPITACION 1300 MESES DE SEQUIA Nov.-Mayo

TEMPERATURA PROMEDIO 18° HELADAS 1 en 20 años

ROCA MADRE arena volcánica SUELO aluvial

TEXTURA DEL SUELO franco cascajoso PROFUNDIDAD 20 cm

TEXTURA DEL SUBSUELO cascajoso PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION aclareo FECHA 1946

ESPACIAMIENTO 6 x 6 AREA 4

MATERIAL de vivero en potes SUPERVIVENCIA 95% a los 12 años

CUIDO 3 limpiezas por año; aclareo de la mitad de los árboles a los 12 años

REPRODUCCION semillas abundantes

LUGAR San José, Finca San Sebastán, 3 km al O de Dueñas, Sacatepequez

COMENTARIOS Sombra de café, corta final a los 30 años

ORIGEN DE INFORMACION Julio Rodas, Dirección Forestal, Min. de Agricultura, Guatemala

ESPECIE Mimosa caesalpinaefolia

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Brazil PLANTACION 106

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 12 | 13 | 1900 | 16 | 100 |

RENDIMIENTO 1000 postes de cerca y 26 $m^3$ de leña a los 12 años

SITIO

LAT. 7°S LONG. 35°42'0 ELEV. 580

PRECIPITACION 1200 MESES DE SEQUIA Sept.-Marzo

TEMPERATURA PROMEDIO 22° HELADAS ninguna

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO arenoso arcilloso REACCION 6.6

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA ondulada, 10% inclinación

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION limpieza FECHA 1947

ESPACIAMIENTO 2 x 2 AREA 0.5 MATERIAL semillas

HERRAMIENTAS pico SUPERVIVENCIA 80% a los 12 años

CUIDO dos limpiezas en 3 años

REPRODUCCION arbolillos abundantes

LUGAR Escuela de Agronomía, Paraiba, Brazil

COMENTARIOS Especie xerofita adaptable a climas con más de 800 mm de precipitación.

ORIGEN DE INFORMACION Diniz Xavier de Andrade, Escuela de Agronomía, Paraiba, Brazil

ESPECIE Pinus caribaea

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Honduras Británica PLANTACION 222

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 9 | 6 | 1670 | 11 | |

SITIO

LAT. 17°N LONG. 89°O ELEV. 450

PRECIPITACION 1600 MESES DE SEQUIA Dic.-Mayo

TEMPERATURA PROMEDIO 23° HELADAS ninguna

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 7 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 1+

REACCION 5.5 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA ondulada, 3% inclinación ASPECTO E

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION tumba y quema FECHA 1954

ESPACIAMIENTO 2.5 x 2.5 AREA 80

MATERIAL de vivero en potes HERRAMIENTAS pala

SUPERVIVENCIA 95% a los 6 años

CUIDO limpieza anual

REPRODUCCION flores ausentes

LUGAR Lote B-1, al N del Punto de Vigilancia de Augustine

COMENTARIOS Pastos con robles y pinos. P. palustris, P. taeda y P. elliottii son más lentos en el crecimiento y probablemente no tendrán éxito.

ORIGEN DE INFORMACION Conservator of Forests, Box 181, Belize, British Honduras.

ESPECIE Pinus elliottii

GRUPO ECOLOGICO Subtropical Húmedo

PAIS British Honduras PLANTACION 36

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | | 3 | 1680 | | |

SITIO

LAT. 17°N LONG. 89°O ELEV. 460

PRECIPITACION 1410 MESES DE SEQUIA Diciembre-Mayo

TEMPERATURA PROMEDIO 23° HELADAS ninguna

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 18 cm

TEXTURA DEL SUBSUELO arenoso arcilloso PROFUNDIDAD 2+

REACCION ácida DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 3% inclinación ASPECTO E

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Estados Unidos de América

SIEMBRA

PREPARACION tumba FECHA 1954

ESPACIAMIENTO 2.5 x 2.5

MATERIAL de vivero en potes, 15 cm de alto

HERRAMIENTAS azada SUPERVIVENCIA 80% a los 5 años

CUIDO limpieza anual

REPRODUCCION ninguna

LUGAR 400 m al NO del Punto de Vigilancia Augustine, Honduras Británica

COMENTARIOS Originalmente crecían pastos con encinos achaparrados y pinos esparcidos

ORIGEN DE INFORMACION Conservator of Forests, Box 181, Belize, British Honduras. Plot No. B. 1. M.P.R.

ESPECIE Pinus merkusii

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Jamaica PLANTACION 223

CRECIMIENTO
DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 6 | 9 | 8 |

SITIO
LAT. 18°N LONG. 76°30'O ELEV. 1650

PRECIPITACION 1140 MESES DE SEQUIA Feb.-Abril,Julio-Aug.

HELADAS ninguna ROCA MADRE pizarra

SUELO residual TEXTURA DEL SUELO franco arcilloso friable

PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO franco arcilloso friable

PROFUNDIDAD 1+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA loma, 30% inclinación ASPECTO NO

ORIGEN DE SEMILLAS Burma

SIEMBRA
PREPARACION tumba FECHA 1954

ESPACIAMIENTO 2.5 x 2.5 AREA 1.5

MATERIAL de vivero en potes, 20 cm

HERRAMIENTAS zapapico SUPERVIVENCIA 90% a los 6 años

CUIDO 2 limpiezas por 2 años, despues anualmente

REPRODUCCION flores abundantes

LUGAR Belle Vue, Compartimiento 3

COMENTARIOS loma alta y expuesta; muchos árboles deformados por el viento, pero muchos excelentes y derechos; se estan produciendo algunos conos

ORIGEN DE INFORMACION Conservator of Forests, Kingston, Jam.

ESPECIE Pinus oocarpa

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Nicaragua PLANTACION 224

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 18 | 25 | 30 | | | 30 |

SITIO

LAT. 13°N LONG. 86°O ELEV. 1200

PRECIPITACION 1900 MESES DE SEQUIA Enero-Abril

TEMPERATURA PROMEDIO 17° HELADAS ninguna

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 30

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 15% inclinación ASPECTO E

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

FECHA 1942

CUIDO quema prescrita

REPRODUCCION semillas abundantes

LUGAR Finca Daraili, Dept. Esteli

COMENTARIOS bosque natural quemado anualmente

ORIGEN DE INFORMACION Juan B. Salas, Dept. Forestal, Min. de

Agric. y Ganadería, Managua, Nicaragua

ESPECIE Swietenia macrophylla

GRUPO ECOLOGICO Subtropical Húmedo

PAIS British Honduras PLANTACION 227

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 11 | 8 | 6 | 125 | | |

SITIO

LAT. 17° N LONG. 89° O ELEV. 450

PRECIPITACION 1600 MESES DE SEQUIA Febrero-Mayo

TEMPERATURA PROMEDIO 23° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 8 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 1+

REACCION 7.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA 5% inclinación

ASPECTO 0 CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION talar sotobosque y quema FECHA 1949

ESPACIAMIENTO 3.6 x 3.6 AREA 1.5

MATERIAL semillas SUPERVIVENCIA 50% a los 11 años

CUIDO 2 limpiezas en las calles

REPRODUCCION flores ausentes

LUGAR Mtn. Pine, al O de Augustine

COMENTARIOS De 100 a 125 árboles/HA suficientemente liberados para dominar la vegetación, otros más pequeños y suprimidos, área para reproducción natural de caoba; 2 semillas sembradas por hoyo

ORIGEN DE INFORMACION Conservator of Forests, Box 181, Belize, British Honduras

ESPECIE Tectona grandis

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Honduras Británica PLANTACION 53

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL |
| 5 | 9 | 6 | 2990 | | |

SITIO

LAT. 17°N LONG. 89°O ELEV. 460

PRECIPITACION 1600 MESES DE SEQUIA Diciembre-Mayo

TEMPERATURA PROMEDIO 23° HELADAS ninguna

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 8 cm

TEXTURA DEL SUBSUELO arenoso arcilloso PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

TOPOGRAFIA 7% inclinación ASPECTO O

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS Trinidad - Burma

SIEMBRA

PREPARACION tumba y quema FECHA 1954

ESPACIAMIENTO 1.8 x 1.8 AREA 0.2

MATERIAL tocones HERRAMIENTAS azada

SUPERVIVENCIA 90% a los 5 años

CUIDO limpieza anual

REPRODUCCION flores escasas

LUGAR 1.2 km de Augustine, en la carretera del vivero viejo, British Honduras

ORIGEN DE INFORMACION Conservator of Forests, Box 181, Belize, British Honduras. Plot No. 5. M.P.R.

ESPECIE Tectona grandis

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Honduras Británica PLANTACION 228

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 8 | 7 | 2838 | | 9 |

SITIO
17°N LONG. 89°O ELEV. 450

PRECIPITACION 1600 MESES DE SEQUIA Dic.-Mayo

TEMPERATURA PROMEDIO 23 ° HELADAS ninguna

ROCA MADRE caliza SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO arenoso arcilloso PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA inclinación lev

ASPECTO S CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS plantación

SIEMBRA
PREPARACION cultivo intercalado con maíz FECHA 1955

ESPACIAMIENTO 1.8 x 1.8 AREA 0.4

MATERIAL tocones SUPERVIVENCIA 95% a los 5 años

CUIDO limpieza anualmente; poda al año y a los 2 años

REPRODUCCION semillas escasas

LUGAR Lote B-13, al O de Augustine

COMENTARIOS Vegetación previa: Santa María y Spondias. La teca se ve mal excepto en sitios bien drenados y en suelos para especies de hoja ancha.

ORIGEN DE INFORMACION Conservator of Forests, Box 181, Belize, British Honduras

ESPECIE Araucaria angustifolia

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Brazil PLANTACION 97

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 11 | 11 | 11 | 2912 | 26 | 92 |
| 14 | 13 | 13 | 2292 | 29 | 193 |
| 16 | 14 | 14 | 1645 | 25 | 180 |

RENDIMIENTO: 29 $m^3$ a los 8 años; 16 $m^3$ - 14 años; 19 $m^3$ - 16 años

SITIO

LAT. 23°25'S LONG. 46°44'O ELEV. 730

TEMPERATURA PROMEDIO 18° HELADAS raras

ROCA MADRE esquisto de mica SUELO coluvial

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD profundo

TEXTURA DEL SUBSUELO compacto REACCION 6.7

DRENAJE libre TOPOGRAFIA 8% inclinación

ASPECTO N CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS bosque natural; 22°55'S, 46°05'O; 1400m; 1600 mm

SIEMBRA

PREPARACION arada y nivelada FECHA 1942
ESPACIAMIENTO irregular AREA 7 MATERIAL semillas
SUPERVIVENCIA 90% a los 6 meses

CUIDO 7 limpiezas con azada y 6 con grada entre calles; 3 aclareos desde abajo; poda eliminando ramas secas

REPRODUCCION ninguna

LUGAR 35 km al N de Sao Paulo, Brazil

COMENTARIOS Esta plantación fué abonada durante 2 años con abono verde (leguminosas). Aclareo desde abajo para dar más espacio a los árboles dominantes pero sin abrir lo suficiente el dosel para formar ramas a los lados o dejar que los rayos solares llegasen al suelo.

ORIGEN DE INFORMACION Hasso Weiszflog, Companhia Melhoramentos de Sao Paulo, Caixa Postal 8120, Sao Paulo, Plantacion Qn 127

ESPECIE Araucaria angustifolia

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Brazil PLANTACION 98

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 23 | 20 | 17 | 1056 | 37 | 242 |
| 26 | 23 | 19 | 628 | 27 | 231 |
| 29 | 24 | 21 | 592 | 29 | 270 |
| 32 | 27 | 22 | 408 | 19 | 190 |

RENDIMIENTO 118 $m^3$ entre los 8 y 32 años

SITIO

LAT. 23°25'S LONG. 46°44'O ELEV. 730

PRECIPITACION 1470 MESES DE SEQUIA Abril-Sept.

TEMPERATURA PROMEDIO 18° HELADAS raras

ROCA MADRE esquisto de mica SUELO coluvial

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD profundo

TEXTURA DEL SUBSUELO compacto REACCION 6.7

DRENAJE libre TOPOGRAFIA llana

ORIGEN DE SEMILLAS 22°55'S, 46°05'O; 1400 m; 1600 mm

SIEMBRA

PREPARACION rastrillado FECHA 1927

ESPACIAMIENTO 1.4 x 1.8 AREA 6

MATERIAL semillas

CUIDO 7 limpiezas con azada y 2 con grada; 1 poda eliminando ramas muertas; 8 aclareos entre los 8 y 32 años.

REPRODUCCION semillas, arbolillos escasos

LUGAR 35 km al N de Sao Paulo, Brazil (Caieiras)

COMENTARIOS Se hicieron aclareos para liberar árboles dominantes. Las condiciones del clima y suelo en Caieiras no son tan buenas para esta especie como en los Estados del Sur, Parana y St. Catharina. Se han iniciado siembras en Serra da Mantiqueria Minas Gerais a una elevación de 1500 m.

ORIGEN DE INFORMACION Hasso Weiszflog, Companhia Melhoramento de Sao Paulo, Caixa Postal 8120, Sao Paulo, Brazil. Plantación Qn 27.

ESPECIE Cryptomeria japonica

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Brazil PLANTACION 99

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 11 | 10 | 3810 | 34 | 157 |
| 15 | 12 | 12 | 3140 | 36 | 193 |
| 18 | 13 | 13 | 2280 | 33 | 196 |

RENDIMIENTO 16 $m^3$ a los 15 años; 38 $m^3$ a los 18 años

SITIO

LAT. 23°25'S LONG. 46°44'O ELEV. 730

PRECIPITACION 1470 MESES DE SEQUIA Abril-Sept.

TEMPERATURA PROMEDIO 18° HELADAS raras

SUELO coluvial TEXTURA DEL SUELO arenoso arcilloso

PROFUNDIDAD profundo TEXTURA DEL SUBSUELO compacto

REACCION 5.7 DRENAJE libre

TOPOGRAFIA 15% inclinación ASPECTO NE

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION quema FECHA 1939

ESPACIAMIENTO 1.5 x 1.5 AREA 2

MATERIAL de vivero a raíz desnuda SUPERVIVENCIA 55% a los 3 meses

CUIDO 6 limpiezas con azada y 2 con grada; 2 aclareos liberando los árboles dominantes y eliminando árboles ramificados; 2 podas eliminando ramas secas

REPRODUCCION semillas abundantes, arbolillos escasos

LUGAR 35 km al N de Sao Paulo, Brazil

COMENTARIOS Ahora se estan iniciando plantaciones con semillones con bolas de tierra mezcladas con abono

ORIGEN DE INFORMACION Hasso Weiszflog, Companhia Melhoramentos de Sao Paulo, Caixa Postal 8120, Sao Paulo, Brazil. Plantación Qn105[b]

ESPECIE Cryptomeria japonica

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Brazil PLANTACION 100

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 16 | 14 | 16 | 3417 | 50 | 372 |
| 18 | 16 | 18 | 2117 | 43 | 342 |
| 20 | 18 | 20 | 1450 | 36 | 319 |

RENDIMIENTO 47 m3 a los 16 años; 81 m3 a los 18 años; 68 m3 a los 20 añ

SITIO

LAT. 23°26'S LONG. 46°44'O ELEV. 730

PRECIPITACION 1470 MESES DE SEQUIA Abril-Sept.

TEMPERATURA PROMEDIO 18° HELADAS raras

ROCA MADRE granito SUELO aluvial

TEXTURA DEL SUELO arenoso PROFUNDIDAD profundo

TEXTURA DEL SUBSUELO cascajoso REACCION 6.0

DRENAJE libre TOPOGRAFIA 5% inclinación

ASPECTO NE CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Caieiras, Brazil, plantación

SIEMBRA

PREPARACION limpieza FECHA 1930

ESPACIAMIENTO 1.5 x 1.5 AREA 0.4

MATERIAL de vivero a raíz desnuda, 20 cm

HERRAMIENTAS azada SUPERVIVENCIA 93% a los 3 meses

CUIDO 5 limpiezas con azada, 2 con disco; 4 aclareos extrayendo árboles bifurcados; 2 podas eliminando ramas secas

LUGAR 35 km al N de Sao Paulo, Brazil

COMENTARIOS buen crecimiento, mejor que el promedio

ORIGEN DE INFORMACION Hasso Weiszflog, Campanhía Melhoramentos de Sao Paulo, Caixa Postal 8120, Sao Paulo, Brazil. Plantación Qn $94^b$.

ESPECIE Cunninghamia lanceolata

GRUPO ECOLOGICO Subtropical Húmedo

PAIS Brazil PLANTACION 101

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 12 | 8 | 2592 | 27 | 108 |
| 13 | 16 | 12 | 2592 | 43 | 245 |
| 15 | 18 | 14 | 2160 | 49 | 321 |

RENDIMIENTO 33 $m^3$ a los 10 años; 16 $m^3$ a los 15 años

SITIO

LAT. 23°25' S LONG. 46°44'O ELEV. 730

PRECIPITACION 1470 MESES DE SEQUIA Abril-Sept.

TEMPERATURA PROMEDIO 18° HELADAS raras

ROCA MADRE esquisto de mica SUELO coluvial

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD profundo

TEXTURA DEL SUBSUELO compacto REACCION 6.5

DRENAJE libre TOPOGRAFIA 30-40% inclinación

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION limpieza FECHA 1943

ESPACIAMIENTO 2 x 1.2 AREA 2

MATERIAL de vivero a raíz desnuda HERRAMIENTAS azada

SUPERVIVENCIA 73% al año

CUIDO 8 desyerbos con azada; poda de ramas muertas hasta 2 m a los 10 años, con serrucho hasta 4 m a los 13 años

REPRODUCCION semillas escasas

LUGAR 35 km al N de Sao Paulo, Brazil

COMENTARIOS Es necesario eliminar los renuevos, despues de cortados los renuevos echan raíces con facilidad. Este árbol produce una buena cubierta de hojas y ramas sobre el suelo de los 12 a los 15 años.

ORIGEN DE INFORMACION Hasso Weiszflog, Companhia Melhoramentos de Sao Paulo, Caixa Postal 8120, Sao Paulo, Brazil. Plantación Qn 139.

ESPECIE Eucalyptus viminalis

GRUPO ECOLOGICO Subtropical Seco

PAIS Venezuela PLANTACION 73

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 6 | 19 | 15 |

SITIO

LAT. 9°12'N LONG. 71°0 ELEV. 2260

PRECIPITACION 1000 TEMPERATURA PROMEDIO 15°

HELADAS ninguna ROCA MADRE granito

SUELO aluvial TEXTURA DEL SUELO arenoso arcilloso

PROFUNDIDAD 1 TEXTURA DEL SUBSUELO pedregoso

REACCION 5.7 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA al nivel

SIEMBRA

FECHA 1950 ESPACIAMIENTO 3 x 3

MATERIAL de vivero en potes

REPRODUCCION ninguna

LUGAR Escaguey, 35 km al NO de Mérida, Venezuela

COMENTARIOS Transición a Templado Seco

ORIGEN DE INFORMACION C. Claverie Rodriguez, a través de G. H. Raets, Instituto Forestal Latino-Americano, Apartado 36, Mérida, Venez.

ESPECIE Casuarina cunninghamiana

GRUPO ECOLOGICO Subtropical Muy Seco

PAIS Perú PLANTACION 108

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 14 | 20 | 8 | 800 | 25 | 93 |

RENDIMIENTO 92 $m^3$/HA a los 14 años

SITIO

LAT. 12°S LONG. 76°47'0 ELEV. 170

PRECIPITACION 31 MESES DE SEQUIA Oct.-Mayo

TEMPERATURA PROMEDIO 18° HELADAS ninguna

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD 1

TEXTURA DEL SUBSUELO arcilloso cascajoso PROFUNDIDAD 1+

REACCION 8.2 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 3-8% inclinación

CONDICION ANTES DE LA SIEMBRA cubierto de piedras y maleza

ORIGEN DE SEMILLAS Bosque Matamula, Lima

SIEMBRA

PREPARACION limpieza de piedras FECHA 1945

ESPACIAMIENTO 1.4 x 1.4 AREA 1

MATERIAL de vivero en potes HERRAMIENTAS zapapico

SUPERVIVENCIA 50% a los 5 años

CUIDO riego, aclareos irregulares pero continuos, 60% removidos

REPRODUCCION semillones abundantes

LUGAR Hacienda San Fernando, cerca de Pachacámac, Provincia Lima, Perú

COMENTARIOS Los árboles necesitan riego para sobrevivir

ORIGEN DE INFORMACION Roberto Hooker Leguía, a traves de Flavio Bazán, Servicio Cooperativo Inter-Americano, Edificio Ministerio del Trabajo, Lima, Perú.

ESPECIE Araucaria spp.

GRUPO ECOLOGICO Templado Pluvial

PAIS Ecuador PLANTACION 230

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 15 ? | 24 | 16 | 420 | | 11 |

SITIO

LAT. 0° LONG. 79°0 ELEV. 1000

PRECIPITACION 2200 MESES DE SEQUIA Oct.-Nov.

TEMPERATURA PROMEDIO 19° HELADAS ninguna

SUELO aluvial TEXTURA DEL SUELO arenoso arcilloso

PROFUNDIDAD 4 cm TEXTURA DEL SUBSUELO arenoso arcilloso pesado

PROFUNDIDAD 2 + REACCION 5.5

DRENAJE libre ESTADO DEL SUELO poco afectado

TOPOGRAFIA 5% inclinación ASPECTO N

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION corte del bosque FECHA 1945 ?

ESPACIAMIENTO 5 x 5 AREA 1.5

MATERIAL de vivero a raíz desnuda

CUIDO 2 limpiezas

REPRODUCCION ausente

LUGAR Hacienda La Favorita, 58 km al O de Quito, 2 km al N de Chiriboga, Prov. Pichincha

COMENTARIOS pastoreo de ganado vacuno

ORIGEN DE INFORMACION Mario Cárdenas, Dept. Forestal, Min. Fomento, Quito, Ecuador

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Templado Fluvial

PAIS Ecuador PLANTACION 231

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 25 ? | 28 | 15 | 2174 | | |

SITIO

LAT. 0° LONG. 79° 0 ELEV. 1000

PRECIPITACION 2200 MESES DE SEQUIA Oct.-Nov.

TEMPERATURA PROMEDIO 19° HELADAS ninguna

SUELO aluvial TEXTURA DEL SUELO arenoso arcilloso

PROFUNDIDAD 4 cm TEXTURA DEL SUBSUELO arenoso arcilloso

PROFUNDIDAD 2+ REACCION 5.5

DRENAJE impedido ESTADO DEL SUELO poco afectado

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION corte de bosque FECHA 1935 ?

ESPACIAMIENTO 2 x 2 AREA 1.0

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 95% a los 25 años

REPRODUCCION flores y semillas escasas

LUGAR Hacienda La Favorita, 58 km al O de Quito, 2 km al N de Chiriboga, Prov. Pichincha

COMENTARIOS necesita aclareo

ORIGEN DE INFORMACION Mario Cárdenas, Dept. For., Min. Fomento, Quito, Ecuador

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Templado Húmedo

PAIS Mexico PLANTACION 232

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 31 | 24 | 14 | 1156 | 32 | |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2800

PRECIPITACION 1280 MESES DE SEQUIA Diciembre-Jumio

TEMPERATURA PROMEDIO 12° HELADAS Diciembre-Febrero

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinación baja ASPECTO O

CONDICION ANTES DE LA SIEMBRA pastos

SIEMBRA

FECHA 1929 ESPACIAMIENTO 2 x 2 Area 2

MATERIAL de vivero en potes HERRAMIENTAS pico

SUPERVIVENCIA 46% a los 31 años

CUIDO ninguno

REPRODUCCION semillas abundantes

LUGAR La Venta

COMENTARIOS ramoso

ORIGEN DE INFORMACION Jesus Olvera Sanchez, Avenida Allende 122, Vera Cruz, Mex.

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Templado Húmedo

PAIS Guatemala PLANTACION 233

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 20 | 26 | 16 | 896 | 33 | |

SITIO

LAT. 14°30'N LONG. 90°20'O ELEV. 1700

PRECIPITACION 1016 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 14° HELADAS Dic., cada 2 o 3 años

ROCA MADRE arena volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO franco cascajoso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA accidentada, 5-20% inclinación

ASPECTO cima de loma CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION cultivado FECHA 1940

ESPACIAMIENTO 3 x 3 AREA 4

MATERIAL de vivero en potes, 25 cm HERRAMIENTAS azada

SUPERVIVENCIA (81% a los 20 años)

CUIDO 2 limpiezas anuales por 6 años

REPRODUCCION semillas abundantes

LUGAR El Pino, Parcela 9, T. Castro, 25 km al NE de Ciudad Guatemala

ORIGEN DE INFORMACION José Gallegos, Director, Escuela de Capacitación Forestal, Amatitlán, Guatemala

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Templado Húmedo

PAIS Guatemala PLANTACION 234

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA : VOL. |
| 13 | 18 | 17 | (1111) | 32 |
| 18 | 19 | 17 | 500 | 18 |

RENDIMIENTO postes a los 18 años

SITIO

LAT. 14°30'N LONG. 90°20'O ELEV. 1700

PRECIPITACION 1016 MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 13° HELADAS Dic., cada 2-3 años

ROCA MADRE arena volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 4 cm

TEXTURA DEL SUBSUELO arenoso arcilloso

PROFUNDIDAD 1+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 5% inclinación ASPECTO N

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION cultivado FECHA 1942

ESPACIAMIENTO 3 x 3 MATERIAL de vivero en potes, 25 cm

SUPERVIVENCIA 99% a los 18 años

CUIDO aclareo a los 18 años

REPRODUCCION semillas abundantes

LUGAR El Pino, Parcela #1, 25 km al NE de Ciudad Guatemala

COMENTARIOS La medición de la vegetación secundaria se hizo despues del aclareo

ORIGEN José Gallegos, Director, Escuela de Capacitación Forestal, Amatitlán, Guatemala

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Templado Húmedo

PAIS Guatemala                                    PLANTACION 235

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 18 | 17 | 16 | 840 | 24 | |

RENDIMIENTO postes a los 16 años

SITIO

LAT. 14°30'N    LONG. 90°20'O    ELEV. 1700

PRECIPITACION 1016    MESES DE SEQUIA Diciembre-Abril

TEMPERATURA PROMEDIO 14°    HELADAS Diciembre, cada 2-3 años

ROCA MADRE arena volcánica    SUELO residual

TEXTURA DEL SUELO franco arcilloso    PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO franco arenoso    PROFUNDIDAD 1+

REACCION 6.5    DRENAJE libre

ESTADO DEL SUELO 5% inclinación    ASPECTO N

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION cultivado    FECHA 1942

ESPACIAMIENTO 2.8 x 2.7    MATERIAL de vivero en potes

SUPERVIVENCIA 98% a los 16 años

CUIDO aclareo a los 16 años

REPRODUCCION semillas abundantes, semillones escasos

LUGAR El Pino, Parcela #4, 25 km al NO de Ciudad Guatemala

ORIGEN DE INFORMACION José Gallegos, Director, Escuela de Capacitación Forestal, Amatitlán, Guatemala

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 236

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 20 | 18 | 15 | 6033 | 104 | |

SITIO

LAT. 6°N LONG. 76°O ELEV. 2550

PRECIPITACION 1800 MESES DE SEQUIA Dic.-Feb., Junio-Agto.

TEMPERATURA PROMEDIO 15° HELADAS ocasionales

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 2

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 40% inclinación

CONDICION ANTES DE LA SIEMBRA bosque secundario

SIEMBRA

PREPARACION corte de maleza FECHA 1939

ESPACIAMIENTO 1.2 x 1.2 AREA 0.2

MATERIAL de vivero a raíz desnuda HERRAMIENTAS pico

CUIDO 1 poda

REPRODUCCION semillas abundantes

LUGAR Gran Via, Parcela 31, Hoya Hidrográfica de Piedras Blancas, Municipio de Medellín

ORIGEN DE INFORMACION Julio Garcia Diaz, Min. de Agric. Sec. de Bosques, Bogotá, Colombia

ESPECIE Acacia mollissima albata

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 210

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 6 | 15 | (1750) | 32 | 516 |

SITIO

LAT. 5°N LONG. 74°O ELEV. 3050

PRECIPITACION 1580 MESES DE SEQUIA Junio - Sept.

TEMPERATURA PROMEDIO 13° HELADAS Dic.-Febrero

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 60 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 2+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA 20% inclinación

ASPECTO NE CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantacion en Chile

SIEMBRA

FECHA 1951 ESPACIAMIENTO 2 x 2 AREA 1

MATERIAL de vivero en potes SUPERVIVENCIA 70% a los 8 años

REPRODUCCION renuevos de raíces abundantes

LUGAR Lago Neusa, 103 km al N de Bogotá

COMENTARIOS se han hecho ensayos de las mejores especies en este sitio

ORIGEN DE INFORMACION Julio García Díaz, Sec. de Bosques, Ministerio de Agricultura, Bogotá, Col.

ESPECIE Araucaria angustifolia

GRUPO ECOLOGICO Templado Húmedo

PAIS Argentina PLANTACION 112

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 25 | 34 | 20 | 350 | 32 | 444 |

SITIO

LAT. 26° 30'S LONG. 54° 40'O ELEV. 150-350

PRECIPITACION 1730 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 20° HELADAS 5 por año

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 1+

TEXTURA DEL SUBSUELO pedregoso REACCION 5.0

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 0 - 20% inclinación

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS Misiones, Arg.; 25-30°S, 50-55°O; 500-1200 m; 1500-2000 mm

SIEMBRA

PREPARACION tumba y quema FECHA 1934

ESPACIAMIENTO 0.4 x 3 AREA 5000

MATERIAL semillas y arbolitos silvestres

CUIDO 2 o 3 limpiezas por 3 años; aclareos a los 7 años y despues a intervalos de 2-3 años; poda antes del primer aclareo

REPRODUCCION semillas y arbolillos escasos

LUGAR Puerto Piray, Misiones, Argentina

COMENTARIOS El pino Paraná crece satisfactoriamente en la Provincia de Misiones solamente en zonas de lluvias univormes y en suelos rojos profundos. Durante un ciclo de explotación de 25 años, se calcula un rendimiento de 18 a 20 $m^3$/HA por año de madera de pasta.

ORIGEN DE INFORMACION Lamberto Golfari, Celulosa Argentina, S.A., Casilla Correo 3499, Buenos Aires, Argentina

ESPECIE Araucaria angustifolia

GRUPO ECOLOGICO Templado Húmedo

PAIS Argentina PLANTACION 111

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 14 | 24 | 16 | 600 | 27 | 260 |

SITIO

LAT. 26°30' S LONG. 54°40'O ELEV. 150-350

PRECIPITACION 1730 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 20° HELADAS 5 por año

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 1+

TEXTURA DEL SUBSUELO pedregoso REACCION 5.0

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 0-20% inclinación

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS bosque natural

SIEMBRA

PREPARACION tumba y quema FECHA 1945

ESPACIAMIENTO 0.4 x 3 AREA 5000

MATERIAL semillas y arbolitos silvestres

CUIDO 2-3 limpiezas con azada por 3 años; ningun aclareo

REPRODUCCION semillas y arbolillos escasos

LUGAR Puerto Piray, Misiones, Argentina

COMENTARIOS El pino Paraná crece satisfactoriamente en la Provincia de Misiones solamente en zonas de lluvias distribuídas uniformemente y en suelos rojos profundos. Durante un ciclo de explotación de 25 años se calcula un rendimiento de 18 a 20 $m^3$/HA por año de madera de pasta.

ORIGEN DE INFORMACION Lamberto Golfari, Celulosa Argentina, S.A. Casilla Correo 3499, Buenos Aires, Argentina

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 214

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 15 | 10 | (1634) | 25 | 366 |

SITIO

LAT. 5°N LONG. 74°O ELEV. 3050

PRECIPITACION 1580 MESES DE SEQUIA Junio-Sept.

TEMPERATURA PROMEDIO 13° HELADAS Dic. - Febrero

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 60 cm

TEXTURA DEL SUBSUELO arcilloso pesado y pedregoso

PROFUNDIDAD 2 REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 20% inclinación ASPECTO NE

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantacion local

SIEMBRA

FECHA 1952 ESPACIAMIENTO 3 x 2 AREA 3

MATERIAL de vivero en potes SUPERVIVENCIA 98% a los 7 años

CUIDO poda a los 7 años

REPRODUCCION semillas abundantes

LUGAR Lago Neusa, 103 km al N de Bogotá

COMENTARIOS muy ramoso, crece mejor en lomas empinadas (60%+)

ORIGEN DE INFORMACION Julio García Díaz, Sec. de Bosques, Min. de Agricultura, Bogotá, Col.

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 215

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 40 | 54 | 41 | | | 38 |

RENDIMIENTO postes a los 25 años; varas y trozas para aserrar a los 40 años

SITIO

LAT. 5°N LONG. 74°O ELEV. 3000

PRECIPITACION 1200 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 14° HELADAS Diciembre-Enero

ROCA MADRE arenisca y pizarra SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 1

TEXTURA DEL SUBSUELO arenoso arcilloso PROFUNDIDAD 2

REACCION 5.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 40% inclinación ASPECTO O

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION limpieza de calles FECHA 1919
ESPACIAMIENTO 3 x 3 AREA 30
MATERIAL de vivero en potes HERRAMIENTAS pala
SUPERVIVENCIA 50% a los 25 años

CUIDO limpiezas en años alternados por 6 años; poda a los 3 años; aclareo a los 25 años

REPRODUCCION semillones abundantes

LUGAR Monte Cipa, Hacienda Pedregal en Zipaguira

COMENTARIOS Plantación excelente, 50% del rodal original

ORIGEN DE INFORMACION Julio García Díaz, Min. de Agricultura, Sec. de Bosques, Bogotá, Colombia

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 216

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 14 | 18 | (2000) | 29 | 588 |

SITIO

LAT. 5°N LONG. 74°O ELEV. 3050

PRECIPITACION 1580 MESES DE SEQUIA Junio-Sept.

TEMPERATURA PROMEDIO 13° HELADAS Dic.-Febrero

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 60 cm

TEXTURA DEL SUBSUELO arcilloso pesado y pedregoso

PROFUNDIDAD 2 REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA 5% inclinación

ASPECTO NE CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Australia

SIEMBRA

FECHA 1952 ESPACIAMIENTO 2 x 2 AREA 10

MATERIAL de vivero en potes SUPERVIVENCIA 80% a los 7 años

REPRODUCCION semillones abundantes

LUGAR Lago Neusa, 103 km al N de Bogotá

COMENTARIOS Se adapta bien en lomas bien drenadas. Necesita aclareo.

ORIGEN DE INFORMACION Julio Garcia Diaz, Min. de Agric., Sec. de Bosques, Bogotá, Colombia

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 217

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 18 | 18 | 2500 ? | 29 | 906 |

SITIO

LAT. 5°N LONG. 74°O ELEV. 3050

PRECIPITACION 13° MESES DE SEQUIA Junio-Septiembre

TEMPERATURA PROMEDIO 13° HELADAS Dic.-Febrero

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 60 cm

TEXTURA DEL SUBSUELO arcilloso pesado y pedregoso

PROFUNDIDAD 2+ REACCION 6.0

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 5% inclinación ASPECTO NE

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación local

SIEMBRA

FECHA 1951 AREA 5 MATERIAL de vivero en potes

HERRAMIENTAS pico y pala

REPRODUCCION semillas abundantes

LUGAR Lago Neusa, 103 km al N de Bogotá

COMENTARIOS E. tereticornis no se adapta al sitio, debido al mal sitio y clima ha fracasado. E. globulus crece mejor en lomas. El suelo es muy pobre en minerales y materias orgánicas.

ORIGEN DE INFORMACION Julio Garcia Diaz, Sec. de Bosques, Min. de Bogotá, Colombia

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Húmedo

PAIS Ecuador PLANTACION 218

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 20 | 17 | (370) | | 18 |

SITIO

LAT. 1°S LONG. 79°O ELEV. 2800

PRECIPITACION 1200 MESES DE SEQUIA Agosto-Sept.

TEMPERATURA PROMEDIO 13° HELADAS Noviembre

ROCA MADRE arena volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 60 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 20% inclinación ASPECTO N

CONDICION ANTES DE LA SIEMBRA pasto

ORIGEN DE SEMILLAS plantación local

SIEMBRA

FECHA 1953 ESPACIAMIENTO 4 x 4 AREA 4

MATERIAL de vivero a raíz desnuda HERRAMIENTAS pala

SUPERVIVENCIA 60% a los 7 años

REPRODUCCION semillas y renuevos abundantes

LUGAR El Cayo, Hacienda Aychapicho, al S de Quito, 36 km

COMENTARIOS Ahora tiene cubierta de yerba. Antes estaba dedicado al pastoreo. Protegido de pastoreo por 2 años.

ORIGEN DE INFORMACION Mario Cardenas, Dep. Forestal, Min. Fomento, Quito, Ecuador

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Húmedo

PAIS Ecuador PLANTACION 219

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 15 | 22 | | 724 | 20 | |
| 18 | 28 | 32 | 720 | 29 | |

SITIO

LAT. 1°S LONG. 79°O ELEV. 3000

PRECIPITACION 1200 MESES DE SEQUIA Agosto-Octubre

TEMPERATURA PROMEDIO 12° HELADAS Julio-Noviembre

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 40 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

DRENAJE libre ESTADO DEL SUELO severamente degradado

TOPOGRAFIA plana CONDICION ANTES DE LA SIEMBRA pasto

ORIGEN DE SEMILLAS plantación local

SIEMBRA

FECHA 1942 ESPACIAMIENTO 3 x 3 AREA 1

MATERIAL de vivero a raíz desnuda SUPERVIVENCIA 80% a los 5 años

CUIDO aclareo a los 7 y 13 años

REPRODUCCION semillas y renuevos abundantes

LUGAR Pilgua, Hacienda Aychapicho, al S de Quito 38 km Prov. de Pichincha

COMENTARIOS Pastore intenso por ganado vacuno. Hay aproximadamente 30,000 HA sembradas en tierras altas del Ecuador, de 3600 a 1500 m de altitud, con varios espaciamientos y tratamientos.

ORIGEN DE INFORMACION Mario Cardenas, Dept. Forestal, Min. Fomento, Quito, Ecuador

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Húmedo

PAIS Ecuador PLANTACION 237

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 9 | 21 | 1295 | | 9 |

SITIO

LAT. 1°S LONG. 78°0 ELEV. 2800

PRECIPITACION 1001 MESES DE SEQUIA Julio-Sept.

TEMPERATURA PROMEDIO 14° HELADAS Noviembre

ROCA MADRE arena volcánica SUELO residual

TEXTURA DEL SUELO arenoso PROFUNDIDAD 80 cm

TEXTURA DEL SUBSUELO arenoso cascajoso PROFUNDIDAD 2+

REACCION 6.0 DRENAJE libre

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA pastos ralos

ORIGEN DE SEMILLAS plantación de Quito

SIEMBRA

FECHA 1949 ESPACIAMIENTO 2.5 x 2.5 AREA 18

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS pala SUPERVIVENCIA (81% a los 6 años)

CUIDO ninguno

REPRODUCCION semillas abundantes, semillones escasos

LUGAR Lote 12, San Agustín del Cayo, Cotopaxi, 65 km al S de Quito

COMENTARIOS Suelo es de arena volcánica reciente

ORIGEN DE INFORMACION Mario Cardenas, Dept. Forestal, Min. de Fomento, Quito, Ecuador

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Húmedo

PAIS Ecuador PLANTACION 238

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA: VOL. |
| 6 | 5 | 10 | 1588 | 17 |

SITIO

LAT. 1°S LONG. 78°O ELEV. 2800

PRECIPITACION 1001 MESES DE SEQUIA Julio-Sept.

TEMPERATURA PROMEDIO 14° HELADAS noviembre

ROCA MADRE arena volcánica SUELO residual

TEXTURA DEL SUELO arenoso PROFUNDIDAD 80 cm

TEXTURA DEL SUBSUELO arenoso PROFUNDIDAD 2+

DRENAJE libre CONDICION DEL SUELO poco afectado

TOPOGRAFIA plana CONDICION ANTES DE LA SIEMBRA arena

ORIGEN DE SEMILLAS plantación de Quito

SIEMBRA

FECHA 1949 ESPACIAMIENTO 2 x 2

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA (64% a los 6 años)

REPRODUCCION semillones abundantes

LUGAR Lote 16, San Agustín del Cayo, Cotopaxi, Sección Santa María, 65 km al S de Quito

COMENTARIOS Plantación establecida en arenas volcánicas recientes practicamente sin ninguna cubierta de vegetacion. El Eucalyptus ha dominado y mejorado el sitio adverso.

ORIGEN DE INFORMACION Mario Cardenas, Dep. Forestal, Min. de Fomento, Quito, Ecuador

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Húmedo

PAIS Ecuador PLANTACION 239

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 8 | 10 | 1000 | 7 | |

SITIO

LAT. 1°S LONG. 78°0 ELEV. 2800

PRECIPITACION 1001 MESES DE SEQUIA Julio-Sept.

TEMPERATURA PROMEDIO 14° HELADAS Noviembre

ROCA MADRE arena volcánica SUELO residual

TEXTURA DEL SUELO arenoso PROFUNDIDAD 80 cm

TEXTURA DEL SUBSUELO arenoso cascajoso PROFUNDIDAD 2+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

ORIGEN DE SEMILLAS plantación de Quito

SIEMBRA

FECHA 1946 ESPACIAMIENTO 3 x 3

MATERIAL de vivero a raíz desnuda

HERRAMIENTAS pala SUPERVIVENCIA 90% a los 11 años

CUIDO ninguno

REPRODUCCION semillones abundantes

LUGAR Lote #1, San Agustin del Cayo, Cotopaxi, 65 km al S de Quito

COMENTARIOS Plantación establecida en arenas volcánicas recientes y practicamente sin cubierta de vegetación. El Eucalyptus ha dominado y mejorado el sitio. 5% del suelo está ahora cubierto con hierbas 2 pies de alto; pastoreo de ovejas y cerdos.

ORIGEN DE INFORMACION Mario Cardenas, Dep. Forestal, Min. de Fomento, Quito, Ecuador

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Húmedo

PAIS Chile PLANTACION 113

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 8 | 7 | 1287 | 7 | 26 |
| 17 | 22 | 21 | 450 | 18 | 159 |

RENDIMIENTO 130 $m^3$ de puntales de minas/HA de los 16 - 20 años

SITIO

LAT. 37°S LONG. 73°O ELEV. 240

PRECIPITACION 1400 MESES DE SEQUIA Noviembre-Marzo

TEMPERATURA PROMEDIO 13° HELADAS Junio-Octobre

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 12 cm

TEXTURA DEL SUBSUELO arcilloso rojo PROFUNDIDAD 1+

REACCION 7.0 - 8.0 DRENAJE libre

TOPOGRAFIA 20% inclinación

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION tumba y quema FECHA 1942, subplantada 1952

AREA 32

CUIDO limpieza a los 8-10 años al cortarse el piso superior; aclareo a los 4 años para dejar 1500-2000 árboles en el piso bajo

REPRODUCCION semillas y retoños abundantes

LUGAR St. B 3, Fundo Descabosado, Curanilahue, 120 km al S de Concepción

COMENTARIOS Bosque de 2 pisos, reproducido con renuevos y arbolitos en el piso bajo. Entre el piso superior y el bajo hay una diferencia de 10 años. Hay 5300 HA de Eucalyptus que se manejan en esta forma.

ORIGEN DE INFORMACION Troels Bay, Schmith, Sociedad "Colcura", Casilla 22, Lota Alto, Chile

ESPECIE Eucalyptus resinifera

BRUPO ECOLOGICO Templado Húmedo

PAIS Mexico PLANTACION 240

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 14 | 13 | 2014 | | 17 |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2250

PRECIPITACION 1158 MESES DE SEQUIA Oct.-Mayo

TEMPERATURA PROMEDIO 15° HELADAS Dic.-Febrero

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 20

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA inclinación baja ASPECTO 0

CONDICION ANTES DE LA SIEMBRA PASTOS

ORIGEN DE SEMILLAS plantación, origen desconocido

SIEMBRA

PREPARACION ninguna FECHA 1952

ESPACIAMIENTO 2 x 2 AREA 6

MATERIAL de vivero en potes, 80 cm

HERRAMIENTAS pico SUPERVIVENCIA 80% a los 8 años

CUIDO

Limpieza 2 años; poda hasta 8 m a los 3 años

REPRODUCCION semillas abundantes, semillones ausentes

LUGAR Parque Los Remedios

ORIGEN DE INFORMACION Ignacio Narváez Galdeano, Lota y Peña Pobre, Dirección de Recursos Forestales y de Caza, Aquiles Serdán 28, México

ESPECIE Eucalyptus saligna

GRUPO ECOLOGICO Templado Húmedo

PAIS Argentina PLANTACION 114

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 19 | 16 | 1100 | 30 | 242 |
| 11 | 29 | 25 | 320 | 20 | 252 |

SITIO

LAT. 26° 30'S LONG. 54° 40'O ELEV. 150-350

PRECIPITACION 1730 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 20° HELADAS 3/año

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 50-150 cm

TEXTURA DEL SUELO pedregoso REACCION 4.3 - 5.5

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 0 - 20 inclinación

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS plantación -22° 30'S, 47° 30'O; 800 m; Rio Claro, Brazil

SIEMBRA

PREPARACION tumba y quema FECHA (1948 & 1951)

ESPACIAMIENTO 2 x 2 & 2 x 2.5 AREA 1000

MATERIAL de vivero en potes HERRAMIENTAS azada

SUPERVIVENCIA 90%

CUIDO 2 limpiezas el primer año; aclareo al rodal de 11 años a los 7 años; rodal de 8 años sin aclarar

REPRODUCCION ninguna

LUGAR Puerto Piray, Misiones, Argentina

COMENTARIOS Esta especie corrientemente se corta para pasta a los 6 o 7 años, y en suelos buenos produce mas de 25 $m^3$/HA/año. E. grandis y E. alba se siembran por lo regular con esta especie.

ORIGEN DE INFORMACION Lamberto Golfari, Celulosa Argentina, S.A., Casilla Correo 3499, Buenos Aires, Argentina

ESPECIE Eucalyptus viminalis

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 241

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 16 | 20 | 19 | 1000 | | 30 |

SITIO

LAT. 6°N LONG. 76°O ELEV. 2550

PRECIPITACION 1800 MESES DE SEQUIA Dic.-Feb., Junio-Agosto

TEMPERATURA PROMEDIO 15° HELADAS anualmente no

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 2

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

CONDICION ANTES DE LA SIEMBRA bosque secundario

SIEMBRA

PREPARACION corte de maleza FECHA 1944

ESPACIAMIENTO 3 x 3 AREA 0.2

MATERIAL de vivero a raíz desnuda HERRAMIENTAS pico

REPRODUCCION semillas abundantes

LUGAR Gran Vía, Hoya Hidrográfica de Piedras Blancas, Municipio de Medellin

COMENTARIOS Gomosis severa en la corteza, las grietas que se estan formando pueden ser la causa del fracaso de la plantación.

ORIGEN DE INFORMACION Julio Garcia Diaz, Min. de Agric., Sec. de Bosques, Bogotá, Colombia

ESPECIE Khaya senegalensis

GRUPO ECOLOGICO Templado Húmedo

PAIS Cuba PLANTACION 242

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 12 | 10 | 18 |
| 13 | 10 | 19 |

SITIO

LAT. 22°N LONG. 80°O ELEV. 635

PRECIPITACION 1600 MESES DE SEQUIA 6

TEMPERATURA PROMEDIO 19° SUELO aluvial

TEXTURA DEL SUELO franco DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 10% inclinación

CONDICION ANTES DE LA SIEMBRA bosque secundario

SIEMBRA

PREPARACION limpieza FECHA 1942

ESPACIAMIENTO 3 x 3 AREA 12 árboles

MATERIAL de vivero en potes SUPERVIVENCIA 100%

CUIDO no se han hecho ni aclareos ni podas

LUGAR Topes de Collantes, unos cuantos km al N de Trinidad

COMENTARIOS Especie prometedora. Estuvo bajo observación hasta el 1955.

ORIGEN DE INFORMACION Gerardo Budowski, Depto. Recursos Renovables, IICA, Turrialba, Costa Rica

ESPECIE Pinus ayacahuite

GRUPO ECOLOGICO Templado Húmedo

PAIS México PLANTACION 244

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 16 | 8 | 1156 | 18 | |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2540

PRECIPITACION 1180 MESES DE SEQUIA Nov.-Marzo

TEMPERATURA PROMEDIO 13° HELADAS Oct.-Febrero

ROCA MADRE volcánica SUELO aluvial

TEXTURA DEL SUELO franco PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO franco PROFUNDIDAD 1+

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA valle ASPECTO NO

CONDICION ANTES DE LA SIEMBRA cultivado 10 años

ORIGEN DE SEMILLAS bosque natural, San Andrés

SIEMBRA

FECHA 1948 ESPACIAMIENTO 2 x 2 AREA 2

MATERIAL de vivero en potes, 30 cm

HERRAMIENTAS azada SUPERVIVENCIA (46% a los 12 años)

CUIDO poda hasta 2 m a los 10 años

REPRODUCCION flores ausentes

LUGAR San Rafael

COMENTARIOS buena forma

ORIGEN DE INFORMACION Guillermo Aguilar Enriquez, Director de la Unidad Forestal, San Rafael, México

ESPECIE Pinus caribaea

GRUPO ECOLOGICO Templado Húmedo

PAIS Cuba PLANTACION 248

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA:VOL. |
| 14 | 20 | 15 | 1600 | 61 |
| 15 | 11 | 16 | 490 | 30 |

RENDIMIENTO postes a los 15 años

SITIO

LAT. 22°N LONG. 80°O ELEV. 670

PRECIPITACION 1600 MESES DE SEQUIA 9

TEMPERATURA PROMEDIO 19° SUELO residual

TEXTURA DEL SUELO laterita franco arcilloso

PROFUNDIDAD 1+ REACCION 4.5 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 20-40% inclinación

CONDITION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación en Pinar del Río; 22°10'N, 83°50'O; 150 m; 1800 mm

SIEMBRA

FECHA 1940 ESPACIAMIENTO 2 x 3 AREA 10

MATERIAL de vivero en potes

CUIDO aclareo desde abajo a los 15 años

LUGAR Topes de Collantes, al N de Trinidad en el Hospital Antituberculoso

COMENTARIOS Crecimiento muy lento y hubo considerable mortandad antes del aclareo a los 15 años; especie de crecimiento rápido durante los primeros años; el área basimétrica debe mantenerse de 30 a 35 $m^2$/HA.

ORIGEN DE INFORMACION Gerardo Budowski, Depto. Recursos Renovables,

IICa, Turrialba, Costa Rica

ESPECIE Pinus montezuma

GRUPO ECOLOGICO Templado Húmedo

PAIS México PLANTACION 245

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 29 | 39 | 30 | 442 | 39 | |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2800

PRECIPITACION 1280 MESES DE SEQUIA Dic.-Junio

TEMPERATURA 12° HELADAS Diciembre-Febrero

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinación protegida ASPECTO E

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION ninguna FECHA 1931

ESPACIAMIENTO 2 x 3 AREA 5

MATERIAL de vivero en potes, 50 cm

HERRAMIENTAS azada SUPERVIVENCIA (26% a los 29 años)

CUIDO ninguno

REPRODUCCION semillas escasas, semillones ausentes

LUGAR La Venta

COMENTARIOS muy ramoso, plantación mezclada con P. patula

ORIGEN DE INFORMACION Luis Sangri Namur, Unidad Industrial de Explotación Forestal, "Loreto y Peña Pobre", Av. de los Insurgentes Sur No. 3496, Tlalpan, D. F.

ESPECIE Pinus montezuma

GRUPO ECOLOGICO Templado Húmedo

PAIS Mexico PLANTACION 246

CRECIMIENTO

| DOMINANTES Y CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 14 | 6 | 2016 | 18 | |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2470

PRECIPITACION 1180 MESES DE SEQUIA Nov.-Marzo

TEMPERATURA PROMEDIO 13° HELADAS Octubre-Febrero

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 2 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 1+

DRENAJE libre TOPOGRAFIA inclinación baja

ASPECTO S CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION ninguna FECHA 1951

ESPACIAMIENTO 2 x 2 AREA 10+

MATERIAL de vivero en potes, 30 cm HERRAMIENTAS azada

SUPERVIVENCIA (81% a los 9 años)

CUIDO Poda hasta 2 m a los 7 años

REPRODUCCION flores ausentes

LUGAR San Rafael

ORIGEN DE INFORMACION Guillermo Aguilar Enriquez, Director de la Unidad Forestal, San Rafael, Mexico

ESPECIE Pinus patula

GRUPO ECOLOGICO Templado Húmedo

PAIS Mexico PLANTACION 247

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 29 | 34 | 26 | 818 | 39 | |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2800

PRECIPITACION 1280 MESES DE SEQUIA Dic.-Junio

TEMPERATURA PROMEDIO 12° HELADAS Dic.-Febrero

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinación protegida ASPECTO E

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION ninguna FECHA 1931

ESPACIAMIENTO 2 x 3 AREA 5

MATERIAL de vivero en potes, 50 cm

HERRAMIENTAS azada SUPERVIVENCIA (49% a los 29 años)

CUIDO ninguno

REPRODUCCION semillas abundantes, semillones ausentes

LUGAR La Venta

COMENTARIOS plantación mezclada con P. montezuma

ORIGEN DE INFORMACION Luis Sangri Namur, Unidad Industrial de Explotación Forestal, "Loreto y Peña Pobre", Av. de los Insurgentes Sur No. 3496, Tlalpan, D. F.

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ESPECIE Pinus patula

GRUPO ECOLOGICO Templado Húmedo

PAIS Mexico PLANTACION 249

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD : | DAP cm : | ALTURA m | NUM.ARBOLES: | AREA BASIMETRICA:VOL. |
| 11 | 14 | 12 | 2250 | 22 |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2500

PRECIPITACION 1180 MESES DE SEQUIA Noviembre-Marzo

TEMPERATURA PROMEDIO 13° HELADAS Octubre-Febrero

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO arenoso arcilloso fino PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arenoso arcilloso fino

PROFUNDIDAD 1+ REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO no esta degradado

TOPOGRAFIA inclinación baja ASPECTO SO

CONDICION ANTES DE LA SIEMBRA bosque cortado

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION ninguna FECHA 1949

ESPACIAMIENTO 2 x 2 AREA 10+

MATERIAL de vivero en potes, 30 cm

HERRAMIENTAS azada SUPERVIVENCIA 90% a los 11 años

CUIDO poda hasta 3 m a los 7 años

REPRODUCCION semillas abundantes, semillones ausentes

LUGAR San Rafael

COMENTARIOS Buena forma

ORIGEN DE INFORMACION Guillermo Aguilar Enriquez, Director de la Unidad Forestal, San Rafael, Mexico

ESPECIE Pinus patula

GRUPO ECOLOGICO Templado Húmedo

PAIS Mexico PLANTACION 250

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 27 | 33 | 20 | 316 | 18 | |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2300

PRECIPITACION 1160 MESES DE SEQUIA Oct.-Mayo

TEMPERATURA PROMEDIO 15° ROCA MADRE volcánica

SUELO residual TEXTURA DEL SUELO franco arcilloso

PROFUNDIDAD 5 cm TEXTURA DEL SUBSUELO franco arcilloso

PROFUNDIDAD 15 REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinación baja ASPECTO O

CONDICION ANTES DE LA SIEMBRA postos

ORIGEN DE SEMILLAS La Venta

SIEMBRA

PREPARACION ninguna FECHA 1933

ESPACIAMIENTO 4 x 4 AREA 1

MATERIAL de vivero en potes, 80 cm

HERRAMIENTAS pico SUPERVIVENCIA (51% a los 27 años)

CUIDO limpieza 2 años

REPRODUCCION semillas escasas; semillones ausentes

LUGAR Barranca Tecamachalco

COMENTARIOS La forma es buena; ramoso

ORIGEN DE INFORMACION Ignacio Narváez Galdeano, Lota y Peña Pobre, Dirección de Recursos Forestales y de Caza, Aquiles Serdán 28, México

ESPECIE Pinus pinaster

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 225

CRECIMIENTO

| DOMINANTES Y CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 12 | 10 | | 22 | 230 |

SITIO

LAT. 5°N LONG. 74°O ELEV. 3050

PRECIPITACION 1580 MESES DE SEQUIA Junio-Septiembre

TEMPERATURA PROMEDIO 13° HELADAS Diciembre-Febrero

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 60 cm

TEXTURA DEL SUBSUELO arcilloso pesado y pedregoso

PROFUNDIDAD 2 REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 15% inclinación ASPECTO NE

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación en España

SIEMBRA

FECHA 1952 ESPACIAMIENTO 3 x 3 AREA 1

MATERIAL de vivero en potes HERRAMIENTAS pico y pala

SUPERVIVENCIA 95% a los 7 años

CUIDO poda a los 4 años

REPRODUCCION semillas abundantes

LUGAR Lago Neusa, 103 km al N de Bogotá

COMENTARIOS No se da tan bueno como el P. patula en este lugar, pero esta desarrollandose bien en las inclinaciones.

ORIGEN DE INFORMACION Julio Garcia Diaz, Min. de Agricultura, Sec. de Bosques, Bogotá, Colombia

ESPECIE *Pinus pseudostrobus*

GRUPO ECOLOGICO Templado Húmedo

PAIS Guatemala PLANTACION 251

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 62 | 55 | 30 | 174 | | 22 |

RENDIMIENTO 24 $m^3$ a los 52 años

SITIO

LAT. 14°40'N LONG. 90°30'O ELEV. 1500

PRECIPITACION 1150 MESES DE SEQUIA Dic.-Abril

TEMPERATURA PROMEDIO 18° HELADAS Dic.-Enero

ROCA MADRE volcánica SUELO coluvial

TEXTURA DEL SUELO franco PROFUNDIDAD 30 cm

TEXTURA DEL SUBSUELO compacto PROFUNDIDAD 75

REACCION 6.2 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 5 - 12% inclinación

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS 14°38'N, 90°49'O; 1587 m; 1260 mm

SIEMBRA

PREPARACION ninguna FECHA (1898)

AREA 12 MATERIAL arbolitos silvestres

CUIDO aclareo

REPRODUCCION semillas abundantes

LUGAR La Giralda

ORIGEN DE INFORMACION Julio Rodas Z., Jefe de Estudios Forestales, Ministerio de Agricultura, Guatemala

ESPECIE Pinus pseudostrobus

GRUPO ECOLOGICO Templado Húmedo

PAIS Guatemala PLANTACION 252

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA:VOL. |
| 19 | 29 | | 540 | 35 |
| 21 | 36 | 32 | 540 | 37 |

SITIO

LAT. 14° 30'N LONG. 90° 20'0 ELEV. 5500

PRECIPITACION 1016 TEMPERATURA PROMEDIO 13°

HELADAS Diciembre, cada 2 ó 3 años ROCA MADRE volcánica

SUELO residual TEXTURA DEL SUELO franco arcilloso

PROFUNDIDAD 5 cm TEXTURA DEL SUBSUELO franco cascajoso

PROFUNDIDAD 1 REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA 40% inclinación ASPECTO E

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION cultivado FECHA 1931

ESPACIAMIENTO 3 x 3 MATERIAL de vivero en potes

HERRAMIENTAS azada SUPERVIVENCIA 50% a los 20 años

CUIDO 2 limpiezas en 6 años

REPRODUCCION semillas abundantes, semillones escasos

LUGAR Parcela 6, El Pino, 25 km al NE de Guatemala

ORIGEN DE INFORMACION José Gallegos, Director, Escuela de

Capacitación Forestal, Amatitlán, Guatemala

ESPECIE Pinus radiata

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 67

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 13 | 22 | 13 | 1400 | 59 | 492 |

SITIO

LAT. 4°36'N LONG. 74°4'O ELEV. 2750

PRECIPITACION 1001

MESES DE SEQUIA Enero-Marzo, Julio-Sept.

TEMPERATURA PROMEDIO 14° HELADAS 2 meses

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 1+

REACCION 5.1 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 30-50% inclinación

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación del Ecuador

SIEMBRA

FECHA 1946 ESPACIAMIENTO 2 x 2 AREA 4

MATERIAL de vivero en potes

HERRAMIENTAS zapapico SUPERVIVENCIA (56% a los 13 años)

CUIDO poda de algunos árboles

REPRODUCCION flores escasas

LUGAR Mediatorta, 1 km de Bogotá, Colombia

ORIGEN DE INFORMACION Elmo Montenegro, Sección de Bosques, Min. de Agricultura, Apartado Aéreo 11768, Bogotá, Colombia

ESPECIE Pinus radiata

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 226

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 10 | 7 | | 16 | 97 |

SITIO

LAT. 5°N LONG. 74°O ELEV. 3050

PRECIPITACION 1580 MESES DE SEQUIA Junio-Septiembre

TEMPERATURA PROMEDIO 13° HELADAS Diciembre-Febrero

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arcilloso

PROFUNDIDAD 60 cm TEXTURA DEL SUBSUELO arcilloso pesado

PROFUNDIDAD 2 REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 5% inclinación ASPECTO NE

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS California

SIEMBRA

FECHA 1954 ESPACIAMIENTO 3 x 3 AREA 1

MATERIAL de vivero en potes SUPERVIVENCIA 90% a los 5 años

CUIDO poda a los 5 años

REPRODUCCION flores ausentes

LUGAR Lago Neusa, 103 km al N de Bogotá

COMENTARIOS Pinus radiata, muerte recesiva del renuevo principal, formación de escobas de bruja, crecimiento en altura es pobre, aparentemente no se adapta a este sitio. P. patula de Mexico, árboles esparcidos han desarrollado bien en inclinaciones, 18 cm 8 a 9 años.

ORIGEN DE INFORMACION Julio Garcia Diaz, Min. de Agric., Sec. Bosques, Bogotá, Colombia

ESPECIE Pinus radiata

GRUPO ECOLOGICO Templado Húmedo

PAIS Chile PLANTACION 115

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 16 | 20 | 26 | 1243 | 39 | 450 |

RENDIMIENTO 720 m3 a los 30 años, calculado

SITIO

LAT. 37°S LONG. 73°O ELEV. 170

PRECIPITACION 1400 MESES DE SEQUIA Nov.-Marzo

TEMPERATURA PROMEDIO 13° HELADAS Junio-Oct.

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO arcilloso rojo PROFUNDIDAD 1

REACCION 5.0 DRENAJE libre

TOPOGRAFIA 15 - 25% inclinación

CONDICION ANTES DE LA SIEMBRA corta total del bosque

ORIGEN DE SEMILLAS plantación local

SIEMBRA

FECHA 1939 ESPACIAMIENTO 1.5 x 1.5 AREA 71

MATERIAL reproducción natural

SUPERVIVENCIA 100% a los 8 años

CUIDO limpieza hasta 1.5 x 1.5 a los 2 años; aclareos cada 4 años despues de los 10 años; poda a los 6 y 12 años

REPRODUCCION semillones abundantes

LUGAR Rodal A1, Fundo Los Rios, Curanilahue, 120 km al S de Concepción

COMENTARIOS El Sitio #7 Sociedad "Colcura" tiene 14,000 HA de plantaciones de Pinus radiata

ORIGEN DE INFORMACION Troels Bay - Schmith, Casilla 22, Lota Alto, Chile, Sociedad Agrícola y Forestal, "Colcura" S.A.

ESPECIE Pinus radiata

GRUPO ECOLOGICO Templado Húmedo

PAIS Chile PLANTACION 116

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 12 | 15 | 15 | 2260 | 45 | 320 |
| 19 | 21 | 22 | 1306 | 47 | 480 |

RENDIMIENTO 245 $m^3$ de madera de pasta & 35 $m^3$ de trozas para aserrar de los entresaques a los 12 y 24 años

SITIO

LAT. 37°S LONG. 73°O ELEV. 25

PRECIPITACION 1280 MESES DE SEQUIA Noviembre-marzo

TEMPERATURA PROMEDIO 14° HELADAS Junio-Octubre

ROCA MADRE granito SUELO playa

TEXTURA DEL SUELO arena fina PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO arena fina PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

TOPOGRAFIA ligeramente ondulado

CONDICION ANTES DE LA SIEMBRA dunas con hierbas

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION desconocida FECHA 1935
ESPACIAMIENTO 1.5 x 1.5 AREA 110
MATERIAL de vivero a raíz desnuda, 20 cm
HERRAMIENTAS barra SUPERVIVENCIA 51% a los 12 años

CUIDO aclareos cada 4-5 años despues de los 10 años

REPRODUCCION semillas abundantes

LUGAR Playa Laraguate, 60 km al S de Concepción

COMENTARIOS A esta plantación se le hará el último aclareo este año, 1959, dejando 600 árboles/HA. Sitio #3.

ORIGEN DE INFORMACION Troels Bay-Schmith, Sociedad "Colcura", Casilla 22, Lota Alto, Chile

ESPECIE Pinus radiata

GRUPO ECOLOGICO Templado Húmedo

PAIS Chile PLANTACION 117

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 47 | 45 | 39 | 420 | 67 | 1037 |

RENDIMIENTO 17 $m^3$ de madera de pasta & 890 $m^3$ de trozas para aserrar a los 52 años

SITIO

LAT. 37°S LONG. 73°O ELEV. 150

PRECIPITACION 1280 MESES DE SEQUIA Nov.-Marzo

TEMPERATURA PROMEDIO 14° HELADAS Junio-Oct.

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 20 cm

TEXTURA DEL SUBSUELO arcilloso rojo PROFUNDIDAD 90

REACCION 5.0 DRENAJE libre

TOPOGRAFIA inclinaciones hasta 30%

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS Monterey, California

SIEMBRA

PREPARACION desconocida FECHA 1907

AREA 16 MATERIAL de vivero a raíz desnuda

CUIDO limpieza a los 2 años

REPRODUCCION semillas abundantes

LUGAR Rodal D-2, Tundo Tren-Tren, 40 km al S de Concepción, Chile

ORIGEN DE INFORMACION Troels Bay - Schmith, Sociedad "Colcura", Casilla 22, Lota Alto, Chile

ESPECIE Pinus radiata

GRUPO ECOLOGICO Templado Húmedo

PAIS Chile PLANTACION 118

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 19 | 25 | 22 | 786 | 38 | 376 |

RENDIMIENTO 190 $m^3$ de madera de pasta y 550 $m^3$ de trozas para aserrar durante un turno de 30 años, estimado

SITIO

LAT. 37°S LONG. 73°O ELEV. 30

PRECIPITACION 1280 MESES DE SEQUIA Noviembre-Marzo

TEMPERATURA PROMEDIO 14° HELADAS Junio-Agosto

ROCA MADRE arenisca SUELO playa

TEXTURA DEL SUELO arena gruesa PROFUNDIDAD 10 cm

TEXTURA DEL SUBSUELO arena gruesa PROFUNDIDAD 2

REACCION 6.5 DRENAJE libre TOPOGRAFIA llana

ORIGEN DE SEMILLAS plantacion local

SIEMBRA

FECHA 1935 ESPACIAMIENTO 2 x 2 AREA 100

MATERIAL de vivero a raíz desnuda HERRAMIENTAS azada

SUPERVIVENCIA 70% a los 10 años

CUIDO 4 aclareos; 2 podas hasta 6 m

REPRODUCCION semillas abundantes

LUGAR Plantación Buen Retiro en Casilla a 30 km de Concepción

COMENTARIOS El sitio es el más pobre de la zona lo que se refleja en la altura de los árboles. Clasificado como el Sitio #4.

ORIGEN DE INFORMACION Troels Bay - Schmith, Sociedad "Colcura", Casilla 22, Lota Alto, Chile

ESPECIE Pinus radiata

GRUPO ECOLOGICO Templado Húmedo

PAIS Chile PLANTACION 119

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 15 | 10 | 2000 | 28 | 120 |
| 20 | 24 | 24 | 1600 | 51 | 350 |

RENDIMIENTO 90 $m^3$ de madera para pasta a los 10 años; 100 $m^3$ de madera para pasta a los 20 años

SITIO

LAT. 37°38'S LONG. 73°O ELEV. 160

PRECIPITACION 1330 MESES DE SEQUIA 4

TEMPERATURA PROMEDIO 13° ROCA MADRE volcánica

SUELO aluvial TEXTURA DEL SUELO arenoso

TEXTURA DEL SUBSUELO arenoso REACCION 6.0

DRENAJE libre TOPOGRAFIA llana

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS plantación en Monte Aguila, 37°S, 73°O; 140 m; 1330 mm

SIEMBRA

PREPARACION se niveló el terreno FECHA (1939)

ESPACIAMIENTO 2 x 2 AREA 20,000

MATERIAL de vivero a raíz desnuda, 22 cm

HERRAMIENTAS pala SUPERVIVENCIA 85% a los 3 años

CUIDO aclareo a los 8, 12, 16, 20 años

REPRODUCCION ninguna

LUGAR Pinos de Cholguán 550 km al S de Santiago, 120 km al O de Concepción, Chile

COMENTARIOS 20,000 HA de plantaciones de 1 a 36 años de edad

ORIGEN DE INFORMACION Eduardo Zañartu B., Casilla 13232, Santiago, Chile

ESPECIE Pinus taeda

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 253

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | |
|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA: VOL. |
| 15 | 22 | 14 | 630 | 19 |

SITIO

LAT. 6°N LONG. 76°0 ELEV. 2550

PRECIPITACION 1800 MESES DE SEQUIA Dic.-Feb., Jun.-Agto.

TEMPERATURA PROMEDIO 15° HELADAS no todos los años

ROCA MADRE granito SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 2

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO severamente degradado

TOPOGRAFIA plana

SIEMBRA

PREPARACION corte de maleza FECHA 1945

ESPACIAMIENTO 1.7 x 1.7 AREA 0.2

MATERIAL de vivero a raíz desnuda HERRAMIENTAS pico

CUIDO ninguno

REPRODUCCION semillas abundantes

LUGAR La Escuela #66, Hoya Hidrográfica de Piedras Blancas, Municipio de Medellín

ORIGEN DE INFORMACION Julio Garcia Diaz, Min. de Agric., Sec. de Bosques, Bogotá, Colombia

ESPECIE Schinopsis balansae

GRUPO ECOLOGICO Templado Húmedo

PAIS Argentina PLANTACION 120

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 6 | 2 | 4000 | | |

SITIO

LAT. 27°17'S LONG. 59°24'O ELEV. 52

PRECIPITACION 1126 MESES DE SEQUIA Julio-Agosto

TEMPERATURA 21° HELADAS 1 mes

ROCA MADRE (caliza) SUELO aluvial

TEXTURA DEL SUELO arcilloso PROFUNDIDAD 20 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 2+

REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA llana

CONDICION ANTES DE LA SIEMBRA bosque explotado selectivamente

ORIGEN DE SEMILLAS local

SIEMBRA

PREPARACION quema y arado FECHA 1951

ESPACIAMIENTO 1 x 2 AREA 8

MATERIAL de vivero en potes HERRAMIENTAS pala

SUPERVIVENCIA (80% a los 8 años)

CUIDO limpieza anual durante 5 años; poda a los 8 y 10 años

REPRODUCCION ninguna

LUGAR al SE ~~de~~ Resistencia, 65 km y al S ~~de~~ Gral. Obligado, 12 km
Nombre - Reforestación Gral. Obligado, Provincia de Chaco

COMENTARIOS El diámetro se midió en la base de los árboles

ORIGEN DE INFORMACION A.J.A. Valentini, a través de Elias Dabas, Adm. Nacional de Bosques, Min. de Agricultura y Ganadería, Buenos Aires, Argentina

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Templado Húmedo

PAIS Colombia PLANTACION 254

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 15 | 10 | (1637) | 25 | 366 |

SITIO

LAT. 5°N LONG. 74°O ELEV. 3050

PRECIPITACION 1580 MESES DE SEQUIA Junio-Septiembre

TEMPERATURA PROMEDIO 13° HELADAS Diciembre-Febrero

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 60 cm

TEXTURA DEL SUBSUELO arcilloso pesado PROFUNDIDAD 2+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 20% inclinación ASPECTO NE

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación en Bogotá

SIEMBRA

FECHA 1952 ESPACIAMIENTO 2 x 3 AREA 3

MATERIAL de vivero en potes HERRAMIENTAS pala

SUPERVIVENCIA 98% a los 7 años

CUIDO poda a los 7 años

REPRODUCCION semillas abundantes

LUGAR Lago Neusa, 103 km al N de Bogotá

COMENTARIOS Dueño - Banco de la República. Los árboles son muy ramosos, no se han adaptado muy bien al sitio. En sitios inclinados 60% de los árboles tienen mejor forma.

ORIGEN DE INFORMACION Julio Garcia Diaz, Min. de Agricultura, Sec. de Bosques, Bogotá, Colombia

SPECIES Eucalyptus globulus

ECOLOGICAL GROUP Temperate Moist

COUNTRY Chile — PLANTATION 264

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 9 | 20 | 29 | 2170 | 28 | |

SITE

LAT. 37°05'S LONG. 73°10'W ELEV. 110

ANNUAL RAINFALL 1240 DRY MONTHS Nov. - March

AV. TEMPERATURE 13° FROST July - August

PARENT ROCK shale SOIL residual

TOPSOIL TEXTURE none SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 5.0 DRAINAGE free

SOIL STATE severely degraded

TOPOGRAPHY 20% slope ASPECT W

CONDITION AT PLANTING secondary forest

SEED ORIGIN Plantation nearby

PLANTING

PREPARATION cleared DATE 1952

SPACING 2 x 2 AREA 40 STOCK bareroot

TOOLS spade

CARE No thinning or pruning

REPRODUCTION None, seeds produced

LOCATION Stand 3, Fundo Roble Huacho, 1 km SE of Lota, Concepción

COMMENTS Excellent Form

SOURCE Hector Lisboa, Sociedad Agrícola y Forestal Colcura, Lota, Chile

13 - 44

SPECIES Eucalyptus globulus

ECOLOGICAL GROUP Temperate Moist

COUNTRY Chile PLANTATION 265

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 20 | 34 | 43 | 2130 | 38 | |

SITE

LAT. 37°05'S LONG. 73°10'W ELEV. 100

ANNUAL RAINFALL 1240 DRY MONTHS Nov. - March

AV. TEMPERATURE 13 FROST July - August

PARENT ROCK shale SOIL residual

TOPSOIL TEXTURE clay DEPTH 15 cm

SUBSOIL TEXTURE clay DEPTH 1 m. +

REACTION 5.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY 50% slope

ASPECT N CONDITION AT PLANTING secondary forest

SEED ORIGIN plantation nearby

PLANTING

DATE 1941 SPACING 2 x 2 AREA 48.8

STOCK bareroot TOOLS planting bar

SURVIVAL 92% at 20 years

REPRODUCTION None, seeds produced

LOCATION Lot A2, Villagrán, 5 km S. of Lota, Concepción

COMMENTS Mature for mine timbers, form excellent

SOURCE Hector Lisboa, Sociedad Agrícola y Forestal Colcura, Lota, Chile

SPECIES Eucalyptus globulus

ECOLOGICAL GROUP Temperate moist

COUNTRY Chile PLANTATION 266

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 47 | 48 | 37 | 260 | 44 | |

SITE

LAT. 37°05'S LONG. 73°10'W ELEV. 250

ANNUAL RAINFALL 1240 DRY MONTHS November-March

AV. TEMPERATURE 13 FROST July-August

PARENT ROCK Schist SOIL residual

TOPSOIL TEXTURE clay DEPTH 15 cm

SUBSOIL TEXTURE clay DEPTH 15 cm

REACTION 5.0 DRAINAGE free

SOIL STATE little disturbed

TOPOGRAPHY lower slope, 70% ASPECT SW

CONDITION AT PLANTING secondary forest

SEED ORIGIN plantation nearby

PLANTING

PREPARATION cleared DATE 1914

SPACING 2 x 2 AREA 3 STOCK bareroot

TOOLS shovel

REPRODUCTION Abundant

LOCATION Stand 3, Lomas del Ganado, 8 km SE of Lota, Concepción

SOURCE Hector Lisboa, Sociedad Agrícola y Forestal Colcura, Lota, Chile

SPECIES Eucalyptus globulus

ECOLOGICAL GROUP Temperate Moist

COUNTRY Chile PLANTATION 267

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 16 | 26 | 33 | 730 | 39 | |

SITE

LAT. 37°05' S LONG. 73°10'W ELEV. 180

ANNUAL RAINFALL 1240 DRY MONTHS November - March

AV. TEMPERATURE 13 FROST July - August

PARENT ROCK Mica schist SOIL residual

TOPSOIL TEXTURE None SUBSOIL TEXTURE clay

DEPTH 50 cm REACTION 6.0 DRAINAGE free

SOIL STATE severely degraded

TOPOGRAPHY Upper slope, 30% ASPECT N

CONDITION AT PLANTING secondary forest

SEED ORIGIN plantation nearby

PLANTING

PREPARATION cleared DATE 1929

SPACING 2 x 2 AREA 10 STOCK bareroot

TOOLS shovel

REPRODUCTION abundant

LOCATION Cerro Alto, 6 km SE of Lota, Concepción

COMMENTS Coppice after cutting in 1945

SOURCE Hector Lisboa, Sociedad Agrícola y Forestal, Colcura, Lota, Chile

SPECIES Eucalyptus grandis

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 283

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 14 | 38 | 37 | 980 | 55 | |

SITE

LAT. 31°20' S LONG. 58°00' W ELEV. 50

ANNUAL RAINFALL 1120 DRY MONTHS none

AV. TEMPERATURE 19 FROST May - August

PARENT ROCK granite SOIL alluvial

TOPSOIL TEXTURE fine sand DEPTH 50 cm

SUBSOIL TEXTURE sand DEPTH 1 m.+

REACTION 4.5 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY level CONDITION AT PLANTING pasture

SEED ORIGIN plantation in Argentina

PLANTING

PREPARATION plowed and disked DATE Oct., 1947

SPACING 3 x 3 AREA 0.2 STOCK potted

TOOLS shovel SURVIVAL 90% at 14 years

CARE Disked 3 times each of first 3 years

REPRODUCTION seed abundant

LOCATION Colonia Ayuy, 25 km N of Concordia, Entre Rios

COMMENTS Form excellent

SOURCE Raul Rossi, San Martin 122, Concordia, Argentina

SPECIES Eucalyptus grandis

ECOLOGICAL GROUP Temperate Humid

COUNTRY Argentina PLANTATION 284

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 6 | 25 | 21 | 1050 | 30 | |

SITE

LAT. 31°20' S LONG. 58°00' W ELEV. 50

ANNUAL RAINFALL 1120 DRY MONTHS none

AV. TEMPERATURE 19 FROST May - August

PARENT ROCK granitic SOIL alluvial

TOPSOIL TEXTURE sand DEPTH 1 m. +

SUBSOIL TEXTURE sand REACTION 5.5

DRAINAGE free SOIL STATE little disturbed

TOPOGRAPHY level CONDITION AT PLANTING pasture

SEED ORIGIN plantation in Argentina

PLANTING

PREPARATION plowed and disked DATE December 1955

SPACING 3 x 3 AREA 5 STOCK potted

TOOLS shovel SURVIVAL 95% at 6 years

CARE Disked 8 times per year for 2 years

REPRODUCTION seeds abundant

LOCATION Yuqueri, 12 km W of Concordia, Entre Rios

SOURCE Guillermo von Wernich, Concordia, Argentina

SPECIES Eucalyptus saligna

ECOLOGICAL GROUP Temperate Humid

COUNTRY Argentina PLANTATION 285

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 8 | 24 | 25 | 1050 | 25 | |

SITE

LAT. 27°50'S LONG. 56°00' W ELEV. 240

ANNUAL RAINFALL 1348 DRY MONTHS none

AV. TEMPERATURE 21° FROST June - August

PARENT ROCK granite SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 m.+

SUBSOIL TEXTURE clay REACCION 5.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY flat ridge CONDITION AT PLANTING pasture

SEED ORIGIN plantation in Argentina

PLANTING

PREPARATION plowed DATE 1953

SPACING 3 x 3 AREA 4 STOCK potted

TOOLS shovel SURVIVAL 95% at 8 years

REPRODUCTION seed produced

LOCATION 5 km S of San José, Corrientes

SOURCE Lamberto Golfari, Celulosa Argentina S.A. Diagonal Norte 933, Buenos Aires, Argentina

13 - 50

SPECIES Eucalyptus saligna

ECOLOGICAL GROUP Temperate humid

COUNTRY Argentina PLANTATION 286

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 23 | 38 | 43 | 345 | 48 | |

SITE

27°40'S LONG. 55°40' W ELEV. 320

ANNUAL RAINFALL 1708 DRY MONTHS none

AV. TEMPERATURE 20 FROST May - September

PARENT ROCK granitic SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 m.+

REACTION 6.0 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT W

CONDITION AT PLANTING secondary forest

SEED ORIGIN Brazil

PLANTING

PREPARATION cleared DATE 1938

SPACING 2 x 2 AREA 1 STOCK potted

TOOLS shovel

REPRODUCTION seed abundant

LOCATION Estación Forestal, 8 km SW of Leandro Alem, Misiones

COMMENTS Form good

SOURCE Ramón Narciso Gómez, Estación Forestal, Leandro Alem,

Misiones, Argentina

SPECIES Eucalyptus microcorys

ECOLOGICAL GROUP Temperate Humid

COUNTRY Argentina PLANTATION 287

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m. | NO. TREES | BASAL AREA | VOLUME |
| 23 | 40 | 35 | 560 | 32 | |

SITE

LAT. 27°40' S LONG. 55°40'W ELEV. 320

ANNUAL RAINFALL 1708 DRY MONTHS none

AV. TEMPERATURE 20 FROST May - September

PARENT ROCK granitic SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 m. +

SUBSOIL texture clay REACTION 6.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY flat ridge

CONDITION AT PLANTING pasture

SEED ORIGIN Brazil

PLANTING

DATE 1938 SPACING 2 x 2 AREA 1

STOCK potted TOOLS shovel

REPRODUCTION seeds produced

LOCATION Estación Forestal, 8 km SW of Leandro Alem, Misiones

SOURCE Ramón Narciso Gómez, Estación Forestal, Leandro Alem, Misiones, Argentina

13 - 52

SPECIES Eucalyptus maculata

ECOLOGICAL GROUP Temperate Humid

COUNTRY Argentina PLANTATION 288

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 23 | 41 | 34 | 280 | 37 | |

SITE

lat. 27°40' S LONG. 55°40' W ELEV. 320

ANNUAL RAINFALL 1708 DRY MONTHS none

AV. TEMPERATURE 20 FROST May - September

PARENT ROCK granitic SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 m.+

SUBSOIL TEXTURE clay REACTION 6.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY flat ridge

CONDITION AT PLANTING pasture

SEED ORIGIN Brazil

PLANTING

DATE 1938 SPACING 2 x 2 AREA 0.25

STOCK potted TOOLS shovel

REPRODUCTION seed produced

LOCATION Estación Forestal, 8 km SW of Leandro Alem, Misiones

COMMENTS Form excellent

SOURCE Ramón Narciso Gómez, Estación Forestal, Leandro Alem, Misiones, Argentina

SPECIES Eucalyptus maculata

ECOLOGICAL GROUP Temperate Humid

COUNTRY Argentina PLANTATION 289

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 5 | 21 | 21 | 1130 | 21 | |

SITE

LAT. 26°30' S LONG. 54°40' W ELEV. 280

ANNUAL RAINFALL 1733 DRY MONTHS none

AV. TEMPERATURE 20 FROST May - September

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE none SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 6.5 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY 5% slope

ASPECT NE CONDITION AT PLANTING virgin forest

SEED ORIGIN Brazil

PLANTING

PREPARATION cleared DATE 1956

SPACING 2 x 2 AREA 0.1 STOCK potted

TOOLS shovel SURVIVAL 45% at 5 years

REPRODUCTION seeds produced

LOCATION Centro Forestal, Puerto Piray, Misiones

SOURCE Hugo Sartori, Celulosa Argentina, S.A. Puerto Piray, Misiones, Argentina

13 - 54

SPECIES Eucalyptus botryoides

ECOLOGICAL GROUP Temperate Humid

COUNTRY Argentina PLANTATION 290

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 5 | 21 | 25 | 1630 | 26 | |

SITE

LAT. 26°30' S LONG. 54°40' W ELEV. 280

ANNUAL RAINFALL 1733 DRY MONTHS none

AV. TEMPERATURE 20 FROST May - September

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE none SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 6.5 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY 5% slope

ASPECT NE CONDITION AT PLANTING virgin forest

SEED ORIGIN Brazil

PLANTING

PREPARATION cleared DATE 1956 SPACING 2 x 2

AREA 0.1 STOCK potted TOOLS shovel

SURVIVAL 65% at 5 years

REPRODUCTION seeds produced

LOCATION Centro Forestal, Puerto Piray, Misiones

SOURCE Hugo Sartori, Celulosa Argentina, S.A. Puerto Piray,

Misiones, Argentina

SPECIES Eucalyptus propinqua

ECOLOGICAL GROUP Temperate Humid

COUNTRY Argentina PLANTATION 291

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 5 | 17 | 24 | 2000 | 29 | |

SITE

LAT. 26°30' S LONG. 54°40' W ELEV. 280

ANNUAL RAINFALL 1733 DRY MONTHS none

AV. TEMPERATURE 20 FROST May - September

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE none SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 6.5 DRAINAGE free

SOIL STATE little disturbed

TOPOGRAPHY 5% slope ASPECT NE

CONDITION AT PLANTING virgin forest

SEED ORIGIN Brazil

PLANTING

PREPARATION cleared DATE 1956

SPACING 2 x 2 AREA 0.1 STOCK potted

TOOLS shovel SURVIVAL 80% at 5 years

REPRODUCTION seeds produced

LOCATION Centro Forestal, Puerto Piray, Misiones

SOURCE Hugo Sartori, Celulosa Argentina S.A. Puerto Piray

Misiones, Argentina

13 - 56

SPECIES Eucalyptus paniculata

ECOLOGICAL GROUP Temperate Humid

COUNTRY Argentina PLANTATION 292

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 5 | 14 | 18 | 2400 | 22 | |

SITE

LAT. 26°30' S LONG. 54°40' W ELEV. 280

ANNUAL RAINFALL 1733 DRY MONTHS none

AV. TEMPERATURE 20 FROST May - September

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE none SUBSOIL TEXTURE clay

DEPTH 1 m. + REACTION 6.5 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY 5% slope

ASPECT NE CONDITION AT PLANTING virgin forest

SEED ORIGIN Brazil

PLANTING

PREPARATION cleared DATE 1956 SPACING 2 x 2

AREA 0.1 STOCK potted TOOLS shovel

SURVIVAL 95% at 5 years

REPRODUCTION seeds produced

LOCATION Centro Forestal, Puerto Piray, Misiones

SOURCE Hugo Sartori, Celulosa Argentina, S.A. Puerto Piray, Misiones, Argentina

SPECIES Eucalyptus alba

ECOLOGICAL GROUP Temperate humid

COUNTRY Argentina PLANTATION 293

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 5 | 23 | 27 | 1630 | 32 | |

SITE

LAT. 26°30' S LONG. 54°40' W ELEV. 280

ANNUAL RAINFALL 1733 DRY MONTHS none

AV. TEMPERATURE 20 FROST May - September

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE none SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 6.5 DRAINAGE free

SOIL STATE little disturbed

TOPOGRAPHY 5% slope ASPECT NE

CONDITION AT PLANTING virgin forest

SEED ORIGIN Brazil

PLANTING

PREPARATION cleared DATE 1956

SPACING 2 x 2 AREA 0.1 STOCK potted

TOOLS shovel SURVIVAL 65% at 5 years

REPRODUCTION seeds produced

LOCATION Centro Forestal, Puerto Piray, Misiones

COMMENTS Good form

SOURCE Hugo Sartori, Celulosa Argentina, S.A. Puerto Piray, Misiones, Argentina

13 - 58

SPECIES Eucalyptus rudis

ECOLOGICAL GROUP Temperate humid

COUNTRY Argentina PLANTATION 294

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 5 | 23 | 24 | 1200 | 20 | |

SITE

LAT. 26°30' S LONG. 54°40' W ELEV. 280

ANNUAL RAINFALL 1733 DRY MONTHS none

AV. TEMPERATURE 20 FROST May - September

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE none SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 6.5 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY 5% slope

ASPECT NE CONDITION AT PLANTING virgin forest

SEED ORIGIN Brazil

PLANTING

PREPARATION cleared DATE 1956 SPACING 2 x 2

AREA 0.1 STOCK potted TOOLS shovel

SURVIVAL 50% at 5 years

REPRODUCTION seeds produced

LOCATION Centro Forestal, Puerto Piray, Misiones

COMMENTS form fair

SOURCE Hugo Sartori, Celulosa Argentina, S.A., Puerto Piray, Misiones, Argentina

Species Eucalyptus grandis

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 295

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 51 | 49 | 1160 | 99 | |

SITE

LAT. 22°20' LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 10 FROST June - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 1 m.+

REACTION 5.5 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT SE

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Australia

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.1 STOCK potted TOOLS pick

SURVIVAL 49% at 37 years

CARE cleaned yearly

REPRODUCTION seeds abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal, Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

13 - 60

SPECIES Eucalyptus saligna

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 296

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 51 | 49 | 1050 | 74 | |

SITE

LAT. 22°20' S LONG. 47° ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m.+

REACTION 5.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Australia

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.4 STOCK potted TOOLS pick

SURVIVAL 45% at 37 years

CARE cleaned yearly

REPRODUCTION seed abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Guimaraes, Servico Florestal, Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brazil

SPECIES Eucalyptus alba

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 297

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 42 | 48 | 1120 | 73 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20 FROST July - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m.+

REACTION 5.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Java

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.4 STOCK potted TOOLS pick

SURVIVAL 45% at 37 years

CARE cleaned yearly

REPRODUCTION seeds abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of

Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal, Companhia
Paulista de Estradas de Ferro, Caixa 29, Rio Claro,
Sao Paulo, Brazil

SPECIES Eucalyptus paniculata

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 298

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 41 | 41 | 970 | 62 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20° FROST July - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m+

REACTION 5.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Brazil

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.4 STOCK potted TOOLS pick

SURVIVAL 39% at 37 years

CARE cleaned yearly

REPRODUCTION seeds abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro Caixa 29, Rio Claro, Brasil

SPECIES Eucalyptus botryoides

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 299

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 44 | 42 | 830 | 55 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20° FROST July - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m.+

REACTION 5.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Australia

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.4 STOCK potted TOOLS pick

SURVIVAL 37% at 37 years

CARE cleaned yearly

REPRODUCTION seeds abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

COMMENTS Form fair

SOURCE Rubens Foot Guimaraes, Servico Florestal Compania Paulista De Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

13 - 64

SPECIES Eucalyptus citriodora

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 300

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 41 | 41 | 820 | 73 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20 FROST July - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m+

REACTION 5.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Brazil

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.4 STOCK potted TOOLS pick

SURVIVAL 33% at 37 years

CARE cleaned yearly

REPRODUCTION seed abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus punctata

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 301

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 40 | 47 | 920 | 71 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20° FROST July - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m.+

REACTION 5.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Africa

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.4 STOCK potted TOOLS pick

SURVIVAL 37% at 37 years

CARE cleaned yearly

REPRODUCTION seeds abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus maculata

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 302

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 42 | 42 | 45 | 720 | 76 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20° FROST July - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m+

REACTION 5.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Brazil

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.4 STOCK potted TOOLS pick

SURVIVAL 29% at 37 years

CARE cleaned yearly

REPRODUCTION seeds abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus microcorys

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 303

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 37 | 45 | 1000 | 58 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20° FROST July-August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m.+

REACTION 5.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Africa

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.4 STOCK potted TOOLS pick

SURVIVAL 44% at 37 years

CARE cleaned yearly

REPRODUCTION seed abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro Caixa 29, Rio Claro, Brasil

SPECIES Eucalyptus resinifera

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 304

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 40 | 40 | 1040 | 64 | |

SITE

LAT. 20°20' S LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20° FROST July - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m+ REACTION 5.5

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY level

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Australia

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.4 STOCK potted TOOLS pick

SURVIVAL 42% at 37 years

CARE cleaned yearly

REPRODUCTION Seed abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

COMMENTS Excellent form

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil.

SPECIES Eucalyptus propinqua

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 305

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE : | DMB cm : | HEIGHT m | NO.TREES : | BASAL AREA : | VOLUME |
| 42 | 41 | 44 | 1620 | 78 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m.+

REACTION 5.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY 10% slope

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Australia

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.2 STOCK potted TOOLS pick

SURVIVAL 65% at 37 years

CARE cleaned yearly

REPRODUCTION seed abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

COMMENTS Excellent form

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus robusta

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 306

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 42 | 39 | 600 | 74 | |

SITE

LAT. 22°20' S LONG. 47°40' S ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20° FROST July - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2m+ REACTION 6.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY 10% slope

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Brazil

PLANTING

PREPARATION plowed DATE 1919 SPACING 2 x 2

AREA 0.2 STOCK potted TOOLS pick

SURVIVAL 24% at 37 years

CARE cleaned yearly

REPRODUCTION seed abundent

LOCATION Horto Florestal Navarro de Andrade, 4 km from Rio Claro, Sao Paulo

COMMENTS Fair form

SOURCE Rubens Foot Guimaraes, Servico Florestal, Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus tereticornis

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 307

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 41 | 40 | 1120 | 67 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20° FROST July - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m+

REACTION 6.0 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT SE

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Brazil

PLANTING

PREPARATION plowed DATE 1919

SPACING 2 x 2 AREA 0.4 STOCK potted

TOOLS pick SURVIVAL 46% at 37 years

CARE cleaned yearly

REPRODUCTION seed abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E of Rio Claro

SOURCE Rubens Foot Guimaraes, Servico Florestal, Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus pilularis

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 308

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 56 | 50 | 470 | 64 | |

SITE

LAT. 22°20' S LONG. 47°40' S ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20° FROST July-August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m+

REACTION 6.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY 10% slope

ASPECT SE CONDITION AT PLANTING coffee plantation

SEED ORIGIN Brazil

PLANTING

PREPARATION plowed DATE 1919

SPACING 2 x 2 AREA 0.4 STOCK potted

TOOLS pick SURVIVAL 19% at 37 years

CARE cleaned yearly

REPRODUCTION seed abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km from Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal, Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus tereticornis

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 309

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 14 | 24 | 33 | 940 | 24 | |

YIELD 24 $m^3$ cuttings, 16 $m^3$ fence posts, and 42 $m^3$ firewood/Ha.

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 580

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20 FROST July - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH 2 m+

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT SW

CONDITION AT PLANTING Eucalyptus plantation

SEED ORIGIN Rio Claro, Brazil

PLANTING

PREPARATION plowed DATE 1947

SPACING 2 x 2 STOCK potted TOOLS pick

CARE cleaned 2 years, thinned in 1960

REPRODUCTION seed and sprouts abundant

LOCATION Lot 91, Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal, Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus grandis

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 310

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 11 | 28 | 28 | 1500 | 20 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 620

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20° FRONST July-August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE sandy DEPTH 1 cm

SUBSOIL TEXTURE sandy DEPTH 3 m+

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT W

CONDITION AT PLANTING Eucalyptus plantation

SEED ORIGIN Rio Claro, Brazil

PLANTING

PREPARATION plowed DATE 1950

SPACING 2 x 2 STOCK potted

TOOLS pick

CARE cleaned 2 years, thinned in 1960

REPRODUCTION seed and sprouts abundant

LOCATION Lot 87, Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal, Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus saligna

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 311

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 13 | 29 | 35 | 800 | 16 | |

YIELD 24 $m^3$ cuttings, 16 $m^3$ fence posts, and 42 $m^3$ firewood/Ha.

SITE

LAT. 22°20' S LONG. 47°40' S ELEV. 610

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20° FROST July-August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE sandy DEPTH 1 cm

SUBSOIL TEXTURE sandy DEPTH 3 m+

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING Eucalyptus plantation

SEED ORIGIN Rio Claro, Brazil

PLANTING

PREPARATION plowed DATE 1948

SPACING 2 x 2 STOCK potted TOOLS pick

CARE cleaned 2 years, thinned in 1960.

REPRODUCTION seed and sprouts abundant

LOCATION Lot 91, Horto Florestal Navarro de Andrade
4 km E of Rio Claro, Sao Paulo

COMMENTS Some are forked

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia
Paulista de Estradas de Ferro, Caixa 29, Rio Claro,
Sao Paulo, Brasil

SPECIES Eucalyptus alba

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 312

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 13 | 27 | 31 | 750 | 17 | |

YIELD 24 $m^3$ cuttings, 16 $m^3$ fence posts, and 42 $m^3$ firewood/Ha.

SITE

LAT. 22°20' S LONG. 47°40' S ELEV. 610

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20° FROST July-August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE sandy DEPTH 1 cm

SUBSOIL TEXTURE sandy DEPTH 3 m+ REACTION 5.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY level

CONDITION AT PLANTING Eucalyptus plantation

SEED ORIGIN Rio Claro, Sao Paulo, Brazil

PLANTING

PREPARATION plowed DATE 1948 SPACING 2 x 2

STOCK potted TOOLS pick

CARE cleaned 2 years, thinned in 1960

REPRODUCTION seed and sprouts abundant

LOCATION Lot 91, Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus citriodora

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brasil PLANTATION 313

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 16 | 20 | 31 | 710 | 16 | |

YIELD 78 $m^3$ fenceposts and 304 $m^3$ firewood/Ha.

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20° FROST July - August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE sandy DEPTH 1 cm

SUBSOIL TEXTURE sandy DEPTH 3 m+

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING Eucalyptus plantation

SEED ORIGIN Rio Claro, Brazil

PLANTING

PREPARATION plowed DATE 1945

SPACING 2 x 2 STOCK potted TOOLS pick

CARE cleaned 2 years, thinned in 1960

LOCATION Lot 119, Horto Florestal Navarro de Andrade, 4 km. E. of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal Compenhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus punctata

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 314

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 11 | 21 | 30 | 2200 | 34 | |

SITE

LAT. 22°20' S LONG. 47°40 W ELEV. 630

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK basalt SOIL residual

SUBSOIL TEXTURE clayey DEPTH 3 m+

REACTION 6.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING Eucalyptus plantation

SEED ORIGIN Rio Claro, Brazil

PLANTING

PREPARATION plowed DATE 1950 SPACING 2 x 2

STOCK potted TOOLS pick

CARE cleaned 2 years

REPRODUCTION seed abundant

LOCATION Lot 106, Horto Florestal Navarro de Andrade 4 km. E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal, Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus microcorys

ECOLCGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 315

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 42 | 44 | 39 | 39 | 40 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 640

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20° FROST July - August

PARENT ROCK basalt SOIL residual

SUBSOIL TEXTURE clayey DEPTH 3 m+

REACTION 6.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY 10% slope

ASPECT N CONDITION AT PLANTING Eucalyptus plantation

SEED ORIGIN Africa

PLANTING

PREPARATION plowed DATE 1919

SPACING 3 x 4 STOCK potted TOOLS pick

CARE several cleanings together with the coffee, thinned in 1954 and 1956

REPRODUCTION seed abundant

LOCATION Lot 3, Horto Florestal Navarro de Andrade 4 km E of Rio Claro, Sao Paulo

COMMENTS Excellent form

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

13 - 80

SPECIES Eucalyptus paniculata

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 316

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 10 | 22 | 30 | 2100 | 33 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 630

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20° FROST July-August

PARENT ROCK basalt SOIL residual

SUBSOIL TEXTURE clayey DEPTH 3 m+

REACTION 6.5 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT N

CONDITION AT PLANTING Eucalyptus plantation

SEED ORIGIN Rio Claro, Brazil

PLANTING

PREPARATION plowed DATE 1951

SPACING 2 x 2 STOCK potted TOOLS pick

CARE cleaned 2 years

REPRODUCTION seed abundant

LOCATION Lot 3, Horto Florestal Navarro de Andrade, 4 km. E of Rio Claro, Sao Paulo

COMMENTS Excellent form

SOURCE Rubens Foot Guimaraes, Servico Florestal, Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus resinifera

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil                                                    PLANTATION 317

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 66 | 49 | 190 | 27 | |

SITE

LAT. 22°20' S        LONG. 47°40' W        ELEV. 630

ANNUAL RAINFALL 1300        DRY MONTHS June - August

AV. TEMPERATURE 20°        FROST July - August

PARENT ROCK basalt        SOIL residual

SUBSOIL TEXTURE clayey        DEPTH 3 m+

REACTION 6.5        DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope        ASPECT N

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Australia

PLANTING

PREPARATION plowed        DATE 1919

SPACING 3 x 4        STOCK potted        TOOLS pick

CARE several cleanings together with the coffee, 13 thinnings at 10, 15, 25, 30 years, and annually since 32 years

REPRODUCTION seed and sprouts abundant

LOCATION Lot 9, Horto Florestal Navarro de Andrade, 4 Km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

13 - 82

SPECIES Eucalyptus paniculata

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 318

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 46 | 46 | 270 | 34 | |

YIELD 17 $m^3$ cuttings; 190 $m^3$ fence posts; 156 $m^3$ firewood/Ha.

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 650

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20° FROST July-August

PARENT ROCK basalt SOIL residual

SUBSOIL TEXTURE clayey DEPTH 3 m+

REACTION 6.5 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT N

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Rio Claro, Brazil

PLANTING

PREPARATION plowed DATE 1919

SPACING 3 x 3 STOCK potted TOOLS pick

CARE several cleanings together with the coffee, 9 thinnings at 12, 18, and 29 years, annually since 32 years.

REPRODUCTION seed abundant

LOCATION Horto Florestal Navarro de Andrade, 4 km E. of Rio Claro, Sao Paulo

COMMENTS Excellent form

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus tereticornis

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 319

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 44 | 59 | 38 | 190 | 32 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 680

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20° FROST July - August

PARENT ROCK basalt SOIL residual

SUBSOIL TEXTURE clayey DEPTH 3 m+

REACTION 7.0 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT N

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Rio Claro, Brazil

PLANTING

PREPARATION plowed DATE 1917

SPACING 3 x 4 STOCK potted TOOLS pick

CARE several cleanings together with the coffee, thinning at 10, 18, 28, 34 and 38 years.

REPRODUCTION seed abundant, sprouts scarce

LOCATION Lot 22, Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

COMMENTS forked at 10 m high

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus maculata

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 320

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 8 | 17 | 20 | 2350 | 25 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 680

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20° FROST July-August

PARENT ROCK basalt SOIL residual

SUBSOIL TEXTURE clayey DEPTH 3 m+

REACTION 7.0 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT N

CONDITION AT PLANTING Eucalyptus plantation

SEED ORIGIN Rio Claro, Brazil

PLANTING

PREPARATION plowed DATE 1953 SPACING 2 x 2

STOCK potted TOOLS pick

CARE cleaned 2 years

REPRODUCTION seed abundant

LOCATION Lot 26, Horto Florestal Navarro de Andrade 4 km E. of Rio Claro, Sao Paulo

COMMENTS Excellent form

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus saligna

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 321

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 40 | 67 | 46 | 120 | 28 | |

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 680

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July - August

PARENT ROCK basalt SOIL residual

SUBSOIL TEXTURE clayey DEPTH 3 m+

REACTION 6.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING coffee plantation

SEED ORIGIN Rio Claro, Brazil

PLANTING

PREPARATION plowed DATE 1921

SPACING 3 x 4 STOCK potted TOOLS pick

CARE several cleanings together with the coffee, several thinnings

REPRODUCTION seed and sprouts abundant

LOCATION Lot 37, Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Eucalyptus microcorys

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 322

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm : | HEIGHT m | NO. TREES: | BASAL AREA: | VOLUME |
| 8 | 19 | 27 | 2350 | 39 | |

SITE

LAT. 22°20' S LONG. 42°40' W ELEV. 600

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20° FROST July-August

PARENT ROCK basalt SOIL residual

SUBSOIL TEXTURE clayey DEPTH 3 m+

REACTION 7.0 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT W

CONDITION AT PLANTING eucalyptus plantation

SEED ORIGIN Rio Claro, Brazil

PLANTING

PREPARATION plowed DATE 1953

SPACING 2 x 2 STOCK potted TOOLS pick

CARE cleaning 2 years

REPRODUCTION seed abundant

LOCATION Lot 56, Horto Florestal Navarro de Andrade, 4 km E of Rio Claro, Sao Paulo

SOURCE Rubens Foot Guimaraes, Servico Florestal Companhia Paulista de Estradas de Ferro, Caixa 29, Rio Claro, Sao Paulo, Brasil

SPECIES Acacia melanoxyla

ECOLOGICAL GROUP Temperate Moist

COUNTRY Chile PLANTATION 325

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 45 | 36 | 37 | | 32 | |

SITE

LAT. 37°05' LONG. 73°10' ELEV. 80

ANNUAL RAINFALL 1240 DRY MONTHS November-March

AV. TEMPERATURE 13° FROST 2 months

PARENT ROCK mica schist SOIL residual

TOPSOIL TEXTURE clay DEPTH 3 cm

SUBSOIL TEXTURE clay DEPTH 30 cm

REACTION 6.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY ridge

ASPECT W CONDITION AT PLANTING secondary forest

PLANTING

DATE 1914 SPACING 2 x 2 AREA 4

STOCK bareroot nursery TOOLS shovel

SURVIVAL 30% at 45 years

REPRODUCTION seeds scarce; sprouts absent

LOCATION 6 km SE of Lota, Province of Concepción

COMMENTS apparently unthinned

SOURCE Hector Lisboa, Sociedad Agr. y Forestal, Colcura, Chile

13 - 88

SPECIES Cupressus macrocarpa

ECOLOGICAL GROUP Temperate Moist

COUNTRY Chile PLANTATION 326

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 40 | 34 | 32 | | | 92 |

SITE

LAT. 37°05' LONG. 73°10' ELEV. 150

ANNUAL RAINFALL 1240 DRY MONTHS November-March

AV. TEMPERATURE 13° FROST 2 months

PARENT ROCK mica schist SOIL residual

TOPSOIL TEXTURE clay DEPTH 4 cm

SUBSOIL TEXTURE clay DEPTH 1 m

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 20% slope ASPECT E

CONDITION AT PLANTING secondary forest

SEED ORIGIN plantation in United States

PLANTING

DATE 1921 SPACING 2 x 2 AREA 2

STOCK bareroot nursery TOOLS shovel

SURVIVAL 70% after 40 years

REPRODUCTION seed abundant; sprouts absent

LOCATION 6 km SE of Lota, Province of Concepción

COMMENTS Excellent form. Needs thinning and pruning

SOURCE Héctor Lisboa, Sociedad Agricola Forestal Colcura, Lota Alto, Chile

SPECIES Pinus radiata

ECOLOGICAL GROUP Temperate Moist

COUNTRY Chile PLANTATION 327

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 20 | 38 | 29 | | 55 | |

SITE

LAT. 36°40' LONG. 73° ELEV. 240

ANNUAL RAINFALL 1338 DRY MONTHS November - March

AV. TEMPERATURE 13° FROST 2 months

PARENT ROCK granite SOIL residual

TOPSOIL TEXTURE clay DEPTH 2 cm

SUBSOIL TEXTURE clay DEPTH deep

REACTION 6.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING cultivated

SEED ORIGIN plantation in Chile

PLANTING

DATE 1941 SPACING 2 x 2 AREA 25

STOCK bareroot nursery TOOLS bar

CARE thinning at 10 - 15 years

REPRODUCTION seeds abundant

LOCATION San Carlos, 8 km N of Pemco, 3 km S of Tome

COMMENTS Maximum diameter in plantation 85 cm. Age checked with increment borer. One ring formed 4 cm. Within 1 km of sea.

SOURCE Hugo Carcano, Galvarino 574, Concepcion, Chile

13 - 90

SPECIES Pinus radiata

ECOLOGICAL GROUP Temperate Moist

COUNTRY Chile PLANTATION 328

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE : | DBH cm : | HEIGHT m | NO. TREES: | BASAL AREA: | VOLUME |
| 12 | 28 | 23 | | 37 | |

SITE

LAT. 36°40' LONG. 73° ELEV. 260

ANNUAL RAINFALL 1338 DRY MONTHS November-March

AV. TEMPERATURE 13° FROST 2 months

PARENT ROCK granite SOIL residual

TOPSOIL TEXTURE clay DEPTH 4 cm

SUBSOIL TEXTURE clay DEPTH deep

REACTION 6.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING cultivated

SEED ORIGIN plantation in Chile

PLANTING

DATE 1949 SPACING 2 x 2 AREA 30

STOCK bareroot nursery TOOLS planting bar

SURVIVAL 80% at 12 years

CARE thinning in 1956; prune to 3 m in 1956.

REPRODUCTION seeds abundant

LOCATION Fundo El Edén, 25 km N of Concepción, 5 km S of Tomé

COMMENTS exposed to sea breezes. Whithin 1 km of sea

SOURCE Hugo Cárcamo, Galvarino 574, Concepción, Chile

SPECIES Pinus radiata

ECOLOGICAL GROUP Temperate Moist

COUNTRY Chile PLANTATION 329

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 19 | 34 | 33 | | 40 | |

YIELD 14 years - 22.8 $m^3$ firewood; 70.2 pulp; 32.4 sawtimber $m^3$/Ha.

SITE

LAT. 36°50' LONG. 73°00' ELEV. 180

ANNUAL RAINFALL 1338 DRY MONTHS November-March

AV. TEMPERATURE 13° FROST 2 months

PARENT ROCK granite SOIL residual

TOPSOIL TEXTURE clay loam DEPTH 4 cm

SUBSOIL TEXTURE clay loam DEPTH 50 cm

REACTION 6.0 DRAINAGE free

SOIL STATE severely degraded

TOPOGRAPHY upper slope, 20% ASPECT W

CONDITION AT PLANTING virgin forest

SEED ORIGIN plantation in Chile

PLANTING

PREPARATION clearcut and burn DATE 1942

SPACING 2 x 2 AREA 50

STOCK bareroot nursery TOOLS planting bar

CARE thinning at 14 years

REPRODUCTION seed abundant, sprouts scarce

LOCATION Fundo San Francisco, 20 km NE of Concepción

COMMENTS Pruned too late. Limby.

SOURCE Hugo Cárcano, Galvarino 574, Concepción, Chile.

SPECIES Pinus caribaea

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 347

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 5 | 8 | 7 | 2300 | 7 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 710

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK granitic SOIL residual

SUBSOIL TEXTURE clay DEPTH deep REACTION 6.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT N

CONDITION AT PLANTING eucalyptus plantation

SEED ORIGIN Cuba

PLANTING

PREPARATION plowed DATE 1957 SPACING 2 x 2

AREA 0.1 STOCK potted TOOLS shovel

SURVIVAL 92% at 5 yrs.

CARE cleaned annually

REPRODUCTION none

LOCATION Lote 21, Horto Florestal Navarro de Andrade, 4 Km E of Rio Claro

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

SPECIES Pinus caribaea

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 348

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 5 | 11 | 8 | 2400 | 13 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 610

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK sandstone SOIL residual

TOPSOIL TEXTURE sand DEPTH 1 cm

SUBSOIL TEXTURE sand DEPTH deep

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING eucalipts

SEED ORIGIN Cuba

PLANTING

PREPARATION plowed DATE 1957

SPACING 2 x 2 AREA 0.1

STOCK potted SURVIVAL 96% at 5 yrs.

CARE cleaned annually

REPRODUCTION none

LOCATION Lote 92, Horto Florestal Navarro de Andrade, 4 Km E of Rio Claro

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

SPECIES Pinus elliottii

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 349

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 6 | 12 | 8 | 2400 | 19 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 610

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK sandstone SOIL residual

TOPSOIL TEXTURE sand DEPTH 1 cm

SUBSOIL TEXTURE sand DEPTH deep REACTION 5.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY level

CONDITION AT PLANTING eucalyptus plantation

PLANTING

PREPARATION plowed DATE 1955 SPACING 2 x 2

AREA 0.1 STOCK potted

SURVIVAL 96% at 6 yrs.

CARE cleaned annually

REPRODUCTION none

LOCATION Lote 92, Horto Florestal Navarro de Andrade, 4 Km E of Rio Claro

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

SPECIES Pinus elliottii

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 350

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 13 | 25 | 14 | 1235 | 39 | |

SITE

LAT. 34°40' S LONG. 61°30' W ELEV. 80

ANNUAL RAINFALL 1029 DRY MONTHS none

AV. TEMPERATURE 16.2 FROST May-September

SOIL alluvial TOPSOIL TEXTURE sandy loam

DEPTH 40 cm SUBSOIL TEXTURE sandy clay

DEPTH deep REACTION 6.0 DRAINAGE free

SOIL STATE little affected TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed DATE 1948

SPACING 2 x 2 AREA 1

STOCK potted TOOLS spade

CARE cleaned 3 yrs, thinned 50% at 10 yrs, pruned to 2.5 m at 6 yrs.

REPRODUCTION few seedlings

LOCATION Parcela 40, Estancia V.P. 20 Km SW of Los Toldos

COMMENTS Form fair to good

SOURCE Enrique Diaz, Estancia V.P. Los Toldos, Province of Buenos Aires, Argentina

13 - 96

SPECIES Pinus elliottii

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 351

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 22 | 31 | 19 | 494 | 28 | |

SITE

LAT. 34°40' S LONG. 61°30' W ELEV. 80

ANNUAL RAINFALL 1029 DRY MONTHS none

AV. TEMPERATURE 16.2 FROST May-September

SOIL alluvial TOPSOIL TEXTURE sandy loam

DEPTH 40 cm SUBSOIL TEXTURE sandy clay

DEPTH deep REACTION 6.0 DRAINAGE free

SOIL STATE little affected TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed DATE 1939 SPACING 2 x 2

AREA 4 STOCK potted

CARE disked 3 yrs., thinned 50% at 17 yrs. and twice thereafter.

REPRODUCTION few seedlings

LOCATION Parcela 38, Estancia V.P., 20 Km SW of Los Toldos

COMMENTS stems with sweep

SOURCE Enrique Diaz, Estancia V.P. Los Toldos, Province of

Buenos Aires, Argentina

SPECIES Pinus elliottii

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 352

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 6 | 10 | 6 | 2400 | 13 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 710

ANNUAL RAINFALL 1300 DRY MONTHS June - August

AV. TEMPERATURE 20 FROST July - August

PARENT ROCK granitic SOIL residual

SUBSOIL TEXTURE clay DEPTH deep

REACTION 6.0 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT N

CONDITION AT PLANTING eucalyptus plantation

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed DATE 1955

SPACING 2 x 2 AREA 0.1 STOCK potted

TOOLS shovel SURVIVAL 96% at 6 yrs.

CARE cleaned annually

REPRODUCTION none

LOCATION Lote 21, Horto Florestal Navarro de Andrade, 4 km E of Rio Claro

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

SPECIES Pinus elliottii

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 353

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 10 | 28 | 15 | 910 | 33 | |

SITE

LAT. 26°30' S LONG. 54°40' W ELEV. 250

ANNUAL RAINFALL 1733 DRY MONTHS none

AV. TEMPERATURE 20 FROST May-September

PARENT ROCK basalt SOIL residual

SUBSOIL TEXTURE clay DEPTH deep REACTION 6.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY 10% upper slope ASPECT NE

CONDITION AT PLANTING virgin forest

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed DATE 1951 SPACING 2 x 3

AREA 17 STOCK potted

CARE lightly thinned at 10 yrs.

REPRODUCTION seedlings rare

LOCATION 19 km E of Puerto Piray, Misiones

COMMENTS form excellent

SOURCE Hugo Sartori, Celulosa Argentina, S.A. Puerto Piray,

Misiones, Argentina

SPECIES Pinus elliottii

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 354

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 12 | 24 | 15 | 1050 | 39 | |

YIELD none

SITE

LAT. 31°20' S LONG. 58°00 W ELEV. 50

ANNUAL RAINFALL 1120 DRY MONTHS none

AV. TEMPERATURE 19 FROST May-August

PARENT ROCK granite SOIL alluvial

TOPSOIL TEXTURE sand DEPTH 50 cm

SUBSOIL TEXTURE yellow clay DEPTH deep

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded

TOPOGRAPHY level CONDITION AT PLANTING pasture

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed & disked DATE 1949

SPACING 3 x 3 AREA 0.5 STOCK bareroot

SURVIVAL 95% at 12 yrs.

CARE disked 3 times for 3 yrs., no thinning or pruning

REPRODUCTION none

LOCATION Establecimiento 9 de julio, Colonia Ayuy, Concordia

COMMENTS Form excellent

SOURCE Raul Rossi, San Martin 122, Concordia, Entre Rios, Argentina

SPECIES Pinus insularis

ECOLOGICAL GROUP Temperate moist

COUNTRY Brazil PLANTATION 355

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 6 | 15 | 14 | 2400 | 35 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 710

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK granitic SOIL residual

SUBSOIL TEXTURE clay DEPTH deep REACTION 6.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT N

CONDITION AT PLANTING eucalyptus plantation

SEED ORIGIN Vietnam

PLANTING

PREPARATION plowed DATE 1955 SPACING 2 x 2

AREA 0.1 STOCK potted TOOLS shovel

SURVIVAL 96% at 6 yrs.

CARE cleaned annually

REPRODUCTION none

LOCATION Lote 21, Horto Florestal Navarro de Andrade, 4 Km E of Rio Claro

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

SPECIES Pinus oocarpa

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 356

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 6 | 14 | 12 | 2400 | 27 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 710

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK granitic SOIL residual

SUBSOIL TEXTURE clay DEPTH deep

REACTION 6.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY 10% slope

ASPECT N CONDITION AT PLANTING eucalyptus plantation

SEED ORIGIN Mexico

PLANTING

PREPARATION plowed DATE 1955 SPACING 2 x 2

AREA 0.1 STOCK potted TOOLS shovel

SURVIVAL 96% at 6 yrs.

CARE cleaned annually

REPRODUCTION none

LOCATION Lote 21, Horto Florestal Navarro de Andrade, 4 Km E of Rio Claro

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

SPECIES Pinus patula

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 357

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 5 | 11 | 9 | 2500 | 19 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 610

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July - August

PARENT ROCK sandstone SOIL residual

TOPSOIL TEXTURE sand DEPTH 1 cm

SUBSOIL TEXTURE sand DEPTH deep

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING eucalyptus plantation

SEED ORIGIN Mexico

PLANTING

PREPARATION plowed DATE 1955 SPACING 2 x 2

AREA 0.1 STOCK potted SURVIVAL 100% at 5 yrs.

CARE cleaned annually

REPRODUCTION none

LOCATION Lote 92, Horto Florestal Navarro de Andrade, 4 Km E of Rio Claro

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

SPECIES Pinus patula

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 358

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 7 | 19 | 21 | 2380 | 38 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47°40' W

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH deep

REACTION 7.0 DRAINAGE impeded

SOIL STATE moderately disturbed TOPOGRAPHY level

CONDITION AT PLANTING secondary forest

SEED ORIGIN Mexico

PLANTING

PREPARATION plowed DATE 1954 SPACING 2 x 2

AREA 0.5 STOCK potted SURVIVAL 95% at 7 yrs.

CARE none

REPRODUCTION none

LOCATION Lote 90, Horto Florestal Navarro de Andrade, 4 km E of Rio Claro

COMMENTS Form only fair

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

SPECIES Pinus taeda

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 359

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 22 | 34 | 18 | 550 | 35 | |

SITE

LAT. 34°40' S LONG. 61°30' W ELEV. 80

ANNUAL RAINFALL 1029 DRY MONTHS none

AV. TEMPERATURE 16 FROST May-September

SOIL alluvial TOPSOIL TEXTURE sandy loam

DEPTH 40 cm SUBSOIL TEXTURE sandy

DEPTH deep REACTION 5.5 DRAINAGE free

SOIL STATE little affected TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed DATE 1939 SPACING 2 x 2

AREA 0.5 STOCK potted TOOLS spade

CARE disked 3 yrs., thinned 60% at 10 yrs, pruned to 2 meters at 6 yrs.

REPRODUCTION seedlings abundant

LOCATION Parcela 38, Estancia V.P. 20 Km SW of Los Toldos

COMMENTS Form better than P. elliottii

SOURCE Enrique Diaz, Estancia V.P. Los Toldos, Buenos Aires, Argentina

SPECIES Pinus taeda

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 360

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 6 | 10 | 6 | 2400 | 12 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 710

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK granitic SOIL residual

SUBSOIL TEXTURE clay DEPTH deep

REACTION 6.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY 10% slope

ASPECT N CONDITION AT PLANTING eucalyptus plantation

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed DATE 1955 SPACING 2 x 2

AREA 0.1 STOCK potted TOOLS shovel

SURVIVAL 96% at 6 yrs.

CARE cleaned annually

REPRODUCTION none

LOCATION Lote 21, Horto Florestal Navarro de Andrade, 4 km E of Rio Claro

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

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SPECIES Pinus taeda

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 361

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 6 | 13 | 8 | 2500 | 22 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 610

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK sandstone SOIL residual

TOPSOIL TEXTURE sand DEPTH 1 cm

SUBSOIL TEXTURE sand DEPTH deep

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING eucalypts plantation

PLANTING

PREPARATION plowed DATE 1955 SPACING 2 x 2

AREA 0.1 STOCK potted SURVIVAL 100% at 6 yrs.

CARE cleaned annually

REPRODUCTION none

LOCATION Lote 92, Horto Florestal Navarro de Andrade, 4 Km al E de Rio Claro

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

SPECIES Pinus taeda

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 362

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 10 | 32 | 20 | 590 | 30 | |

YIELD unknown

SITE

LAT. 26°30' S LONG. 54°40' W ELEV. 240

ANNUAL RAINFALL 1733 DRY MONTHS none

AV. TEMPERATURE 20 FROST May-September

PARENT ROCK Granite SOIL residual

TOPSOIL TEXTURE clay loam DEPTH 1 cm

SUBSOIL TEXTURE clay DEPTH deep REACTION 5.5

DRAINAGE impeded SOIL STATE moderately degraded

TOPOGRAPHY valley bottom CONDITION AT PLANTING swamp

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed DATE 1951 SPACING 2 x 3

AREA 11 STOCK potted

CARE thinned from below at 10 yrs.

REPRODUCTION none

LOCATION 19 km E of Puerto Piray, Misiones

COMMENTS more branchy than P. elliottii

SOURCE Hugo Sartori, Celulosa Argentina, S.A. Puerto Piray, Misiones, Argentina

13 - 108

SPECIES Pinus taeda

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 363

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 12 | 25 | 15 | 1050 | 39 | |

YIELD none

SITE

LAT. 31°20' S LONG. 58° W ELEV. 50

ANNUAL RAINFALL 1120 DRY MONTHS none

AV. TEMPERATURE 18.8 FROST May-August

PARENT ROCK granite SOIL alluvial

TOPSOIL TEXTURE sand DEPTH 50 cm

SUBSOIL TEXTURE yellow clay DEPTH deep

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed & disked DATE 1949

SPACING 3 x 3 AREA 0.5 STOCK bare root

SURVIVAL 95% at 12 yrs.

CARE disked 3 times for 3 yrs., no thinning or pruning

REPRODUCTION none

LOCATION Establecimiento 9 de julio, Colonia Ayuy, Concordia

COMMENTS form excellent

SOURCE Raul Rossi, San Martin 122, Concordia, Entre Rios, Argentina

SPECIES *Araucaria angustifolia*

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 364

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 8 | 8 | 7 | 2300 | 9 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47° 40' W ELEV. 610

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK sandstone SOIL residual

TOPSOIL TEXTURE sand DEPTH 1 cm

SUBSOIL TEXTURE sand DEPTH deep REACTION 5.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY level CONDITION AT PLANTING eucalypts

SEED ORIGIN Brazil

PLANTING

PREPARATION plowed DATE 1954 SPACING 2 x 2

AREA 0.1 STOCK potted SURVIVAL 92% at 8 yrs.

CARE cleaned annually

REPRODUCTION none

LOCATION Lote 92, Horto Florestal Navarro de Andrade, 4 km al E de Rio Claro

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

13 - 110

SPECIES Araucaria angustifolia

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 365

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 17 | 32 | 20 | 555 | 28 | 223 |

YIELD 15 tons pulpwood at 11yrs, 25 tons at 13 yrs, and 20 tons at 16 yrs.

SITE

LAT. 26° 30' S LONG. 54° 40' W ELEV. 150

ANNUAL RAINFALL 1733 DRY MONTHS none

AV. TEMPERATURE 20 FROST May-September

PARENT ROCK basalt SOIL residual

TOPSOIL TEXTURE clay DEPTH deep

SUBSOIL TEXTURE clay DEPTH deep REACTION 6.0

DRAINAGE free SOIL STATE little disturbed

TOPOGRAPHY level CONDITION AT PLANTING virgin forest

SEED ORIGIN natural forest, Argentina

PLANTING

PREPARATION plowed DATE 1944 SPACING 2 x 3

AREA 100 STOCK potted

CARE thinned at 11, 13, and 16 yrs.

REPRODUCTION none

LOCATION Sección 3 A, 3 Km E of Puerto Piray, Misiones

COMMENTS best site locally, excellent form

SOURCE Angel Carlos Bianchi, Celulosa Argentina, S.A.
Puerto Piray, Misiones, Argentina

SPECIES Araucaria angustifolia

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 366

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 20 | 28 | 20 | 1520 | 63 | |

YIELD none

SITE

LAT. 27°40' S LONG. 55°40' W ELEV. 320

ANNUAL RAINFALL 1708 DRY MONTHS none

AV. TEMPERATURE 20.5 FROST May-September

PARENT ROCK granite SOIL residual

TOPSOIL TEXTURE clay DEPTH deep REACTION 6.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY 10% slope ASPECT NW

CONDITION AT PLANTING pasture

SEED ORIGIN natural stand, Misiones, Argentina

PLANTING

DATE 1941 SPACING 2.5 x 2.5 AREA 0.25

SURVIVAL 95% at 20 yrs.

REPRODUCTION none

LOCATION Estación Forestal 8 Km SW of Leandro Alem, Misiones

COMMENTS Form excellent

SOURCE Ramón Narciso Gómez, Estación Forestal Leandro Alem, Misiones, Argentina

13 - 112

SPECIES Cunninghamia lanceolata

ECOLOGICAL GROUP Temperate Moist

COUNTRY Brazil PLANTATION 367

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 8 | 13 | 8 | 2400 | 29 | |

YIELD none

SITE

LAT. 22°20' S LONG. 47°40' W ELEV. 610

ANNUAL RAINFALL 1300 DRY MONTHS June-August

AV. TEMPERATURE 20 FROST July-August

PARENT ROCK sandstone SOIL residual

TOPSOIL TEXTURE sand DEPTH 1 cm

SUBSOIL TEXTURE sand DEPTH deep

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING eucalypts plantation

PLANTING

PREPARATION plowed DATE 1954 SPACING 2 x 2

AREA 0.1 STOCK potted

SURVIVAL 96% at 8 years

CARE cleaned annually

REPRODUCTION none

LOCATION Lote 92, Horto Florestal Navarro de Andrade, 4 Km E of Rio Claro

SOURCE Rubens Foot Guimaraes, Companhia Paulista de Estradas de Ferro, Rio Claro, Sao Paulo, Brazil

SPECIES Cupressus lusitanica

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 368

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 20 | 28 | 18 | 1750 | 46 | |

YIELD none

SITE

LAT. 34°40' S LONG. 61°30' W ELEV. 80

ANNUAL RAINFALL 1029 DRY MONTHS none

AV. TEMPERATURE 16.2 FROST May-September

SOIL alluvial TOPSOIL TEXTURE fine sandy loam

DEPTH 30 cm SUBSOIL TEXTURE fine sandy loam

DEPTH deep REACTION 6.0 at surface, 6.5 at 25 cm

DRAINAGE free SOIL STATE little affected

TOPOGRAPHY level CONDITION AT PLANTING pasture

SEED ORIGIN plantation, Argentina

PLANTING

PREPARATION plowed DATE 1941 SPACING 2 x 2

AREA 1.6 STOCK potted TOOLS spade

SURVIVAL 70% at 20 yrs.

CARE cleaned 2 years, pruned to 2 m at 11 yrs.

REPRODUCTION none

LOCATION Parcela 21, Estancia V.P. 20 Km SW of Los Toldos

COMMENTS Form good but branchy, many suppressed and dying

SOURCE Enrique Diaz, Estancia V.P. Los Toldos, Province of Buenos Aires, Argentina

13 - 114

SPECIES Schizolobium parahybum

ECOLOGICAL GROUP Temperate Moist

COUNTRY Argentina PLANTATION 369

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 10 | 26 | 20 | 2000 | 78 | |

YIELD none

SITE

LAT. 27°40' S LONG. 55°40' W ELEV. 320

ANNUAL RAINFALL 1708 DRY MONTHS none

AV. TEMPERATURE 20 FROST May-September

PARENT ROCK granite SOIL residual

TOPSOIL TEXTURE clay DEPTH deep REACTION 6.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY level CONDITION AT PLANTING pasture

SEED ORIGIN Brazil

PLANTING

DATE 1951 SPACING 2 x 2 AREA 0.1

STOCK bare root SURVIVAL 80% at 10 yrs.

CARE none

REPRODUCTION none

LOCATION Estación Forestal, 8 Km SW of Leandro Alem, Misiones

COMMENTS form good

SOURCE Ramon Narciso Gomez, Estación Forestal, Leandro Alem,

Misiones, Argentina

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Seco

PAIS Colombia PLANTACION 70

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 15 | 9 | 1510 | 17 | 195 |

RENDIMIENTO 880 puntales de minas a los 9 años

SITIO

LAT. 4°49'N LONG. 74°3'O ELEV. 2600

PRECIPITACION 800 MESES DE SEQUIA 6

TEMPERATURA PROMEDIO 14° HELADAS 2 meses

ROCA MADRE arenisca SUELO coluvial

TEXTURA DEL SUELO franco PROFUNDIDAD 40 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 50

REACCION 4.6 DRENAJE impedido

TOPOGRAFIA plana CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantacion al lado de Bogotá

SIEMBRA

FECHA 1950 ESPACIAMIENTO 1.5 x 1.5 AREA 4

MATERIAL de vivero en potes HERRAMIENTAS pico

SUPERVIVENCIA 95% a los 8 años

REPRODUCCION semillas y renuevos abundantes

LUGAR Km 15, Autopista de Bogotá

COMENTARIOS No resiste bien ni las heladas ni los suelos pobres, se esta investigando una enfermedad aparentemente "fungus" que está atacando los árboles.

OIRGEN DE INFORMACION Elmo Montenegro, Sección de Bosques, Min. de Agricultura, Apartado Aéreo 11768, Bogotá, Col.

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Seco

PAIS Colombia PLANTACION 71

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 9 | 11 | 6 | 2000 | 16 | 90 |

SITIO

LAT. 4°49'N LONG. 74°3'0 ELEV. 2600

PRECIPITACION 800 MESES DE SEQUIA 6

TEMPERATURA PROMEDIO 14° HELADAS 2 meses

ROCA MADRE arenisca SUELO coluvial

TEXTURA DEL SUELO franco PROFUNDIDAD 40 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 50

REACCION 4.6 DRENAJE impedido

TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS plantación local

SIEMBRA

FECHA 1950 ESPACIAMIENTO 1.5 x 1.5 AREA 4

MATERIAL de vivero en potes HERRAMIENTAS pico

SUPERVIVENCIA 95% a los 8 años

REPRODUCCION semillas y renuevos abundantes

LUGAR Km 15, Autopista de Bogotá

ORIGEN DE INFORMACION Elmo Montenegro, Ministerio de Agricultura,

Apartado Aéreo 11768, Bogotá, Colombia

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Seco

PAIS Perú PLANTACION 68

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 23 | 22 | 1111 | 45 | 335 |

SITIO

LAT. 8°S LONG. 78°30'O ELEV. 2950

PRECIPITACION 900 MESES DE SEQUIA 6

TEMPERATURA PROMEDIO 13° HELADAS 2 meses

SUELO coluvial TEXTURA DEL SUELO franco arenoso

PROFUNDIDAD 30-50 cm REACCION 6.0 - 7.0

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 40-70% inclinación

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION desconocida FECHA (1949)

ESPACIAMIENTO 3 x 3 AREA 14

MATERIAL de vivero HERRAMIENTAS pala

CUIDO riego por 4 años; 2 limpiezas el primer año

REPRODUCCION semillas abundantes

LUGAR Hacienda Motil, 90 km de Trujillo

COMENTARIOS 200 HA de las siembras de 1 a 40 años de edad

ORIGEN DE INFORMACION Flavio Bazan, Servicio Cooperativo Inter-Americano, Edificio Ministerio del Trabajo, Lima, Perú

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Seco

PAIS Perú PLANTACION 69

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 8 | 16 | 16 | (2250) | | 52 |

SITIO

LAT. 9°54'S LONG. 76°30'O ELEV. 2500

PRECIPITACION 700 MESES DE SEQUIA 6

TEMPERATURA PROMEDIO 14° HELADAS 1 mes

SUELO residual PROFUNDIDAD 40 - 60 cm

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 50 - 70% inclinación

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION limpieza FECHA 1950

ESPACIAMIENTO 2 x 2 AREA 100

MATERIAL de vivero en potes HERRAMIENTAS pala

SUPERVIVENCIA 90% a los 8 años

CUIDO riego por 3 años; limpieza anualmente

REPRODUCCION ninguna

LUGAR Mitotambo, 30 km de Huánuco

ORIGEN DE INFORMACION Flavio Bazan, Servicio Cooperativo Inter-Americano, Edificio Ministerio del Trabajo, Lima, Perú

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Seco

PAIS Perú PLANTACION 76

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 20 | 30 | 30 | 1111 | 80 | 777 |

SITIO

LAT. 8°S LONG. 78°30'O ELEV. 3100

PRECIPITACION 999 MESES DE SEQUIA 6

TEMPERATURA PROMEDIO 12° HELADAS 3 meses

SUELO coluvial TEXTURA DEL SUELO arenoso arcilloso

PROFUNDIDAD 30-50 cm REACCION 6.0 - 7.0

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 40 - 70% inclinación

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS plantación local

SIEMBRA

FECHA 1938 ESPACIAMIENTO 3 x 3 AREA 45

MATERIAL de vivero a raíz desnuda HERRAMIENTAS pala

CUIDO riego por 4 años; 1 o 2 limpiezas por año

REPRODUCCION semillas abundantes

LUGAR Hacienda Chota, 92 km de Trujillo, Perú

COMENTARIOS En este lugar las plantaciones de más de 15 años han sido cortadas y se estan obteniendo nuevas producciones por medio de renuevos. Transición a bosque Templado Húmedo.

ORIGEN DE INFORMACION Flavio Bazan, Servicio Cooperativo Inter-Americano, Edificio Ministerio del Trabajo, Lima, Perú

ESPECIE Eucalyptus robusta

GRUPO ECOLOGICO Templado Seco

PAIS Argentina PLANTACION 121

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 9 | 9 | 1583 | 10 | 89 |

SITIO

LAT. 27°S LONG. 63°O ELEV. 152

PRECIPITACION 544 TEMPERATURA PROMEDIO 20°

HELADAS Mayo-Septiembre TEXTURA DEL SUELO arenoso

PROFUNDIDAD profundo DRENAJE libre

TOPOGRAFIA llana

SIEMBRA

PREPARACION arada y rastrillada FECHA 1948

ESPACIAMIENTO 2 x 2 AREA 0.2

MATERIAL de vivero en potes SUPERVIVENCIA 60% a los 2 años

CUIDO corte de hierbas

REPRODUCCION ninguna

LUGAR Estación Forestal, Fernández, Santiago de Estero, 2 km de Fernández

COMENTARIOS La próxima medición se hará en el 1960 a los 10 años de edad

ORIGEN DE INFORMACION F. J. Cersosimo, por conducto de Elias Dabas, Adm. Nacional de Bosques, Min. de Agricultura y Ganadería, Buenos Aires, Argentina

ESPECIE Eucalyptus tereticornis

GRUPO ECOLOGICO Templado Seco

PAIS Argentina PLANTACION 122

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 14 | 16 | | | 210 |

SITIO

LAT. 24°S LONG. 65°O ELEV. 1100

PRECIPITACION 678 MESES DE SEQUIA Junio-Agosto

TEMPERATURA PROMEDIO 17° HELADAS si

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD variable

REACCION levemente ácida

SIEMBRA

FECHA 1948 ESPACIAMIENTO 2 x 2 AREA 8000

MATERIAL (de vivero) SUPERVIVENCIA 80% a los 10 años

LUGAR Zapla, Gen. Savio, Prov. de Jujuy, Argentina

COMENTARIOS _E. rostrata_ y _E. saligna_ han sido reportados bajo estas mismas condiciones.

ORIGEN DE INFORMACION Luciano E. Romanutti, Altos Hornos Zapla, General Savio, Provincia de Jujuy, Argentina

ESPECIE Eucalyptus viminalis

GRUPO ECOLOGICO Templado Seco

PAIS Venezuela PLANTACION 72

CRECIMIENTO
DOMINANTES Y CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 6 | 8 | 6 |

SITIO
LAT. 9°N LONG. 81°O ELEV. 2700

PRECIPITACION 900 TEMPERATURA PROMEDIO 13°

HELADAS si ROCA MADRE granito SUELO aluvial

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD 70 cm

TEXTURA DEL SUBSUELO pedregoso REACCION 6.0

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 10% inclinación ASPECTO SE

CONDICION ANTES DE LA SIEMBRA pastos

SIEMBRA
FECHA 1950 AREA 66 MATERIAL de vivero

LUGAR "Moconoque" 52 km al NE de Merida, Venezuela

COMENTARIOS Transición a bosques Templado Húmedo y Fresco Húmedo

ORIGEN DE INFORMACION C. Claverie Rodriguez, por conducto de G. H. Raets, Instituto Forestal Latino-Americano, Ap. 36, Merida, Venezuela

ESPECIE Eucalyptus viminalis

GRUPO ECOLOGICO Templado Seco

PAIS Argentina PLANTACION 123

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 11 | 11 | 1761 | 20 | 122 |

SITIO

LAT. 35°40'S LONG. 58°50'O ELEV. 40

PRECIPITACION 847 TEMPERATURA PROMEDIO 16°

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD profundo

ESTADO DEL SUELO poco afectado TOPOGRAFIA llana

SIEMBRA

PREPARACION arado y rastrillado FECHA 1952

ESPACIAMIENTO 2 x 2 AREA 1064

SUPERVIVENCIA 70% a los 2 años

CUIDO corte de hierbas

LUGAR Ruta Nacional #3, Km 28 Provincia de Buenos Aires,

Pte. Sarmiento

COMENTARIOS Se volverá a medir a los 10 años en 1962.

ORIGEN DE INFORMACION F. J. Cersosimo, a traves de Elias Dabas,

Adm. Nacional de Bosques, Min. de Agricultura y Ganaderia,

Buenos Aires, Argentina

ESPECIE *Pinus elliottii elliottii*

GRUPO ECOLOGICO Templado Seco

PAIS Argentina PLANTACION 124

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 15 | 7 | 2000 | 38 | 170 |
| 16 | 25 | 20 | 600 | 30 | 355 |

SITIO

LAT. 34 °S LONG. 59°O ELEV. 1 - 2

PRECIPITACION 950 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 16° HELADAS 10/año

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO limo arenoso

TEXTURA DEL SUBSUELO arenoso REACCION 4.2 - 5.5

DRENAJE impedido TOPOGRAFIA plana, nivel freático 50cm

ORIGEN DE SEMILLAS Southern Seed Co., Baldwin, Ga.

SIEMBRA

PREPARACION arada y emparejada FECHA (1943)

ESPACIAMIENTO 2 x 2.5 AREA 1000

MATERIAL de vivero en potes SUPERVIVENCIA 80%

CUIDO limpieza 2 años; aclareo a los 7 años y despues cada 2 ó 3 años; poda despues de los 5 años

REPRODUCCION semillones escasos

LUGAR Isla Victoria, Delta del Rio Paraná

COMENTARIOS El P. taeda tambien se siembra en el Delta, con un desarrollo mejor que el P. elliottii durante los primeros 20 años. Las plantaciones crecen mejor en terrenos de mayor elevación al borde de los arroyos. En el Delta una plantación de este pino deberá producir mas de 20 $m^3$ de madera descortezada/HA/año.

ORIGEN DE INFORMACION Lamberto Golfari, Celulosa Argentina, S.A., Casilla Correo 3499, Buenos Aires, Argentina

ESPECIE Pinus montezuma

GRUPO ECOLOGICO Templado Seco

PAIS Mexico PLANTACION 255

CRECIMIENTO

| DOMINANTES Y CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 17 | 18 | 11 | 1431 | 25 | |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2400

PRECIPITACION 875 MESES DE SEQUIA Dic.-Junio

TEMPERATURA PROMEDIO 12° HELADAS Oct.-Febrero

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 1+

REACCION 7.0 DRENAJE libre

TOPOGRAFIA loma llana

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS La Venta, Mex.; 19°N; 2800 m

SIEMBRA

PREPARACION limpiar pastos FECHA 1943

ESPACIAMIENTO 2 x 2 AREA 1

MATERIAL de vivero en potes, 30 cm

HERRAMIENTAS azada y pico SUPERVIVENCIA 57% a los 17 años

CUIDO ninguno

REPRODUCCION flores ausentes

LUGAR Zacayucan

COMENTARIOS muy ramoso

ORIGEN DE INFORMACION Luis Sangri Namur, Unidad Industrial de Explotación Forestal, "Loreto y Peña Pobre", Av. de los Insurgentes Sur No. 3496, Tlalpan, D. F.

ESPECIE Pinus patula

GRUPO ECOLOGICO Templado Seco

PAIS Colombia PLANTACION 74

CRECIMIENTO

DOMINANTES & CODOMINANTES / DENSIDAD POR HECTAREA

| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
|---|---|---|---|---|---|
| 25 | 21 | 11 | 1000 | 64 | 570 |

SITIO

LAT. 4°42'N LONG. 74°2'O ELEV. 2700

PRECIPITACION 989 MESES DE SEQUIA 6

TEMPERATURA PROMEDIO 14° HELADAS 2 meses

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 20 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 60

REACCION 5.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 0 - 30% inclinación

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS Mexico

SIEMBRA

FECHA 1934 ESPACIAMIENTO 3 x 3 AREA 3

MATERIAL de vivero en potes HERRAMIENTAS pico

SUPERVIVENCIA (90% a los 25 años)

REPRODUCCION semillones abundantes

LUGAR 1 km de Usaquen, Colombia

COMENTARIOS Ha demostrado buena adaptacion a las condiciones de algunas partes de Colombia. Transición a bosque Templado Húmedo.

ORIGEN DE INFORMACION Elmo Montenegro, Sección de Bosques, Ministerio de Agricultura, Apartado Aéreo 11768, Bogotá, Colombia

ESPECIE Pinus patula

GRUPO ECOLOGICO Templado Seco

PAIS Mexico PLANTACION 256

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 24 | 25 | 16 | 462 | 21 | |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2300

PRECIPITACION 875 MESES DE SEQUIA Dic.-Junio

TEMPERATURA PROMEDIO 16° HELADAS Oct.-Febrero

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO arcilloso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA inclinación baja ASPECTO NE

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS bosque natural en La Venta, 19°N & 2800 m

SIEMBRA

PREPARACION limpieza FECHA 1936

ESPACIAMIENTO 2.5 x 2.5 AREA 4

MATERIAL de vivero en potes, 30 cm HERRAMIENTAS pico y azada

SUPERVIVENCIA 95% al año; 28% a los 24 años

REPRODUCCION semillas viables, semillones ausentes

LUGAR Zacayucan

COMENTARIOS poda natural pobre

ORIGEN DE INFORMACION Luis Sangri Namur, Unidad Industrial de Explotación Forestal "Loreto y Pena Pobre, Av. de los Insurgentes Sur. No. 3496, Tlalpan, D. F.

ESPECIE Pinus taeda

GRUPO ECOLOGICO Templado Seco

PAIS Mexico PLANTACION 257

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 22 | 18 | 11 | 1621 | 28 | |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2400

PRECIPITACION 875 MESES DE SEQUIA Diciembre-Junio

TEMPERATURA PROMEDIO 12° HELADAS Octubre-Febrero

ROCA MADRE volcánica SUELO residual

TEXTURA DEL SUELO franco arcilloso PROFUNDIDAD 5 cm

TEXTURA DEL SUBSUELO franco arcilloso PROFUNDIDAD 1+

REACCION 6.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA loma llana

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS Estados Unidos de América

SIEMBRA

PREPARACION limpieza de círculos FECHA 1938

ESPACIAMIENTO 2 x 2 AREA 1

MATERIAL de vivero en potes

HERRAMIENTAS azada y pico SUPERVIVENCIA 65% a los 22 años

CUIDO ninguno

REPRODUCCION flores ausentes

LUGAR Zacayucan

COMENTARIOS Torcidos, forma pobre

ORIGEN DE INFORMACION Luis Sangri Namur, Unidad Industrial de Explotación Forestal "Loreto y Peña Pobre", Av. de los Insurgentes Sur No. 3496, Tlalpan, D. F.

ESPECIE Populus deltoides

GRUPO ECOLOGICO Templado Seco

PAIS Mexico PLANTACION 258

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 22 | 15 | 275 | 9 | |

SITIO

LAT. 19°N LONG. 99°O ELEV. 2300

PRECIPITACION 980 MESES DE SEQUIA Dic.-Junio

TEMPERATURA PROMEDIO 15° HELADAS Dic.-Febrero

ROCA MADRE volcánica SUELO aluvial

TEXTURA DEL SUELO arcilloso TEXTURA DEL SUBSUELO arcilloso

PROFUNDIDAD 1+ REACCION 8.0 DRENAJE libre

TOPOGRAFIA valle

CONDICION ANTES DE LA SIEMBRA cultivado por muchos años

ORIGEN DE SEMILLAS plantación local

SIEMBRA

FECHA 1954 ESPACIAMIENTO 6 x 6 AREA 5

MATERIAL esquejes, 100 cm HERRAMIENTAS azada

SUPERVIVENCIA 97% a los 6 años

CUIDO Aplastar con disco 3 veces/año; riego mensualmente;

abonado con 13-13-13, 1958-1960

REPRODUCCION flores ausentes

LUGAR Chalco

COMENTARIOS forma excelente

ORIGEN DE INFORMACION Jesus Aldape Rosales, La Imperial

Fábrica de Cerillas, Mexico, D. F.

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ESPECIE Populus deltoides

GRUPO ECOLOGICO Templado Seco

PAIS Mexico PLANTACION 259

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 26 | 32 | 27 | 736 | 34 | |

SITIO

LAT. 19°N LONG. 99°0 ELEV. 2300

PRECIPITACION 984 MESES DE SEQUIA Diciembre-Junio

TEMPERATURA PROMEDIO 15° HELADAS Diciembre-Febrero

ROCA MADRE volcánica SUELO aluvial

TEXTURA DEL SUELO arcilloso TEXTURAL DEL SUBSUELO arcilloso

PROFUNDIDAD 1+ REACCION 8.0 DRENAJE libre

ESTADO DEL SUELO no está degradado TOPOGRAFIA valle

CONDICION ANTES DE LA SIEMBRA cultivado por muchos años

ORIGEN DE SEMILLAS Mississippi, Estados Unidos de América

SIEMBRA

FECHA 1934 ESPACIAMIENTO 3 x 3 AREA 60

MATERIAL esquejes, 100 cm SUPERVIVENCIA 66% a los 26 años

CUIDO pasar disco 3 veces/año cada año; riego mensual; abonado con 13-13-13, 450 kgr/HA/año durante 1956-1960

REPRODUCCION flores ausentes

LUGAR Finca Maderalba, Chalco

COMENTARIOS forma excelente

ORIGEN DE INFORMACION Jesus Aldape Rosales, La Imperial Fabrica de Cerillas, Mexico, D. F.

ESPECIE Populus x euramericana cv. I-214

GRUPO ECOLOGICO Templado Seco

PAIS Argentina PLANTACION 125

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 16 | 15 | 1200 | 23 | 207 |

SITIO

LAT. 34°S LONG. 59°O ELEV. 1 - 2

PRECIPITACION 950 MESES DE SEQUIA ninguno

TEMPERATURA PROMEDIO 16° HELADAS 10/año

ROCA MADRE mixta SUELO aluvial

TEXTURA DEL SUELO limo arenoso

TEXTURA DEL SUBSUELO arenoso REACCION 4.2-5.5

DRENAJE impedido

ESTADO DEL SUELO poco afectado

TOPOGRAFIA plana, nivel freático de 0.5 cm

ORIGEN DE SEMILLAS Valle del Po, Italia

SIEMBRA

PREPARACION apisonar con tractor FECHA (1949)

ESPACIAMIENTO 2 x 3 AREA 2000

MATERIAL esquejes SUPERVIVENCIA 98%

CUIDO limpieza por 2 años; poda a los 2 años

REPRODUCCION semillas escasas

LUGAR Isla Victoria, Delta del Río Paraná

COMENTARIOS Se espera un rendimiento de 20 a 23 $m^3$ de madera de pasta en un turno de explotación de 10-12 años. El Alamo #214 tiene el mayor crecimiento, pero el Alamo #154 es de mayor difusión. De las 100,000 HA de montes en el Delta, 15% es de álamos y 83% de sauces. (S. alba calva y varios híbridos.)

ORIGEN DE INFORMACION Lamberto Golfari, Celulosa Argentina S.A., Casilla Correo 3499, Buenos Aires, Argentina

ESPECIE Populus x euramericana (Dode) Guinier cv I - 214

GRUPO ECOLOGICO Templado Seco

PAIS Argentina PLANTACION 126

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 6 | 14 | 19 | 900 | 14 | 116 |
| 12 | 22 | 23 | 900 | 23 | 350 |

RENDIMIENTO 187 $m^3$ a los 8 años

SITIO

LAT. 34°S LONG. 58°30'O ELEV. 1 - 2

PRECIPITACION 980 MESES DE SEQUIA Enero-Feb., Aug.-Sept.

TEMPERATURA PROMEDIO 18° HELADAS 2 meses

SUELO aluvial TEXTURA DEL SUELO fino

PROFUNDIDAD 90 - 120 cm TEXTURAL DEL SUBSUELO mediano

REACCION 4.5 - 6.5 DRENAJE libre

ESTADO DEL SUELO poco afectado TOPOGRAFIA plana

CONDICION ANTES DE LA SIEMBRA pastos

SIEMBRA

PREPARACION quema y se pasó disco FECHA (1947)

ESPACIAMIENTO 3 x 3 MATERIAL esquejes, 50 cm

SUPERVIVENCIA 97% al año; 90% a los 5 años

CUIDO 3 limpiezas durante 3 años

REPRODUCCION semillas abundantes

LUGAR 54 km al N del pueblo Tigres, Estacion Forestal "D.F. Sarmiento"

ORIGEN DE INFORMACION O. C. Catani, por conducto de Elias Dabas, Adm. Nacional de Bosques, Min. de Agricultura y Ganadería, Buenos Aires, Argentina

ESPECIE Populus euramericana I-154

GRUPO ECOLOGICO Templado Seco

PAIS Argentina PLANTACION 127

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 10 | 10 | 1380 | 14 | 161 |

SITIO

LAT. 35°30'S LONG. 60°0 ELEV. 52

PRECIPITACION 872 TEMPERATURA PROMEDIO 15°

HELADAS Abril-Octubre

TEXTURA DEL SUELO arenoso arcilloso

PROFUNDIDAD muy profundo DRENAJE libre

TOPOGRAFIA llana

SIEMBRA

PREPARACION arado y rastrillado FECHA 1950

ESPACIAMIENTO 2.5 x 2.5 AREA 0.2

MATERIAL esquejes SUPERVIVENCIA 91% al año

CUIDO corte de yerbas

REPRODUCCION ninguna

LUGAR Vivero Forestal 25 de Mayo, 8 km al S del pueblo 25 de Mayo, Prov. de Buenos Aires

COMENTARIOS Próxima medición será a los 10 años de edad, 1960

ORIGEN DE INFORMACION F. J. Cersosimo, por conducto de Elias Dabas, Adm. Nacional de Bosques, Min. de Agricultura y Ganadería, Buenos Aires, Argentina

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Templado Seco

PAIS Colombia PLANTACION 229

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 14 | 11 | 804 | | |

SITIO

LAT. 6°N LONG. 73°O ELEV. 2900

PRECIPITACION 800 MESES DE SEQUIA Diciembre-Febrero

TEMPERATURA PROMEDIO 12° HELADAS Diciembre-Febrero

SUELO aluvial TEXTURA DEL SUELO arenoso

PROFUNDIDAD 50 cm REACCION 5.0

DRENAJE libre TOPOGRAFIA 40% inclinación

ORIGEN DE SEMILLAS local

SIEMBRA

FECHA 1952 ESPACIAMIENTO 2.5 x 3 AREA 250

MATERIAL de vivero en potes SUPERVIVENCIA 60% a los 7 años

CUIDO limpieza anualmente; aclareos cuando son necesarios

REPRODUCCION flores abundantes

LUGAR aproximadamente 7 km al NO de Paz del Rio

ORIGEN DE INFORMACION Jose V. Rodriguez, Min. de Agric. Serv. Tec. Agri., Col. Am. Calle 60 No. 10-09, Bogotá, Colombia

SPECIES Eucalyptus camaldulensis

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 271

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 13 | 37 | 32 | 680 | 44 | |

SITE

LAT. 34°20' S LONG. 58°40' W ELEV. 20

ANNUAL RAINFALL 980 DRY MONTHS none

AV. TEMPERATURE 16 FROST May - September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 30 cm SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 6.0 DRAINAGE impeded

SOIL STATE moderately degraded

TOPOGRAPHY level CONDITION AT PLANTING pasture

SEED ORIGIN plantation in Argentina

PLANTING

PREPARATION plowed DATE 1948 SPACING 2 x 2

AREA 4 STOCK potted TOOLS shovel

SURVIVAL 27% at 13 years

REPRODUCTION seeds abundant

LOCATION Aeropuerto Ezeira, Buenos Aires

COMMENTS poor form

SOURCE Rosario Leonardis, Papelera Argentina S.A., Diagonal Norte 938, Buenos Aires, Argentina

SPECIES Eucalyptus viminalis

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 272

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 15 | 39 | 31 | 880 | 44 | |

SITE

LAT. 34°20' S LONG. 58°40' W ELEV. 20

ANNUAL RAINFALL 980 DRY MONTHS none

AV. TEMPERATURE 16 FROST May - September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 30 cm SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 6.0

DRAINAGE impeded SOIL STATE little disturbed

TOPOGRAPHY level CONDITION AT PLANTING pasture

SEED ORIGIN plantation in Argentina

PLANTING

PREPARATION plowed DATE 1946 SPACING 2 x 2

AREA 10 STOCK potted TOOLS shovel

SURVIVAL 35% at 15 years

REPRODUCTION seeds abundant

LOCATION Aeropuerto Ezeiras, Buenos Aires

COMMENTS form variable

SOURCE Juan Negrotti, Celulosa Argentina, S.A., Diagonal

Norte 938, Buenos Aires, Argentina

SPECIES Eucalyptus maideni

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 273

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 6 | 21 | 22 | 2170 | 33 | |

SITE

LAT. 34°10' S LONG. 59°40' W ELEV. 40

ANNUAL RAINFALL 986 DRY MONTHS none

AV. TEMPERATURE 16 FROST May - September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 30 cm SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 5.5 DRAINAGE impeded

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN plantation in Madagascar

PLANTING

PREPARATION plowed and subsoiled DATE 1954

SPACING 2 x 2 AREA 1 STOCK potted

TOOLS shovel SURVIVAL 85% at 6 years

CARE weeded 2 years

REPRODUCTION seed abundant

LOCATION 3 km NW of Estación Cortines, Buenos Aires

COMMENTS Form excellent

SOURCE Julio van Houtte, Alsina 1475, Buenos Aires, Argentina

14 - 24

SPECIES Eucalyptus viminalis

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 274

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE : | DBH cm : | HEIGHT m | NO.TREES: | BASAL AREA : | VOLUME |
| 9 | 25 | 25 | 1350 | 39 | |

SITE

LAT. 34°10' S LONG. 59°40' W ELEV. 40

ANNUAL RAINFALL 986 DRY MONTHS none

AV. TEMPERATURE 16° FROST May - September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 40 cm SUBSOIL TEXTURE clay DEPTH 1 m.+

REACTION 6.0 DRAINAGE impeded

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN plantation in Argentina

PLANTING

PREPARATION plowed and subsoiled DATE 1952

SPACING 2 x 2 AREA 1 STOCK potted

TOOLS shovel SURVIVAL 80% after 1 year

CARE cleaned for 2 years, thinned every 3 years, heavily in 1959

REPRODUCTION seeds abundant

LOCATION 3 km NW of Estación Cortines, Buenos Aires

SOURCE Julio Van Houtte, Alsina 1475, Buenos Aires, Argentina

SPECIES Eucalyptus macarthuri

ECOLOGICAL GROUP Temperate dry

COUNTRY Argentina PLANTATION 275

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 13 | 29 | 25 | 1160 | 47 | |

SITE

LAT. 34°20'S LONG. 59°00' W ELEV. 30

ANNUAL RAINFALL 980 DRY MONTHS none

AV. TEMPERATURE 16 FROST May - September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 40 cm SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 6.0 DRAINAGE impeded

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN Australia

PLANTING

PREPARATION plowed DATE 1948 SPACING 2 x 2

AREA 0.1 STOCK potted TOOLS shovel

SURVIVAL 45% after 13 years

REPRODUCTION seeds abundant

LOCATION Estación Forestal Castelar, 3 km NW of Morón, Buenos Aires

COMMENTS Form poor above 6 meters

SOURCE J. J. M. García, Estación Forestal Castelar, Casilla de Correo #7, Sucursal Tessei, Province of Buenos Aires, Argentina

SPECIES Eucalyptus sideroxylon

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 276

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 6 | 15 | 12 | 2250 | 30 | |

SITE

LAT. 34°20' S LONG. 59°00' W ELEV. 30

ANNUAL RAINFALL 980 DRY MONTHS none

AV. TEMPERATURE 16 FROST May-September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 40 cm SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 6.5 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN Australia

PLANTING

PREPARATION plowed DATE 1955

SPACING 2 x 2 AREA 0.1 STOCK potted

SURVIVAL 95% after 6 years

REPRODUCTION seeds abundant

LOCATION Estación Forestal Castelar, 3 km NW of Morón, Buenos Aires

COMMENTS Form excellent

SOURCE J. J. M. Garcia, Estación Forestal Castelar, Casilla de Correo #7, Sucursal Tessei, Province of Buenos Aires, Argentina

SPECIES Eucalyptus ovata

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 277

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 8 | 24 | 25 | 1950 | 45 | |

SITE

LAT. 34°20' S LONG. 59°00' W ELEV. 30

ANNUAL RAINFALL 980 DRY MONTHS none

AV. TEMPERATURE 16 FROST May - September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 40 cm SUBSOIL TEXTURE clay

DEPTH 1 m.+ REACTION 6.0 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN Australia

PLANTING

PREPARATION plowed DATE 1953 SPACING 2 x 2

AREA 0.1 STOCK potted TOOLS shovel

SURVIVAL 80% at 8 years

REPRODUCTION seeds abundant

LOCATION Estación Forestal Castelar, 3 km NW of Morón, Buenos Aires

SOURCE Hector Mangeiri, Administración Nacional de Bosques, Azcuénaga 1344, Buenos Aires, Argentina

14 - 28

SPECIES Eucalyptus viminalis

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 278

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 10 | 25 | 20 | 1990 | 41 | |

SITE

LAT. 24°10' S LONG. 61°00' W ELEV. 80

ANNUAL RAINFALL 903 DRY MONTHS none

AV. TEMPERATURE 16 FROST May - September

SOIL alluvial TOPSOIL TEXTURE fine sand

DEPTH 30 cm SUBSOIL TEXTURE sand

DEPTH 1 m.+ REACTION 6.0 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN plantation in Argentina

PLANTING

PREPARATION plowed DATE 1951 SPACING 2 X 2

AREA 11 STOCK potted TOOLS shovel

SURVIVAL 80% at 10 years

CARE disked for 2 years

REPRODUCTION seeds produced

LOCATION Lote 3, Estancia El Soleado, Baigorrita, Junin,

Buenos Aires

COMMENTS Form fair

SOURCE Mario Argentino Copello, El Soleado, Baigorrita, Junín,

Buenos Aires, Argentina

SPECIES Eucalyptus viminalis

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 279

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 41 | 64 | 45 | 410 | 87 | |

SITE

LAT. 36°20' S LONG. 61°40' W ELEV. 120

ANNUAL RAINFALL 718 DRY MONTHS none

AV. TEMPERATURE 15 FROST May - September

PARENT ROCK sandstone SOIL alluvial

TOPSOIL TEXTURE sandy DEPTH 1 m.+

SUBSOIL TEXTURE sandy REACTION 6.0

DRAINAGE free SOIL STATE little disturbed

TOPOGRAPHY level CONDITION AT PLANTING pasture

SEED ORIGIN plantation in Argentina

PLANTING

DATE 1920 SPACING 4 x 4 AREA 2

STOCK potted TOOLS shovel

SURVIVAL 65% after 41 years

REPRODUCTION seed abundant

LOCATION 1 km E of Caseros (Daireaux), Buenos Aires

COMMENTS form excellent

SOURCE Lamberto Golfari, Celulosa Argentina SA, Diagonal

Norte 978, Buenos Aires, Argentina

SPECIES Eucalyptus viminalis

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 280

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 8 | 22 | 21 | 1570 | 34 | |

SITE

LAT. 33°00' S LONG. 60°40' W ELEV. 30

ANNUAL RAINFALL 925 DRY MONTHS none

AV. TEMPERATURE 18 FROST May - September

SOIL alluvial TOPSOIL TEXTURE clay

DEPTH 1 m.+ SUBSOIL TEXTURE clay REACTION 6.0

DRAINAGE impeded SOIL STATE little disturbed

TOPOGRAPHY level CONDITION AT PLANTING cultivated 3 yrs.

SEED ORIGIN Australia

PLANTING

PREPARATION plowed DATE. 1953 SPACING 2.5 x 2.5

AREA 1 STOCK potted TOOLS shovel

SURVIVAL 95% at 8 years

CARE harrowed 2 years, pruned to 2 meters

REPRODUCTION seed produced

LOCATION Andino, 20 km NW of Rosario, Santa Fe

SOURCE Oscar E. Colombo, Celulosa Argentina S.A., Rosario, Santa Fe, Argentina

SPECIES Eucalyptus tereticornis

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 281

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 8 | 22 | 20 | 1570 | 44 | |

SITE

LAT. 33°00' S LONG. 60°40' W ELEV. 30

ANNUAL RAINFALL 925 DRY MONTHS none

AV. TEMPERATURE 18 FROST May - September

SOIL alluvial TOPSOIL TEXTURE silt loam

DEPTH 1 m.+ REACTION 5.5 DRAINAGE impeded

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING cultivated 3 years

SEED ORIGIN plantation in Brazil

PLANTING

PREPARATION plowed DATE 1953

SPACING 2 x 2.5 AREA 8 STOCK potted

TOOLS shovel SURVIVAL 95% after 8 years

CARE cultivated 2 years

REPRODUCTION seeds abundant

LOCATION Andino, 30 km NW of Rosario, Santa Fe

SOURCE Oscar E. Colombo, Celulosa Argentina S.A.,

Rosario, Santa Fe, Argentina

14 - 32

SPECIES Eucalyptus saligna

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 282

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 14 | 36 | 35 | 430 | 30 | |

SITE

LAT. 33°00' S LONG. 60°40'W ELEV. 30

ANNUAL RAINFALL 925 DRY MONTHS none

AV. TEMPERATURE 18 FROST May - September

SOIL alluvial TOPSOIL TEXTURE silt loam

DEPTH 1 m.+ SUBSOIL TEXTURE loam

REACTION 5.5 & 6.0 DRAINAGE impeded

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING cultivated 3 years

SEED ORIGIN plantation in Brazil

PLANTING

PREPARATION plowed DATE 1947

SPACING 2 x 2 AREA 1 STOCK potted

TOOLS shovel

CARE cultivated 2 years, heavily thinned in 1958, pruned to 2 meters

REPRODUCTION seeds and sprouts abundant

LOCATION Andino, 30 km NW of Rosario, Santa Fe

COMMENTS Form good

SOURCE Oscar E. Colombo, Celulosa Argentina, S.A.

Rosario, Santa Fe, Argentina

SPECIES Pinus patula

ECOLOGICAL GROUP Temperate Dry

COUNTRY Colombia PLANTATION 330

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| | 40 | 25 | | | 459 |

SITE

LAT. 4°42' N LONG. 74°2' W ELEV. 2700

ANNUAL RAINFALL 989 DRY MONTHS 6

AV. TEMPERATURE 14° FROST 2 months

PARENT ROCK sandstone SOIL residual

TOPSOIL TEXTURE silty sand & clayey DEPTH 20

SUBSOIL TEXTURE silty sand & clayey DEPTH 60

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY hilly

CONDITION AT PLANTING secondary forest

PLANTING

SPACING 3 x 3 AREA 6

SURVIVAL 73% after 22 years

REPRODUCTION flowers abundant; seed and sprouts scarce

LOCATION 1 km from Usaquén, Cundinamarca

SOURCE Elmo Montenegro, Ing. Forestal, Investigación,

Ministerio de Agricultura, Colombia

SPECIES Pinus patula

ECOLOGICAL GROUP Temperate Dry

COUNTRY Colombia PLANTATION 331

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 22 | 45 | 28 | | | 400 |

SITE

LAT. 4°42' N LONG. 74°21' W ELEV. 2700

ANNUAL RAINFALL 989 DRY MONTHS 6

AV. TEMPERATURE 14° FROST 2 months

PARENT ROCK sandstone SOIL residual

TOPSOIL TEXTURE silty sand & clayey DEPTH 20

REACTION 5.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY hilly

CONDITION AT PLANTING secondary forest

PLANTING

SPACING 3 x 3 AREA .63

SURVIVAL 77% after 22 years

REPRODUCTION flowers abundant; seed and sprouts scarce

LOCATION 1 km from Usaquén, Cundinamarca

COMMENTS Trying to use this forest as an experimental area for the Universidad Distrital

SOURCE Elmo Montenegro, Ing. Forestal Investigación, Ministerio de Agricultura, Colombia

SPECIES Robinia pseudoacacia

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 370

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 9 | 16 | 13 | 990 | 16 | |

YIELD None

SITE

LAT. 34°20' S LONG. 59° ELEV. 30

ANNUAL RAINFALL 980 DRY MONTHS none

AV. TEMPERATURE 16.5 FROST May-September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 40 cm SUBSOIL TEXTURE clay DEPTH deep

REACTION 6.5 at surface, 6.0 at 15 cm DRAINAGE free

SOIL STATE little affected TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN plantation - Argentina

PLANTING

PREPARATION plowed DATE 1952 SPACING 3 x 3

AREA 0.1 STOCK bare root TOOLS spade

SURVIVAL 90% at 9 yrs.

REPRODUCTION few seedlings

LOCATION Estación Forestal Castelar, 3 Km NW of Moron, Province of Buenos Aires

COMMENTS Form fair

SOURCE Ing. J.J.M. García, Estación Forestal Castelar, Casilla de Correo #7, Sucursal Tessei, Buenos Aires, Argentina

14 - 36

SPECIES Gleditsia triacanthos

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 371

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 9 | 12 | 11 | 1100 | 13 | |

YIELD none

SITE

LAT. 34°20' S LONG. 59°W ELEV. 30

ANNUAL RAINFALL 980 DRY MONTHS none

AV. TEMPERATURE 16.5 FROST May-September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 40 cm SUBSOIL TEXTURE clay DEPTH deep

REACTION 7.0 at surface, 6.0 at 15 cm DRAINAGE free

SOIL STATE little affected TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN plantation - Argentina

PLANTING

PREPARATION plowed DATE 1952 SPACING 3 x 3

AREA 0.1 STOCK bare rool

SURVIVAL 100% at 9 yrs.

REPRODUCTION seed but no regeneration

LOCATION Estación Forestal Castelar, 3 Km NW of Moron, Province of Buenos Aires

COMMENTS form good

SOURCE Ing. Hector Mangeiri, Administración Nacional de Bosques, Azcuenaga 1344, Buenos Aires, Argentina

SPECIES Ulmus pumila

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 372

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 6 | (before thinning) | | 2493 | 24 | 127 |
| 6 | (after thinning) | | 2302 | 22 | 122 |
| 10 | 17 | 17 | 1780 | 30 | |

SITE

LAT. 34°10' S LONG. 59°40' W ELEV. 40

ANNUAL RAINFALL 986 DRY MONTHS none

AV. TEMPERATURE 16.5 FROST May-September

SOIL alluvial TOPSOIL TEXTURE heavy clay

DEPTH 5 cm SUBSOIL TEXTURE loam DEPTH deep

REACTION 8.0 on surface, 6.0 at 10 cm

DRAINAGE impeded SOIL STATE little affected

TOPOGRAPHY level CONDITION AT PLANTING pasture

SEED ORIGIN U.S.A., 1939

PLANTING

PREPARATION plowed DATE 1951 SPACING 2 x 2

AREA 2 STOCK potted

SURVIVAL 99% at 6 yrs.

CARE thinned lightly at 6 and 9 yrs, pruned to 6 m. at 9 yrs.

REPRODUCTION sprouts abundant

LOCATION Lote 13, Parcela de Observacion U.P.2, Km 80, 3 Km. NW of Estación

COMMENTS form excellent

SOURCE Julio Van Houtte., Alsina 1475, Buenos Aires, Argentina

SPECIES Populus X euroamericana I 154

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 373

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 16 | 25 | 21 | 370 | 16 | |

SITE

LAT. 33°40' LONG. 59°20' ELEV. 0

ANNUAL RAINFALL 950 DRY MONTHS none

AV. TEMPERATURE 16.5 FROST May-September

PARENT ROCK sedimentary SOIL alluvial

TOPSOIL TEXTURE heavy clay DEPTH deep

SUBSOIL TEXTURE heavy clay DEPTH deep

REACTION 6.0 DRAINAGE impeded

SOIL STATE little affected TOPOGRAPHY level

CONDITION AT PLANTING secondary forest

SEED ORIGIN plantation - Argentina

PLANTING

PREPARATION plowed & disked DATE 1945

SPACING 3 x 1.5 AREA 1 STOCK cuttings

TOOLS shovel

CARE disked every year, thinned 25% at 9 yrs, 25% at 10 yrs, and 10% at 15 yrs, pruned to 3 meters

REPRODUCTION none

LOCATION Tajiber, Seccion 2, Parcela J, 10 Km SE of Campana

COMMENTS form fair, some loss to borers last 5 yrs

SOURCE Jose M. Pizzichini, Casilla #11, Campana, Buenos Aires, Argentina

SPECIES Populus X euroamericana I 154

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 374

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 12 | 19 | 20 | 1045 | 25 | |

SITE

LAT. 34°10' S LONG. 59°40' W ELEV. 40

ANNUAL RAINFALL 986 DRY MONTHS none

AV. TEMPERATURE 16.5 FROST May - September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 50 cm SUBSOIL TEXTURE loam DEPTH deep

REACTION 6.0 DRAINAGE impeded

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN Argentina plantation

PLANTING

PREPARATION plowed DATE 1948

SPACING irregular, 3000/HA AREA 1

STOCK cuttings

CARE pruned first year, thinned lightly almost every year

REPRODUCTION none

LOCATION Km 80 Norte, 3 Km NW Estación Cortines, Province of Buenos Aires

COMMENTS form with slight sweep

SOURCE Julio Van Houtte, Alsina 1475, Buenos Aires, Argentina

14 - 40

SPECIES Populus X euroamericana x214

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 375

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 6 | 18 | 15 | 600 | 16 | |

SITE

LAT. 33°40' S LONG. 59°20' W ELEV. 0

ANNUAL RAINFALL 950 DRY MONTHS none

AV. TEMPERATURE 16.5 FROST May-September

SOIL alluvial TOPSOIL TEXTURE silt loam

DEPTH deep SUBSOIL TEXTURE silt loam DEPTH deep

REACTION 6.0 DRAINAGE impeded

SOIL STATE little affected TOPOGRAPHY level

CONDITION AT PLANTING secondary forest

SEED ORIGIN plantation, Argentina

PLANTING

PREPARATION plowed DATE 1955 SPACING 3 x 3

AREA 1.3 STOCK cuttings TOOLS shovel

CARE disked each year, thinned 25% at 4 yrs, 20% at 6 yrs, pruned to 2 meters

REPRODUCTION none

LOCATION Tajiber, Seccion 4, Parcela A, 10 Km SE of Campana

COMMENTS form better than I 154

SOURCE José M. Pizzichini, Casilla #11, Campana, Buenos Aires, Argentina

SPECIES Populus X euroamericana I 214

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 376

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 5 | 19 | 13 | 560 | 16 | |

YIELD none

SITE

LAT. 34°10' S LONG. 61°W ELEV. 80

ANNUAL RAINFALL 903 DRY MONTHS none

AV. TEMPERATURE 16.2 FROST May-September

SOIL alluvial TOPSOIL TEXTURE sandy loam

DEPTH 30 cm SUBSOIL TEXTURE sandy

DEPTH deep REACTION 6.0 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING secondary forest

SEED ORIGIN Argentina plantation

PLANTING

PREPARATION plowed DATE 1956

SPACING 4 x 4 AREA 1 STOCK cuttings

SURVIVAL 95% at 5 yrs.

CARE disked 3 times annually, first 3 yrs.

REPRODUCTION none

LOCATION El Soleado (Baigorrita), 17 km S of Junín

COMMENTS form good, better than variety 262 nearby

SOURCE Mario Argentino Capello, El Soleado, Junín, Argentina

14 - 42

SPECIES Populus pyramidalis

ECOLOGICAL GROUP Temperate Dry

COUNTRY Chile PLANTATION 377

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 23 | 40 | 42 | 450 | 44 | |

SITE

LAT. 34°20' S LONG. 70°50' W ELEV. 230

ANNUAL RAINFALL 562 DRY MONTHS November-March

AV. TEMPERATURE 14 FROST 2 months

PARENT ROCK granite SOIL alluvial

TOPSOIL TEXTURE heavy clay DEPTH deep

SUBSOIL TEXTURE gravelly clay DEPTH deep

REACTION 8.0 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING cultivated

SEED ORIGIN Chile plantation

PLANTING

PREPARATION plowed & cultivated DATE 1938

SPACING double rows, 2x2, by 4 m. AREA 3

STOCK cuttings TOOLS bar SURVIVAL high

CARE Cleaned annually, thinned at 5 & 11 yrs., pruned at 1, 6, and 12 yrs. Irrigated 6 months each year.

REPRODUCTION none

LOCATION Fundo Naicura, 12 Km W of Rosario, O'Higgins Province

SOURCE Ing. Bjorn Herlin, Compañia Agrícola y Forestal Copihue, Casilla 23, Estación Rosario, Chile

SPECIES Populus pyramidalis

ECOLOGICAL GROUP Temperate Dry

COUNTRY Chile PLANTATION 378

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 11 | 31 | 34 | 752 | 32 | |

SITE

LAT. 34°20' S LONG. 70°50' W ELEV. 260

ANNUAL RAINFALL 562 DRY MONTHS November-March

AV. TEMPERATURE 14 FROST 2 months

PARENT ROCK granite SOIL alluvial

TOPSOIL TEXTURE heavy clay DEPTH deep

SUBSOIL TEXTURE gravelly clay DEPTH deep

REACTION 7.5 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING cultivated

SEED ORIGIN Chile plantation

PLANTING

PREPARATION plowed & cultivated DATE 1950

SPACING 2 x 5 AREA 12 STOCK cuttings

TOOLS bar SURVIVAL high

CARE cleaned annually, irrigated 6 months each year, thinned at 5 yrs, pruned first & 6th years (to 4 meters)

REPRODUCTION none

LOCATION Los Culenes Arriba, 12 Km W of Rosario, O'Higgins Province

SOURCE Ing. Bjorn Herlin, Compañia Agrícola y Forestal Copihue, Casilla 23, Estación Rosario, Chile

SPECIES Populus pyramidalis

ECOLOGICAL GROUP Temperate Dry

COUNTRY Chile PLANTATION 379

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 24 | 40 | 39 | 605 | 57 | |

SIZE

LAT. 34°20' S LONG. 70°50' W ELEV. 240

ANNUAL RAINFALL 562 DRY MONTHS November-March

AV. TEMPERATURE 14° FROST 2 months

PARENT ROCK granite SOIL alluvial

TOPSOIL TEXTURE clay loam DEPTH deep

SUBSOIL TEXTURE gravelly DEPTH deep REACTION 7.5

DRAINAGE free SOIL STATE little degraded

TOPOGRAPHY valley CONDITION AT PLANTING cultivated

SEED ORIGIN Chile plantation

PLANTING

PREPARATION plowed & disked DATE 1937

SPACING double rows 2x2 by 4 m. AREA 6

STOCK cuttings TOOLS bar SURVIVAL high

CARE Thinned at 5, 10, and 21 yrs. Pruned first year after each thinning. Fertilized 200 Kilos $P_2O_5$ and 1000 kilos $CaCo_2$/HA when planted. Irrigated 6 months each year.

REPRODUCTION none

LOCATION Fundo Los Sauces, 4 Km S of Rengo, O'Higgins Province

COMMENTS Form excellent

SOURCE Ing. Bjorn Herlin, Compañía Agrícola Forestal Copihue, Casilla 23, Estación Rosario, Chile

SPECIES Populus arnoldo mussolini

ECOLOGICAL GROUP Temperate Dry

COUNTRY Chile PLANTATION 380

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 19 | 45 | 40 | 250 | 25 | |

SITE

LAT. 34°20' S LONG. 70°50' W ELEV. 230

ANNUAL RAINFALL 562 DRY MONTHS November-March

AV. TEMPERATURE 14° FROST 2 months

PARENT ROCK granite SOIL alluvial

TOPSOIL TEXTURE heavy clay DEPTH deep

SUBSOIL TEXTURE gravelly DEPTH deep

REACTION 8.0 DRAINAGE free

SOIL STATE little degraded TOPOGRAPHY valley

CONDITION AT PLANTING cultivated

SEED ORIGIN Italy plantation

PLANTING

PREPARATION plowed and cultivated DATE 1942

SPACING double rows 2 x2 by 4 m AREA 3

STOCK cuttings TOOLS bar SURVIVAL high

CARE weeded annually, thinned early & heavily, pruned early. Fertilized when planted. Irrigated 6 months each year.

REPRODUCTION none

LOCATION Fundo Naicura, 12 Km W of Rosario, O'Higgins Province

COMMENTS form inferior to P. pyramidalis

SOURCE Ing. Bjorn Herlin, Compañia Agrícola y Forestal Copihue, Casilla 23, Estación Rosario, Chile

SPECIES Casuarina cunninghamiana

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 381

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 15 | 26 | 20 | 1600 | 60 | |

YIELD none

SITE

LAT. 34°20' S LONG. 58°40' W ELEV. 20

ANNUAL RAINFALL 980 DRY MONTHS none

AV. TEMPERATURE 16.5 FROST May-September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 40 cm SUBSOIL TEXTURE loam DEPTH deep

REACTION 6.0 DRAINAGE impeded

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN Argentina plantation

PLANTING

PREPARATION plowed DATE 1946 SPACING 2 x 2

AREA 3 STOCK potted SURVIVAL 50% at 15 yrs.

REPRODUCTION seed but no regeneration

LOCATION Parque Ezeiza, Buenos Aires

COMMENTS straight but heavy taper

SOURCE Ing. Rosario Leonardis, Papelera Argentina, Av. Roque Saeny Pena 938, Buenos Aires, Argentina

SPECIES Pinus taeda

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 382

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 13 | 30 | 16 | 990 | 53 | |

YIELD 35 tons pulpwood/ha at 7 yrs and 30 tons at 9 yrs.

SITE

LAT. 33°40' LONG. 59°20'

ANNUAL RAINFALL 950 DRY MONTHS none

AV. TEMPERATURE 16.5 FROST May-September

PARENT ROCK sedimentary SOIL alluvial

TOPSOIL TEXTURE silty loam DEPTH 10 cm

SUBSOIL TEXTURE silty loam DEPTH deep

REACION 6.0 DRAINAGE impeded

SOIL STATE little affected TOPOGRAPHY level

CONDITION AT PLANTING secondary forest

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed DATE 1948

SPACING 2.5 x 2.5 AREA 3 STOCK potted

SURVIVAL 86% at 7 yrs.

CARE Disked 2 yrs, thinned 25% at 7 yrs and 15% at 9 yrs. Pruned to 2 meters at 4 yrs and to 4 meters at 9 yrs.

REPRODUCTION seedlings abundant

LOCATION Tajiber, Sección 4, Parcela C, Cuadro 14, 10 Km SE of Campana

COMMENTS form better than *P. elliottii*

SOURCE Jose M. Pizzichini, Casilla #11, Campana, Buenos Aires, Argentina

14 - 48

SPECIES Pinus taeda

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 383

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 18 | 32 | 15 | 560 | 30 | |

SITE

LAT. 33°00' S LONG. 60°40' W ELEV. 30

ANNUAL RAINFALL 925 DRY MONTHS none

AV. TEMPERATURE 18 FROST May-September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 35 cm SUBSOIL TEXTURE clay DEPTH deep

REACTION 6.0 DRAINAGE impeded

SOIL STATE little affected TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed DATE 1943 SPACING 2 x 3

AREA 5 STOCK potted TOOLS shovel

CARE disked 2 yrs., thinned various times, pruned to 2 meters

REPRODUCTION few seedlings

LOCATION Campo San Fernando, Capitan Bermudez, 12 Km N of Rosario, Santa Fe

COMMENTS more limby than P. elliottii nearby

SOURCE Oscar E. Colombo, Celulosa Argentina, S.A. Andino, Santa Fe, Argentina

SPECIES Pinus elliottii

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 384

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 18 | 29 | 15 | 515 | 23 | |

SITE

LAT. 33°S LONG. 60°40' W ELEV. 30

ANNUAL RAINFALL 925 DRY MONTHS none

AV. TEMPERATURE 18 FROST May - September

SOIL alluvial TOPSOIL TEXTURE clay loam

DEPTH 35 cm SUBSOIL TEXTURE clay DEPTH deep

REACTION 6.0 DRAINAGE impeded

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN U. S. A.

PLANTING

PREPARATION plowed DATE 1943 SPACING 2 x 3

AREA 5 STOCK potted TOOLS shovel

CARE cleaned 2 yrs., thinned various times, pruned to 2 meters.

REPRODUCTION few seedlings

LOCATION Campo San Fernando, Capitan Bermudez, 12 Km N of Rosario, Santa Fe

COMMENTS good form, branches thin

SOURCE Oscar E. Colombo, Celulosa Argentina, S.A., Andino, Santa Fe, Argentina

14 - 50

SPECIES Pinus elliottii

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 385

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 14 | 29 | 19 | 920 | 37 | |

YIELD 30 tons pulpwood/HA at 8 yrs., 25 tons at 11 yrs.

SITE

LAT. 33°40' LONG. 59°20' ELEV. 00

ANNUAL RAINFALL 950 DRY MONTHS none

AV. TEMPERATURE 16.5 FROST May-September

PARENT ROCK sedimentary SOIL alluvial

TOPSOIL TEXTURE silty clay DEPTH 10 cm

SUBSOIL TEXTURE silt DEPTH deep REACTION 6.0

DRAINAGE impeded SOIL STATE little affected

TOPOGRAPHY level CONDITION AT PLANTING pasture

SEED ORIGIN U.S.A.

PLANTING

PREPARATION plowed DATE 1947 SPACING 2.5 x 2.5

AREA 1.5 STOCK potted TOOLS shovel

SURVIVAL 90% at 8 yrs.

CARE disked 2 yrs; thinned 40% in 1955 & 20% in 1958; pruned at years 3 and 8 (to 5 m.)

REPRODUCTION none

LOCATION Tajiber, Sec. 4, Parcela E. Cuadro 4, 10 KM SE of Campana

COMMENTS form good

SOURCE Jose M. Pizzichini, Casilla #11, Campana, Buenos Aires, Argentina

SPECIES Pinus canariensis

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 386

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 42 | 45 | 29 | 535 | 57 | |

Yield none

SITE

LAT. 36°20' LONG. 61°40' W ELEV. 120

ANNUAL RAINFALL 718 DRY MONTHS none

AV. TEMPERATURE 15.3 FROST May-September

PARENT ROCK sandstone SOIL dune

TOPSOIL TEXTURE sand DEPTH deep

SUBSOIL TEXTURE sand DEPTH deep

REACTION 5.0 at surface, 6.0 at 15 cm DRAINAGE free

SOIL STATE little affected TOPOGRAPHY level

CONDITION AT PLANTING pasture

PLANTING

PREPARATION plowed DATE 1919 SPACING 2.5 x 2.5

AREA 0.1 STOCK potted SURVIVAL 33% at 42 yrs.

REPRODUCTION few seedlings

LOCATION Estancia La Larga, Province of Buenos Aires

COMMENTS very limby, many epicormic branches, but erect

SOURCE Dr. Lamberto Golfari, Celulosa Argentina, Diagonal Norte 938, Buenos Aires, Argentina

14 - 52

SPECIES Pinus pinaster

ECOLOGICAL GROUP Temperate Dry

COUNTRY Argentina PLANTATION 387

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 34 | 35 | 15 | 625 | 41 | |

YIELD unknown volume of fuelwood

SITE

LAT. 36°20' S LONG. 61°40' W ELEV. 120

ANNUAL RAINFALL 718 DRY MONTHS none

AV. TEMPERATURE 15.3 FROST May-September

SOIL dune TOPSOIL TEXTURE sand

SUBSOIL TEXTURE sand DEPTH deep REACTION 6.0

DRAINAGE free SOIL STATE little affected

TOPOGRAPHY 15% slope ASPECT SW

CONDITION AT PLANTING pasture

SEED ORIGIN plantation, Argentina

PLANTING

PREPARATION none DATE 1927 SPACING 4 x 4

AREA 1 STOCK potted TOOLS spade

CARE none

REPRODUCTION seedlings & saplings abundant

LOCATION Estancia La Irenita, 15 km S of Caceros, Province of Buenos Aires

COMMENTS very branchy but only pine adapted to this region

SOURCE Los Diaz, Estancia La Irenita, S.A. Caceros, Buenos Aires, Argentina

ESPECIE Pinus radiata

GRUPO ECOLOGICO Templado Muy Seco

PAIS Argentina PLANTACION 129

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 10 | 12 | 11 | 2412 | 27 | 164 |

SITIO

LAT. 32°25'S LONG. 69°O ELEV. 500

PRECIPITACION 193 TEMPERATURA PROMEDIO 16°

HELADAS Junio-Julio TEXTURA DEL SUELO arenoso

PROFUNDIDAD poco profundo DRENAJE libre

TOPOGRAFIA ondulada

SIEMBRA

PREPARACION arado y rastrillado FECHA 1948

ESPACIAMIENTO 2 x 2 AREA 0.2

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 96% al año

CUIDO corte de yerbas

LUGAR Plantación de los Hnos. Mosso, 5 km al O de Tunuyán, Mendoza, Argentina

COMENTARIOS El crecimiento de los árboles en este clima árido probablemente se debe a la presencia de aguas subterráneas. La próxima medición será en 1961 a los 15 años.

ORIGEN DE INFORMACION F. J. Cersosimo, por conducto de Elias Dabas, Adm. Nacional de Bosques, Min. de Agricultura y Ganadería, Buenos Aires, Argentina

ESPECIE Populus euramericana monílifera

GRUPO ECOLOGICO Templado Muy Seco

PAIS Argentina PLANTACION 128

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 5 | 8 | 12 | 1970 | 16 | 172 |
| 9 | 14 | 21 | 1970 | 29 | 310 |

SITIO

LAT. 33°25' S LONG. 69°0 ELEV. 500

PRECIPITACION 193 TEMPERATURA PROMEDIO 16°

HELADAS Junio-Julio TEXTURA DEL SUELO arenoso

PROFUNDIDAD muy profundo DRENAJE libre

TOPOGRAFIA llana

SIEMBRA

PREPARACION arada y rastrillada FECHA 1945

ESPACIAMIENTO 1 x 5 AREA 0.3

MATERIAL de vivero a raíz desnuda

SUPERVIVENCIA 99% al año

CUIDO cortar hierbas

REPRODUCCION ninguna

LUGAR Plantacion de Manuel Ruano e Hijos, 3 km al O de Tunuyan, Prov. Mendoza

COMENTARIOS El crecimiento de árboles en este clima árido probablemente se debe a la presencia de aguas subterráneas. La próxima medición se hará a los 15 años en 1961.

ORIGEN DE INFORMACION F. J. Cersosimo, por conducto de Elias Dabas, Adm. Nacional de Bosques, Min. de Agricultura y Ganadería, Buenos Aires, Argentina.

SPECIES Eucalyptus globulus

ECOLOGICAL GROUP Temperate Very Dry

COUNTRY Chile PLANTATION 263

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 12 | 17 | 19 | 3030 | 28 | |

SITE

LAT. 33°20' S LONG. 71°40' W ELEV. 40

ANNUAL RAINFALL 438 DRY MONTHS November-June

AV. TEMPERATURE 14 FROST July - August

PARENT ROCK granite SOIL residual

TOPSOIL TEXTURE sandy loam DEPTH 10 cm

SUBSOIL TEXTURE sandy loam DEPTH 30 cm

REACTION 6.5 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING pasture

SEED ORIGIN plantation in Chile

PLANTING

PREPARATION plowed DATE 1949

SPACING 2 x 1.5 AREA 4 STOCK potted

TOOLS shovel SURVIVAL 90% after 12 years

REPRODUCTION seed abundant, sprouts scarce

LOCATION 1 km N. of Las Cruces, San Antonio, Province of Santiago

SOURCE René Fernández, Administración Forestal, Ministerio de Agricultura, Santiago, Chile

SPECIES Eucalyptus globulus

ECOLOGICAL GROUP Temperate Very Dry

COUNTRY Chile PLANTATION 268

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 15 | 22 | 26 | 1640 | 25 | |

SITE

LAT. 30°20' S LONG. 71°30' W ELEV. 80

ANNUAL RAINFALL 129 DRY MONTHS September-June

AV. TEMPERATURE 15 FROST July - August

PARENT ROCK limestone SOIL alluvial

TOPSOIL TEXTURE sandy DEPTH 2 cm

SUBSOIL TEXTURE Sandy DEPTH 1 m. +

REACTION 8.0 DRAINAGE free

SOIL STATE moderately degraded TOPOGRAPHY level

CONDITION AT PLANTING grazed

SEED ORIGIN plantation in Chile

PLANTING

DATE 1920 SPACING 2 x 2 AREA 10

STOCK potted TOOLS shovel

CARE Cut twice, second time in 1946, sprouts thinned

REPRODUCTION seed and sprouts abundant

LOCATION Fundo El Tanque, Ovalle, Provincia Coquimbo

SOURCE Hugo Gonzalez, Fundo Infiernillo, Casilla 151, Ovalle, Chile

SPECIES Eucalyptus globulus

ECOLOGICAL GROUP Temperate very Dry

COUNTRY Chile PLANTATION 269

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 24 | 42 | 40 | 1600 | 78 | |

SITE

LAT. 30°40' S LONG. 71°20' W ELEV. 340

ANNUAL RAINFALL 129 DRY MONTHS September - June

AV. TEMPERATURE 15° FROST July - August

PARENT ROCK granite SOIL alluvial

TOPSOIL TEXTURE sandy loam DEPTH 5 cm

SUBSOIL TEXTURE gravel DEPTH 1 m.+

REACTION 7.5 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING grazed

SEED ORIGIN plantation in Chile

PLANTING

PREPARATION plowed DATE 1937

SPACING 2 x 2 AREA 1 STOCK potted

TOOLS shovel SURVIVAL 60% after 24 years

REPRODUCTION seeds and sprouts scarce

LOCATION Vivero Forestal David Perry, Avalle, Coquimbo

SOURCE Orlando Bustamente, Vivero Forestal David Perry,

Recolecta Comuna, Ovalle, Chile

15 - 6

SPECIES Eucalyptus globulus

COUNTRY Chile PLANTATION 270

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO.TREES | BASAL AREA | VOLUME |
| 16 | 36 | 44 | 1240 | 56 | |

SITE

LAT. 30°40' S LONG. 71°20' W ELEV. 200

ANNUAL RAINFALL 129 DRY MONTHS September-June

AV. TEMPERATURE 15 FROST June-July

PARENT ROCK granite SOIL alluvial

TOPSOIL TEXTURE clay DEPTH 10 cm

SUBSOIL TEXTURE clay with gravel DEPTH 1 m.+

REACTION 8.0 DRAINAGE free

SOIL STATE little disturbed TOPOGRAPHY level

CONDITION AT PLANTING cultivated

SEED ORIGIN plantation in Chile

PLANTING

PREPARATION plowed DATE 1946

SPACING 2.5 x 2.5 AREA 10 STOCK potted

TOOLS shovel SURVIVAL 60% after 16 years

REPRODUCTION seed abundant

LOCATION Fundo El Mirador, Ovalle, Coquimbo

COMMENTS Form excellent, high water table

SOURCE Felix Corral, Fundo El Mirador, Ovalle, Chile

SPECIES Pinus radiata

ECOLOGICAL GROUP Temperate Very Dry

COUNTRY Chile PLANTATION 332

GROWTH

| DOMINANTS & CODOMINANTS | | | STAND PER HECTARE | | |
|---|---|---|---|---|---|
| AGE | DBH cm | HEIGHT m | NO. TREES | BASAL AREA | VOLUME |
| 17 | 26 | 19 | | 12 | |

SITE

LAT. 33°30' S LONG. 71°30' W ELEV. 180

ANNUAL RAINFALL 438 DRY MONTHS November - June

AV. TEMPERATURE 14° FROST ?

PARENT ROCK granite SOIL residual

TOPSOIL TEXTURE clay loam DEPTH 15 cm

SUBSOIL TEXTURE clay REACTION 6.0

DRAINAGE free SOIL STATE moderately degraded

TOPOGRAPHY 5% slope ASPECT N

CONDITION AT PLANTING cultivated

SEED ORIGIN plantation in Chile

PLANTING

1944 SPACING 2 x 2 AREA 4

STOCK bareroot nursery TOOLS spade

SURVIVAL 80% after 15 years

CARE thinning from below at 15 years; pruning to 10 ft. at 15 years

REPRODUCTION seeds scarce; sprouts absent

LOCATION Cruce Cartagena, Depto. San Antonio, Santiago Province

COMMENTS good form

SOURCE René Fernández, Ministry of Agriculture, Santiago, Chile

ESPECIE Abies religiosa

GRUPO ECOLOGICO Fresco Muy Húmedo

PAIS Mexico PLANTACION 110

CRECIMIENTO

DOMINANTES Y CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 32 | 30 | 22 |

RENDIMIENTO 5743 $m^3$ a los 40 años

SITIO

LAT. 19°35'N LONG. 99°0 ELEV. 2800

PRECIPITACION 1200 MESES DE SEQUIA Enero-Junio

HELADAS Octubre-Febrero

TEXTURA DEL SUELO arcilloso

TOPOGRAFIA 30% inclinación

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS bosque natural

SIEMBRA

PREPARACION ninguna FECHA 1918

ESPACIAMIENTO 3 x 3 AREA 280

MATERIAL de vivero HERRAMIENTAS pala

SUPERVIVENCIA 75%

REPRODUCCION semillas abundantes

LUGAR "La Venta", Cuajimalpa, D.F., 24 km de Ciudad Mexico

ORIGEN DE INFORMACION Ing. Tomas Gutierrez Gomez, Unidad IndustrialForestal Loreto y Peña Pobre, Tlalpan, D. F., Mexico

ESPECIE Cupressus sp.

GRUPO ECOLOGICO Fresco Muy Húmedo

PAIS Ecuador PLANTACION 260

CRECIMIENTO
DOMINANTES & CODOMINANTES
EDAD : DAP cm : ALTURA m
43 30 16

SITIO
LAT. 38°S LONG. 78°33'O ELEV. 3600

PRECIPITACION 1100 MESES DE SEQUIA Junio-Agosto

TEMPERATURA PROMEDIO 7° HELADAS irregular durante el año

ROCA MADRE arena volcánica SUELO residual

TEXTURA DEL SUELO arcilloso limoso PROFUNDIDAD 12 cm

TEXTURA DEL SUBSUELO cascajoso arenoso PROFUNDIDAD 2+

REACCION 5.5 DRENAJE libre

TOPOGRAFIA 30% inclinación

CONDICION ANTES DE LA SIEMBRA llanura con pastos

ORIGEN DE SEMILLAS desconocido

SIEMBRA
FECHA 1927 ESPACIAMIENTO 3 x 3

MATERIAL de vivero a raíz desnuda

CUIDO ninguno

REPRODUCCION semillas abundantes

LUGAR 46 km al S de Quito, en la Estación de Ferrocarril de Cotopaxi

COMENTARIOS muy ramoso

ORIGEN DE INFORMACION Mario Cardenas, Depto. Forestal, Min. de Fomento, Quito, Ecuador

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Fresco Muy Húmedo

PAIS Ecuador PLANTACION 261

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 26 | 40 | 21 | | | |
| 29 | 44 | 21 | 1096 | | |

SITIO

LAT. 1°S LONG. 79°O ELEV. 3200

PRECIPITACION 1400 MESES DE SEQUIA Agosto-Sept.

TEMPERATURA PROMEDIO 10° HELADAS ninguna

ROCA MADRE arena volcánica SUELO residual

TEXTURA DEL SUELO franco limoso PROFUNDIDAD 40 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 2+

REACCION 5.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 10% inclinación ASPECTO S

CONDICION ANTES DE LA SIEMBRA bosque virgen

ORIGEN DE SEMILLAS desconocido

SIEMBRA

PREPARACION tumba completa FECHA 1931

ESPACIAMIENTO 4.2 x 2.2 AREA 0.2

MATERIAL de vivero a raíz desnuda

CUIDO aclareo del 50% a los 15 años

REPRODUCCION flores abundantes

LUGAR Los Alpes, 48 km al SO de Quito

COMENTARIOS Pastoreo de ganado vacuno y cerdos. Casi todo el tiempo hay neblina.

ORIGEN DE INFORMACION Mario Cardenas, Depto. Forestal, Min. de Fomento, Quito, Ecuador

ESPECIE Pinus radiata

GRUPO ECOLOGICO Fresco Muy Húmedo

PAIS Ecuador PLANTACION 75

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD : | DAP cm : | ALTURA m |
|---|---|---|
| 14 | 30 | 11 |
| 30 | 60 | 16 |

SITIO

LAT. 38' S LONG. 78° 33'0 ELEV. 3600

PRECIPITACION 1001 MESES DE SEQUIA Junio-Agosto

TEMPERATURA PROMEDIO 7° HELADAS Junio & Noviembre

ROCA MADRE arena volcánica SUELO residual

TEXTURA DEL SUELO franco arenoso arcilloso

PROFUNDIAD 30 cm TEXTURA DEL SUBSUELO arenoso

PROFUNDIDAD 2 REACCION 5.0 - 5.5 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA 0 - 30% inclinación

CONDICION ANTES DE LA SIEMBRA pastos

ORIGEN DE SEMILLAS comprada a Otto Katsenstein, Atlanta, Georgia

SIEMBRA

Fecha 1928 ESPACIAMIENTO 1.5 x 3 AREA 15,000 árboles

MATERIAL de vivero a raíz desnuda, 50-60 cm

HERRAMIENTAS barra SUPERVIVENCIA 65% a los 5 años

CUIDO limpieza; poda a los 4 y 6 años

REPRODUCCION flores escasas

LUGAR Cotopaxi, 60 km al S de Quito

COMENTARIOS Sembrado con P. muricata, P. montezumae, P. patula, P. canariensis, P. halepensis, P. taeda, P. caribaea, P. thumbergii, Cupressus spp., Thuja spp., Sequoia spp., Taxodium spp. & Chamaecyparis. Solamente P. radiata y P. muricata son vigorosos y de desarrollo rápido.

ORIGEN DE INFORMACION Luciano Andrade Marin, Calle Luis F. Borja 500, Quito, Ecuador

ESPECIE Cupressus lusitanica

GRUPO ECOLOGICO Fresco Húmedo

PAIS Colombia PLANTACION 78

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM. ARBOLES | AREA BASIMETRICA | VOL. |
| 15 | 20 | 12 | 800 | 28 | 302 |

SITIO

LAT. 4°36'N LONG. 74°O ELEV. 2600

PRECIPITACION 999 MESES DE SEQUIA 9

TEMPERATURA PROMEDIO 11° HELADAS 2 meses

ROCA MADRE arenisca SUELO residual

TEXTURA DEL SUELO franco arenoso PROFUNDIDAD 15 cm

TEXTURA DEL SUBSUELO franco arenoso PROFUNDIDAD 80

REACCION 4.8 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 30% inclinación

CONDICION ANTES DE LA SIEMBRA bosque secundario

ORIGEN DE SEMILLAS plantación - 4°32'N, 74°5'O; 2700 m; 1200 mm

SIEMBRA

FECHA 1944 ESPACIAMIENTO 2 x 2 AREA 2

MATERIAL de vivero en potes HERRAMIENTAS barra

CUIDO desconocido

REPRODUCCION semillones abundantes

LUGAR Bosque del Acueducto, 5 km de Bogotá

ORIGEN DE INFORMACION Elmo Montenegro, Sección de Bosques, Min. de Agricultura, Apartado Aéreo 11768, Bogotá, Colombia

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Fresco Húmedo

PAIS Venezuela PLANTACION 77

CRECIMIENTO

DOMINANTES & CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 37 | 58 | 23 |

SITIO

LAT. 8°48'N LONG. 70°55'O ELEV. 3270

PRECIPITACION 700 TEMPERATURA PROMEDIO 10°

HELADAS si ROCA MADRE granito SUELO aluvial

TEXTURA DEL SUELO arenoso arcilloso PROFUNDIDAD 1

DRENAJE libre ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA 9% inclinación ASPECTO SO

SIEMBRA

FECHA 1925 ESPACIAMIENTO 4 x 4 AREA 51 árboles

MATERIAL de vivero

LUGAR "Apartaderitos" 69 km al NE de Merida, Venezuela

ORIGEN DE INFORMACION C. Claverie Rodriguez, por conducto de G. H. Raets, Instituto Forestal Latino-Americano, Apartado 36, Merida, Venezuela

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Fresco Húmedo

PAIS Venezuela PLANTACION 79

CRECIMIENTO

DOMINANTES Y CODOMINANTES

| EDAD | DAP cm | ALTURA m |
|---|---|---|
| 9 | 20 | 17 |

SITIO

LAT. 8°47'N LONG. 71°0 ELEV. 2977

PRECIPITACION 708 TEMPERATURA PROMEDIO 11°

HELADAS si ROCA MADRE granito

SUELO aluvial TEXTURA DEL SUELO arenoso arcilloso

PROFUNDIDAD 1 REACCION 5.0 DRENAJE libre

ESTADO DEL SUELO poco afectado

TOPOGRAFIA llana

SIEMBRA

FECHA 1947 ESPACIAMIENTO 6 x 6

AREA 33 árboles MATERIAL de vivero

LUGAR Plaza Rangel, Mucuchies, 55 km al NE de Merida, Venezuela

ORIGEN DE INFORMACION C. Claverie Rodriguez, por conducto de G. H. Raets, Instituto Forestal Latino-Americano, Apartado 36, Merida, Venezuela

ESPECIE Eucalyptus globulus

GRUPO ECOLOGICO Fresco Húmedo

PAIS Peru PLANTACION 80

CRECIMIENTO

| DOMINANTES & CODOMINANTES | | | DENSIDAD POR HECTAREA | | |
|---|---|---|---|---|---|
| EDAD | DAP cm | ALTURA m | NUM.ARBOLES | AREA BASIMETRICA | VOL. |
| 7 | 19 | 19 | 400 | 12 | 57 |
| 8 | 21 | 23 | 400 | 14 | 80 |

SITIO

LAT. 12°S LONG. 75°20'0 ELEV. 3350

PRECIPITACION 962 MESES DE SEQUIA 5 - 6

TEMPERATURA PROMEDIO 11° HELADAS 2 - 3 meses

TEXTURA DEL SUELO arcilloso pedregoso PROFUNDIDAD 30 cm

REACCION 7.0 DRENAJE libre

ESTADO DEL SUELO moderadamente degradado

TOPOGRAFIA llana

CONDICION ANTES DE LA SIEMBRA cultivado

ORIGEN DE SEMILLAS plantación local

SIEMBRA

PREPARACION preparado el terreno con disco FECHA 1951

ESPACIAMIENTO 5 x 5 AREA 130

MATERIAL de vivero en potes HERRAMIENTAS pala

SUPERVIVENCIA 95% a los 9 años

CUIDO riego por 5 años; 2 limpiezas al año; aclareo del 50% de un espaciamiento de 2.5 a 5

REPRODUCCION semillas abundantes

LUGAR Hacienda Porvenir, 4 km de Huancayo, Depto. Junin

ORIGEN DE INFORMACION Flavio Bazan, Servicio Cooperativo Inter-Americano, Edificio Ministerio del Trabajo, Lima, Peru

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double-spaced typewritten pages, although an occasional longer article of special interest may be acceptable. Articles should be submitted in the author's native tongue, and should include title or position of the author as well as a brief summary of the material. Manuscripts should be typewritten, double spaced, on one side of the page only, on 8½ x 11 inch white bond paper.

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Le "Caribbean Forester" est une revue semi-annuelle qui a été publiée depuis l'année 1938 en Puerto Rico por le Centre Tropique de Recherche Forestier, Service Forestier du Départment de l'Agriculture des Etats-Unis. Cette revue est dediée a l'aménagement et a l'utilisation des forests surtout dans la region caraïbe.

Par les pages de cette revue les personnes qui travaillent aux tropiques peuvent etre informées sur les problemes specifiques des forets tropicales et sur les travaux effectués pour realiser une ameilloration technique par l'aménagement et l'usage des resources forestiéres. Cette revue pourvoit aussi un moyen de destribuer l'information et les resultats obtenus par le programme experemental du Centre Tropique de Recherche Forestier de Puerto Rico; en plus cette revue offre ses pages a les autres travailleurs forestiers des pays tropicaux pour qu'ils purssent publier les resultats de leur travaux.

Cette revue accepte volontiers des contributions ne depassant pas 20 pages dactilografiées a double espace, cependant que certains travaux du intéret spécial plus long purvent etre acceptés. Les contributions doivent etre ecrites dans la langue maternelle de l'auteur et doivent bien preciser son titre et sa position professionnelle, l'appert doct etre accompagné d'un résumé de l'étude. Les manuscripts doivent etre dactilografiées en double espace su du paper 8½ por 11 pouces.

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