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2nd edition, revised

# A Guide to Species Selection for Tropical and Sub-Tropical Plantations

by Derek B. Webb  
Peter J. Wood  
Julie P. Smith  
G. Sian Henman

Unit of Tropical Silviculture  
Commonwealth Forestry Institute  
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1984



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# **A Guide to Species Selection for Tropical and Sub-Tropical Plantations**

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## PREFACE

This publication has been developed from Tropical Forestry Papers No. 15 "A Guide to Species Selection for Tropical and Sub-Tropical Plantations", which was published in 1980 and is now out of print. This revised version includes more species, and incorporates a program in BASIC for the Apple II microcomputer, rather than the previous FORTRAN IV program.

The use of punched cards suggested in the earlier book did not evoke a great deal of interest; nevertheless details of a usable system are suggested here for anyone who wishes to use this method. The BASIC program for a microcomputer is slower to run than that in FORTRAN but provides a portable, flexible system suitable for users with limited computing experience. The more detailed FORTRAN program will be sent on request to anyone requiring it for a larger machine.

To save space and weight the two pages of data for a given species are photoreduced to one. However, blank sheets at the original size are included for users to photocopy and build up their own data base for new species.

Ms G.S. Henman joined the original group of authors to help with the expansion and correction of the earlier book. All the authors express their grateful acknowledgements to the many who helped in this work, and in particular to Mrs E.M. Kariuki, Ms J. Stewart, Drs. R.D. Barnes, B.T. Styles and R.J. Poynton, and Messrs G.L. Gibson, C.E. Hughes, P.J. Robinson and P.D. Hardcastle. The typing, retyping and rearrangement has been done by Ms T.D. Hodgkinson to whom a special debt of gratitude is due.

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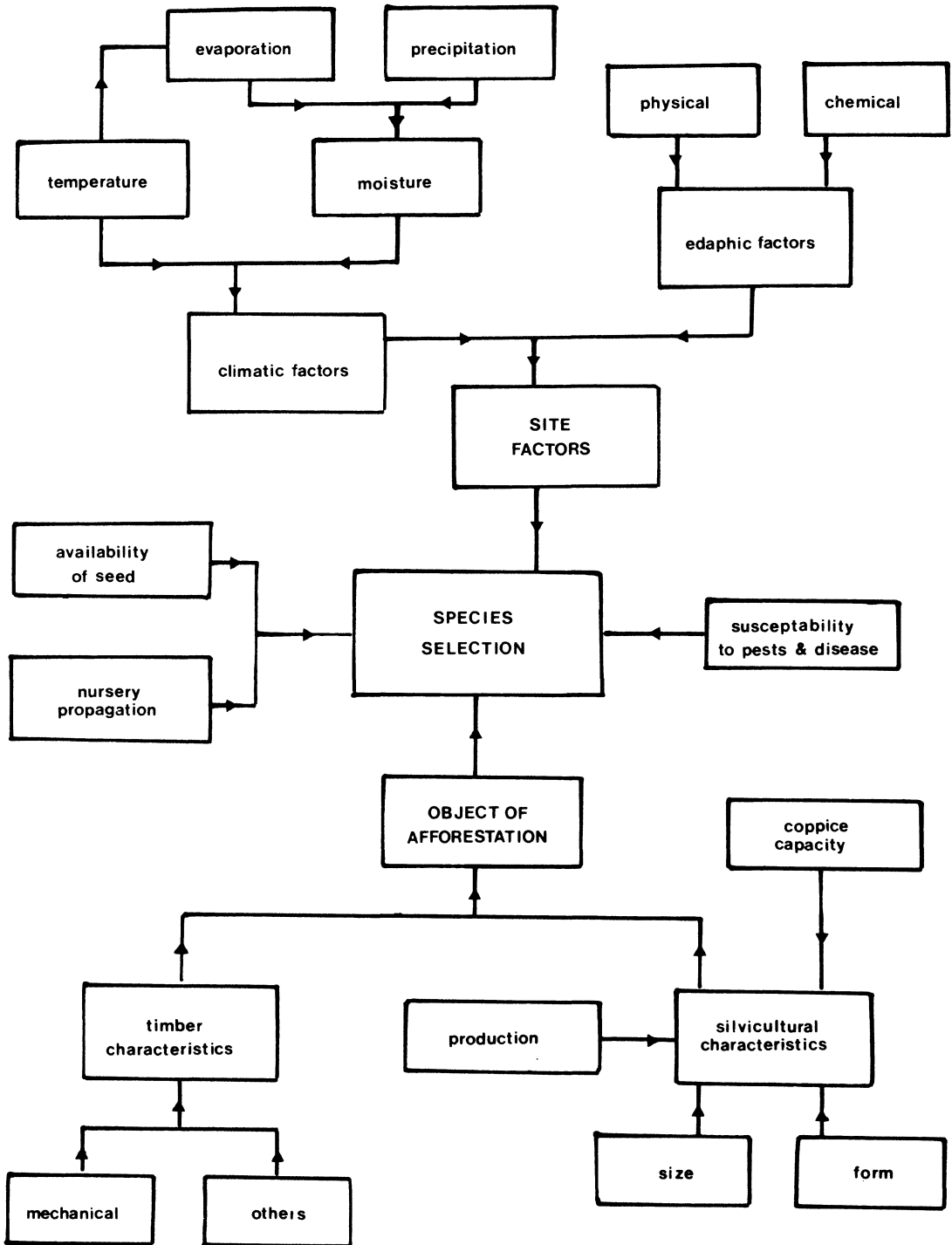
## 1. INTRODUCTION

- 1.1 The aim of this publication is to assist foresters in the selection of species for inclusion in the initial phase of forest species trials programmes. The intention is not to recommend particular species for specific site or climatic conditions, or plantation objectives. Given the varying tolerance and adaptability of different species, and the imprecise methods of quantifying site factors and their interactions, such final selection can only be based on first hand experience of species' performance under any given set of site conditions. Such experience can only be gained by the establishment of species trials. Whilst the degree of sophistication and duration of trials programmes may vary, the need for some form of trials before embarking on large scale planting programmes cannot be overemphasized.
- 1.2 The choice of species for inclusion in the trials is one of the first steps in such a programme. The selection should of course be based on an attempt to equate the conditions of the trial site (which in turn should be representative of the zone of proposed afforestation) with the known and reported characteristics of exotic and indigenous tree species. The site conditions consist of climatic and edaphic factors, each of which in turn depends on such basic elements as temperature and humidity in the case of the climate, and chemical and physical properties in the case of the soil. At the same time the choice of species for trial will be greatly influenced by the objective of the proposed afforestation; whether it be for the production of saw-timber, pulp, fuelwood, etc. or for purely protection purposes. Again the capacity of a given species to meet such objectives depends on a series of basic characteristics, i.e. size, form, growth rate and wood properties. Finally, some consideration must be given to factors such as a species' inherent resistance or susceptibility to pests and diseases, the availability of seed and ease of propagation. A schematic representation of the combination of the major factors involved in species selection is given on page 3.
- 1.3 Although the forester may well appreciate the importance of considering all the factors involved, he has in the past often been handicapped by a lack of available information on the characteristics and requirements of certain species. Thus the first aim of the present publication is to provide such data in a concise and compact form. The authors lay no claim to originality. The guide is simply a compilation of previously reported data on species' characteristics, often amplified by personal experience of their performance in the field.
- 1.4 The guide is designed to cover species warranting consideration for trial in tropical and sub-tropical climates, i.e. approximately between latitudes 30°N and 30°S, including high altitude sites which sometimes may be more suited to species originating from more temperate climates and higher latitudes. However, in this connection it should be noted that a species' capacity to adapt to changes in day length and light intensity often determine its success or failure at lower latitudes. A total of 173 different species, varieties and

provenances have been included. They represent an attempt to ensure the inclusion of all species of major importance and potential as exotics, and at the same time maintain some balance between groups of species suited to various sites and climatic conditions.

- 1.5 Species' characteristics are presented in the form of data sheets for each species. These include brief information on the species' natural occurrence, climatic and edaphic preferences, silvicultural characteristics, production potential, wood properties and uses, seed supply and nursery requirements. The data sheets are in note form, and lengthy descriptions have been intentionally avoided. More detailed information can always be obtained from the principal references quoted for each species. Blank data sheets have been included at the end of the book to enable users to collect information on other species of particular interest.
- 1.6 The second aim of the publication is to assist in the selection of species for inclusion in trial programmes. This may be especially helpful in developing countries where there is little previous experience on which to base the trial programmes. Equally it may help to ensure that even experienced workers do not overlook potentially suitable, but little tried, species. Three systems of arriving at an objective selection are suggested. These are:
  - i) computerised data base and retrieval program;
  - ii) perforated card key;
  - iii) species selection tables.

FACTORS INFLUENCING THE SELECTION OF SPECIES FOR TRIAL



## 2. SELECTION BY SPECIES DATABASE AND RETRIEVAL PROGRAM

### 2.1 The INSPIRE <sup>1/</sup> computer program consists of four parts:

- i) loading to establish the species data base and to add new species;
- ii) editing to allow for up-dating and correction of the base;
- iii) species selection by data retrieval from the base;
- iv) printing of information for an individual species.

Species data are listed and stored under a total of 21 main features. Selection is made by successively applying the user's requirements and site conditions to any of these features until a final choice is achieved. The program also allows the user to revert to a previous selection level in case he has lost all or most of the pool of species by introducing an excessively limiting parameter. A list of all suitable species is displayed at each stage in the program, and full print-outs of the species can be obtained after the final selection.

### 2.2 The flexibility of the selection process is increased by the program's acceptance of ranges of values for all numerical parameters, e.g. rainfall, temperature, etc., together with AND/OR choices of features where alternatives are available, e.g. soils, production requirements, etc. The species selected are listed as either:

MAIN - being species which fully meet all the selections, ranges or requirements applied

or MARGINAL - being species which only partly cover the ranges specified or which only demonstrate a limited tolerance or suitability to certain features.

Marginal species are listed with a star rating indicating the number of features on which they only marginally meet the requirements.

### 2.3 The computer program package is currently in use by the Forestry Department of the Commonwealth Forestry Institute at Oxford. It is written in CP/M BASIC language for an Apple II microcomputer. The program is entirely interactive, which is especially important for species selection, where the response to the user's enquiry can influence his future instructions. The user simply types his requirements into the computer when requested, until he arrives at a suitable selection of species.

### 2.4 The complete INSPIRE package can be stored on one 5 inch floppy disk. It consists of a single program requiring approximately 25 kilobytes of memory, and five data files currently occupying approximately 50 kilobytes of data storage for the 173 species in this guide. The database is designed to be totally flexible, providing a versatile, compact and convenient selection system.

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<sup>1/</sup> INSPIRE: INTERactive SPecies Information RETrieval

- 2.5 This INSPIRE database in BASIC language supplements an original package in FORTRAN IV for a large computer. The FORTRAN version is still available and is likely to be converted to FORTRAN 77 at a later date. Details and advice are obtainable on request to users wishing to implement these programs on their own computers.

### 3. SELECTION BY PERFORATED CARD KEY

- 3.1 Perforated cards offer a convenient means of selection by the application of a series of site factors and/or species characteristics. A suggested design for a commonly available size of card 1/, together with the relevant key to the location of the characteristics used, is given in examples 3.4 and 3.5. The factors included are all those which would normally be applied in arriving at a species selection. Thus side A of the card deals with altitude and climate (features 6-12 of the species data sheets). The ranges relevant to each factor have been divided into a series of arbitrary bands. Side B of the card covers soil characteristics (features 13-16 on the species data sheets), again offering choices by broad classifications. Side C includes levels of potential production and plantation objectives (features 22-24 and 30-32), whilst side D refers to species' silvicultural characteristics.
- 3.2 As in any standard perforated card key system, the final selection is achieved by successively applying a series of characteristics, at each step eliminating unsuitable species. Thus, in a simple example, by first applying a certain level of mean annual rainfall one might be left with a total of 30 cards, or species, which could be considered for a given rainfall level. If the second selection was then made for mean annual temperatures of 21-23°C, perhaps only 20 of these species would also fit this requirement, the remaining 10 cards from the original selection being rejected. Further application of a particular soil type, a requirement that the species should be capable of coppicing and an objective of growing fuelwood, might reduce the final selection to some half dozen species, all of which fulfilled all five of the selection parameters applied. The number of parameters applied, and the consequent degree of selectivity can of course be varied to suit the user's requirements. Clearly, however, the use of highly detailed selections on difficult sites where the number of species available is in any case limited will inevitably lead to a very reduced final choice.
- 3.3 The punched card, as emphasized above, is necessarily limited to selection on discrete steps in its information base. It cannot therefore list marginal site characteristics for a particular species, and it has to assume that every species can be classified using the same discrete steps. Clearly this is an unsatisfactory situation and the selection of species resulting from the use of a small punched card alone would be very crude.

No worker selecting species for trial would wish to be limited to card information only however; one of the objectives of this guide is to condense information into a small and convenient space and to give guidelines to more detailed sources of information on species of interest. Fortunately the centre and reverse side of the card contains space for much supplementary information, such as:

the actual site requirements of a species, where discrete steps are inaccurate;

pests and diseases, where these occur and their severity;

a description of the tree, including flower colour for ornamentals, nectar production;

seed problems if any;

a list of major references, particularly from places where the species is successfully grown as an exotic.

Thus the practical field forester, who does not have computer facilities nearby, can still have a convenient, quick, and reasonably flexible system in his office. The card becomes the preliminary selection unit, and the source of further detailed information.

Example of Perforated Card  
Layout for Species Selection

<b>Pests and diseases</b>
<b>Seed : sources</b>
<b>No./kilo</b>
<b>Pretreatment</b>
<b>Storage</b>
<b>Nursery technique</b>
<b>Time required to plantable size</b>

<b>B. SOILS</b>															
Species (family)															
Synonyms															
Local names															
Natural distribution															
Plantation experience															
References															
<b>A. ALTITUDE AND CLIMATE</b>															
<b>D. SILVICULTURAL CHARACTERISTICS</b>															
<b>C. PRODUCTION AND UTILIZATION</b>															

## 3.5 Key to Card Characteristics

A Altitude and Climate		B Soils		C Production and Utilization		D Silvicultural Characteristics	
	<u>Altitude</u>		<u>Texture</u>		<u>Production Potential</u>		<u>Size of tree</u>
1	0-500 m	1	light	1	under 5 m <sup>3</sup> /ha/an	1	large tree (over 30 m)
2	500-1000 m	2	medium	2	5-10 m <sup>3</sup> /ha/an	2	medium tree (15-30 m)
3	1000-1500 m	3	heavy	3	10-20 m <sup>3</sup> /ha/an	3	small tree (under 15 m)
4	1500-2000 m		<u>Reaction</u>	4	over 20 m <sup>3</sup> /ha/an		<u>Form</u>
5	over 2000 m	4	acid		<u>Protection Planting</u>		
	<u>Mean Annual Rainfall</u>	5	neutral	5	shade	4	exceptional/good
6	250-400 mm	6	alkaline	6	shelterbelts and windbreaks	5	acceptable
7	400-650 mm		<u>Drainage</u>	7	anti-erosion	6	poor
8	650-1000 mm	7	good/free draining	8	dune fixation		<u>Light Requirements</u>
9	1000-1600 mm	8	moist	9	agricultural shade	7	light demanding
10	over 1600 mm	9	impeded	10	ornamental	8	semi-tolerant
	<u>Rainfall Regime</u>	10	seasonal waterlogging		<u>Density</u>	9	shade tolerant
11	winter		<u>Other Characteristics</u>	11	light (S.G. under 0.5)	10	shade tolerant when young
12	summer	11	shallow	12	medium (S.G. 0.5-1.0)		<u>Other Characteristics</u>
13	uniform	12	deep	13	heavy (S.G. over 1.0)	11	coppices/root suckers
	<u>Dry Season</u>	13	fertile		<u>Sawtimber</u>	12	fire resistant
14	0-2 months	14	saline	14	heavy construction	13	frost resistant
15	2-4 months	15	-	15	light construction	14	resistant to termites
16	4-6 months	16	-	16	boxes, crates and shuttering	15	requires wide spacing
17	over 6 months			17	furniture	16	fixes nitrogen
	<u>Mean Max. Temp. hottest month</u>				<u>Roundwood</u>	17	windfirm
18	under 20°C			18	transmission poles		
19	20-30°C			19	building poles		
20	over 30°C			20	fenceposts		
	<u>Mean Min. Temp. coldest month</u>			21	fuel and charcoal		
21	under 10°C			22	shortfibre pulp		
22	10-20°C			23	longfibre pulp		
23	over 20°C			24	veneer/plywood		
	<u>Mean Annual Temperature</u>				<u>Other Products</u>		
24	under 16°C			25	resins		
25	16-20°C			26	tannins		
26	20-24°C			27	fodder		
27	over 24°C			28	oils and gums		
28	-			29	miscellaneous		
29	-						

#### 4. SPECIES SELECTION TABLES

- 4.1 A species selection key is presented in the form of six tables. The first five of these are based on mean annual precipitation levels ranging from 250 to over 1,600 mm. The former figure has been accepted as the lowest level of rainfall at which tree growth can be hoped for in the absence of stored ground water or artificial irrigation. Each table is subdivided into columns covering ranges of mean annual temperature from over 24°C to less than 18°C. The tables cover this range in five subdivisions each covering a band of 2°C variation in mean annual temperature. The use of the latter as a parameter is justified in the tropics and sub-tropics where the seasonal extremes of temperate latitudes are generally less marked. If the site under study does exhibit such extremes, these can be checked against the values for mean maximum and mean minimum temperature for the hottest and coldest months which will be found in the relevant data sheets.
- 4.2 The tables name species which would be suitable over the whole range of the classes specified. These are followed by the code numbers of species which could be equally suitable but only over a limited part of the given rainfall or temperature range.

Obviously many species overlap the arbitrary limits applied and consequently occur in more than one temperature or rainfall range. Equally, the extreme ranges of some species have been omitted from the tables, particularly in the case of dry zone species which would thrive in higher rainfalls where, however, more desirable species are usually available.

- 4.3 Where temperature data are not available, the tables can also be entered by applying altitude. However, since mean annual temperatures vary with latitude as well as altitude, some adjustment may be necessary when dealing with higher latitudes. Study of climatic data from a wide range of stations between 30°N and 30°S in all three continents shows:
- i) The temperature lapse rate throughout the zone varies between 0.3 and 0.6 degrees for every rise of 100 metres in altitude 1/.
  - ii) The lapse rate with latitude averages some 0.15 degrees of temperature for every increase of one degree of latitude from the "temperature equator".
  - iii) The "temperature equator" does not coincide with the geographic equator, but in all continents occurs at latitudes of some 7-10 degrees north.

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1/ This does not apply to the arid land masses of Africa north of latitude 15°N, or Australia south of latitude 15°S.

4.4 The tables have been constructed on the basis of a notional MAT of  $27^{\circ}\text{C}$  at sea level on the temperature equator and a mean lapse rate of  $0.5^{\circ}\text{C}$  per 100 metres rise in altitude. Thus at this latitude,  $7^{\circ}\text{N}$ , the MAT is assumed to fall to  $22^{\circ}\text{C}$  at 1,000 metres altitude etc. Applying the latitudinal lapse rate of  $0.15^{\circ}\text{C}$  per degree of latitude to the above sea level MAT, it will be seen that this will fall to  $24^{\circ}\text{C}$  (the limit of the next temperature range used in the tables) at latitudes of approximately  $27^{\circ}\text{N}$  and  $13^{\circ}\text{S}$ . It is therefore suggested that entry to the tables via altitude can be made directly for sites between these latitudes. At higher latitudes the following adjustments should be made:

$27-30^{\circ}\text{N}$  drop one column, i.e. read the 600-1,000 metre ( $22-24^{\circ}\text{C}$   
 $13-26^{\circ}\text{S}$  column for sites of 0-600 metres.

$26-30^{\circ}\text{S}$  as above but dropping two columns.

4.5 Whilst the above MAT/altitude/latitude relation generally holds good in the tropics and sub-tropics, certain anomalies do occur and the writers recommend that wherever possible mean annual temperature rather than altitude should be used for entry to the tables. Further details of the MAT/altitude/latitude relationship can be found in Appendix II.

4.6 The final selection table (6) deals with soils. It lists species tolerant of heavy soils, impeded drainage, saline and alkaline soils. This table should be consulted in conjunction with the relevant rainfall/MAT table when these soil conditions apply to the site under study.

TABLE 1

Species worth considering for Mean Annual Rainfall 250-400 mm

Mean Annual Temperature (Altitude)		
24°C and above (0-600 metres)	22-24°C (600-1000 metres)	20-22°C (1000-1400 metres)
1. <i>Acacia albida</i> 10. <i>Acacia nilotica</i> 13. <i>Acacia senegal</i> 14. <i>Acacia tortilis</i> subsp. <i>raddiana</i> 46. <i>Conocarpus lancifolius</i>	1. <i>Acacia albida</i> 4. <i>Acacia cyclops</i> 13. <i>Acacia senegal</i> 30. <i>Brachychiton populneum</i> 42. <i>Ceratonia siliqua</i> 45. <i>Colophospermum mopane</i> 54. <i>Dalbergia sissoo</i> 58. <i>Eucalyptus brockwayi</i> 59. <i>Eucalyptus camaldulensis</i> (N. Provs.) 72. <i>Eucalyptus intertexta</i> 73. <i>Eucalyptus largiflorens</i> 78. <i>Eucalyptus microtheca</i> 89. <i>Eucalyptus salmonophloia</i> 97. <i>Euphorbia tirucalli</i> 103. <i>Haloxylon aphyllum</i> 118. <i>Parkinsonia aculeata</i> 150. <i>Prosopis chilensis</i> 152. <i>Prosopis juliflora</i> 161. <i>Simmondsia chinensis</i> 164. <i>Tamarix aphylla</i> 173. <i>Zizyphus spina-christi</i>	1. <i>Acacia albida</i> 30. <i>Brachychiton populneum</i> 42. <i>Ceratonia siliqua</i> 54. <i>Dalbergia sissoo</i> 58. <i>Eucalyptus brockwayi</i> 59. <i>Eucalyptus camaldulensis</i> (N. Provs.) 72. <i>Eucalyptus intertexta</i> 73. <i>Eucalyptus largiflorens</i> 89. <i>Eucalyptus salmonophloia</i> 103. <i>Haloxylon aphyllum</i> 118. <i>Parkinsonia aculeata</i> 150. <i>Prosopis chilensis</i> 152. <i>Prosopis juliflora</i> 161. <i>Simmondsia chinensis</i> 164. <i>Tamarix aphylla</i> 173. <i>Zizyphus spina-christi</i>
3 4 6 12 30 31 37 42 45 54 58 59 62 72 73 78 81 89 90 97 103 117 118 150 151 152 161 164 173	3 6 10 12 37 46 60 62 81 90 117 151	3 4 6 11 12 13 37 45 60 62 78 81 90 97 123 131 151 158

TABLE 1 (cont.)

Species worth considering for Mean Annual Rainfall 250-400 mm

Mean Annual Temperature (Altitude)	
18-20°C (1400-1800 metres)	18°C and below (1800 metres and above)
1. <i>Acacia albida</i> 11. <i>Acacia pendula</i> 30. <i>Brachychiton populneum</i> 42. <i>Ceratonia siliqua</i> 54. <i>Dalbergia sissoo</i> 72. <i>Eucalyptus intertexta</i> 89. <i>Eucalyptus salmonophloia</i> 103. <i>Haloxylon aphyllum</i> 150. <i>Prosopis chilensis</i> 152. <i>Prosopis juliflora</i> 161. <i>Simmondsia chinensis</i> 164. <i>Tamarix aphylla</i>	50. <i>Cupressus arizonica</i> 56. <i>Elaeagnus angustifolia</i> 103. <i>Haloxylon aphyllum</i>
3   6   12   37   50   58   59   60   62   73 81   90   118   123   131   143   153   158   173	1   3   6   11   12   30   37   42   54   60 62   72   89   90   123   131   143   150   152   153 158   161   164

TABLE 2

Species worth considering for Mean Annual Rainfall 400-650 mm

Mean Annual Temperature (Altitude)		
24°C and above (0-600 metres)	22-24°C (600-1000 metres)	20-22°C (1000-1400 metres)
1. <i>Acacia albida</i> 10. <i>Acacia nilotica</i> 14. <i>Acacia tortilis</i> subsp. <i>raddiana</i> 31. <i>Butyrospermum paradoxum</i> 117. <i>Parkia biglobosa</i>	1. <i>Acacia albida</i> 3. <i>Acacia cyanophylla</i> 4. <i>Acacia cyclops</i> 12. <i>Acacia salicina</i> 30. <i>Brachychiton populneum</i> 42. <i>Ceratonia siliqua</i> 45. <i>Colophospermum mopane</i> 54. <i>Dalbergia sissoo</i> 59. <i>Eucalyptus camaldulensis</i> (N. Provs.) 62. <i>Eucalyptus cladocalyx</i> 78. <i>Eucalyptus microtheca</i> 81. <i>Eucalyptus occidentalis</i> 97. <i>Euphorbia tirucalli</i> 118. <i>Parkinsonia aculeata</i> 151. <i>Prosopis cineraria</i> 152. <i>Prosopis juliflora</i>	1. <i>Acacia albida</i> 3. <i>Acacia cyanophylla</i> 12. <i>Acacia salicina</i> 30. <i>Brachychiton populneum</i> 42. <i>Ceratonia siliqua</i> 54. <i>Dalbergia sissoo</i> 59. <i>Eucalyptus camaldulensis</i> (N. Provs.) 60. <i>Eucalyptus camaldulensis</i> (S. Provs.) 62. <i>Eucalyptus cladocalyx</i> 81. <i>Eucalyptus occidentalis</i> 118. <i>Parkinsonia aculeata</i> 152. <i>Prosopis juliflora</i>
3 4 6 12 13 18 20 22 28 30 36 42 45 46 54 58 59 61 62 64 72 73 78 81 89 90 91 93 97 98 99 103 105 106 108 109 118 129 150 151 152 161 164 173	6 10 13 18 20 28 36 46 53 57 58 60 61 64 70 72 73 89 90 91 93 98 99 103 105 106 108 109 117 129 150 161 164 173	4 6 11 13 18 20 28 36 45 53 57 58 61 64 70 72 73 74 76 78 89 90 91 93 97 98 99 103 105 106 108 109 123 129 131 150 151 158 161 164 173

TABLE 2 (cont.)

Species worth considering for Mean Annual Rainfall 400-650 mm

Mean Annual Temperature (Altitude)	
18-20°C (1400-1800 metres)	18°C and below (1800 metres and above)
1. <i>Acacia albida</i> 3. <i>Acacia cyanophylla</i> 11. <i>Acacia pendula</i> 12. <i>Acacia salicina</i> 30. <i>Brachychiton populneum</i> 42. <i>Ceratonia siliqua</i> 54. <i>Dalbergia sissoo</i> 60. <i>Eucalyptus camaldulensis</i> (S. Provs.) 62. <i>Eucalyptus cladocalyx</i> 123. <i>Pinus brutia</i> 131. <i>Pinus halepensis</i> 152. <i>Prosopis juliflora</i>	50. <i>Cupressus arizonica</i> 143. <i>Pinus pinea</i>
6 18 20 50 53 57 58 59 61 64 69 70 72 73 74 76 81 89 90 91 93 98 99 103 105 106 108 109 118 124 129 142 143 146 150 154 158 161 164 173	1 3 6 11 12 20 30 42 53 54 56 57 60 61 62 64 69 70 72 74 76 89 90 93 98 99 103 123 124 129 130 131 142 144 146 150 152 154 158 161 164

TABLE 3

Species worth considering for Mean Annual Rainfall 650-1000 mm

Mean Annual Temperature (Altitude)																																							
24°C and above (0-600 metres)										22-24°C (600-1000 metres)										20-22°C (1000-1400 metres)																			
1. Acacia albida										1. Acacia albida											1. Acacia albida																		
10. Acacia nilotica										3. Acacia cyanophylla											3. Acacia cyanophylla																		
22. Anacardium occidentale										18. Albizia lebbek											18. Albizia lebbek																		
28. Azadirachta indica										20. Alnus nepalensis											20. Alnus nepalensis																		
31. Butyrospermum paradoxum										28. Azadirachta indica											53. Cupressus torulosa																		
117. Parkia biglobosa										36. Cassia siamea											54. Dalbergia sissoo																		
										54. Dalbergia sissoo											57. Eucalyptus botryoides																		
										59. Eucalyptus camaldulensis (N. Provs.)											59. Eucalyptus camaldulensis (N. Provs.)																		
										61. Eucalyptus citriodora											60. Eucalyptus camaldulensis (S. Provs.)																		
										78. Eucalyptus microtheca											61. Eucalyptus citriodora																		
										93. Eucalyptus tereticornis											70. Eucalyptus gomphocephala																		
										97. Euphorbia tirucalli											93. Eucalyptus tereticornis																		
										98. Ficus benghalensis											98. Ficus benghalensis																		
										99. Gleditsia triacanthos											99. Gleditsia triacanthos																		
										105. Jacaranda copaia											105. Jacaranda copaia																		
										106. Jacaranda mimosifolia											106. Jacaranda mimosifolia																		
										108. Leucaena leucocephala (Hawaiian type)											108. Leucaena leucocephala (Hawaiian type)																		
										109. Leucaena leucocephala (Salvador type)											109. Leucaena leucocephala (Salvador type)																		
										129. Pinus elliottii var. elliottii											129. Pinus elliottii var. elliottii																		
										152. Prosopis juliflora											152. Prosopis juliflora																		
3	4	7	12	14	18	20	25	29	30	4	7	10	12	25	29	30	32	33	38	4	7	8	11	12	19	25	28	29	30										
32	33	36	38	39	40	42	43	45	47	39	40	42	43	45	47	51	53	55	57	32	33	36	38	39	40	42	43	45	47										
54	55	59	61	62	63	64	71	78	81	60	62	63	64	70	71	75	77	81	82	51	52	55	62	63	64	71	74	75	76										
83	87	91	93	94	97	98	99	100	101	83	87	88	91	94	100	101	107	112	117	77	78	81	82	84	86	87	88	91	94										
105	106	107	108	109	112	118	120	121	125	118	120	125	127	128	132	133	139	141	151	97	100	101	102	107	110	112	118	123	125										
127	129	133	151	152	155	157	160	171	155	156	157	159	160	165	171	127	128	131	132	133	135	138	139	141	147														
																				148	151	156	157	159	160	165	171												

TABLE 3 (cont.)

Species worth considering for Mean Annual Rainfall 650-1000 mm

Mean Annual Temperature (Altitude)																			
18-20°C (1400-1800 metres)										18°C and below (1800 metres and above)									
1. Acacia albida 3. Acacia cyanophylla 20. Alnus nepalensis 53. Cupressus torulosa 54. Dalbergia sissoo 57. Eucalyptus botryoides 60. Eucalyptus camaldulensis (S. Provs.) 61. Eucalyptus citriodora 70. Eucalyptus gomphocephala 74. Eucalyptus maculata 93. Eucalyptus tereticornis 98. Ficus benghalensis 99. Gleditsia triacanthos 129. Pinus elliotii var. elliotii 152. Prosopis juliflora										53. Cupressus torulosa 69. Eucalyptus globulus 124. Pinus canariensis 142. Pinus pinaster (Portuguese Provs.) 146. Pinus radiata									
5	7	8	9	11	12	18	19	25	29	1	3	5	7	8	9	11	12	19	20
30	33	38	39	42	47	50	51	52	55	21	25	30	33	38	39	42	50	51	52
59	62	63	64	68	69	71	75	76	77	54	55	57	60	61	62	63	64	65	67
81	82	84	86	87	88	91	94	102	105	68	70	71	74	75	76	77	79	80	82
106	107	108	109	110	118	123	124	128	131	84	85	86	87	88	92	93	94	96	98
132	135	136	138	139	140	141	142	143	145	99	102	110	123	128	129	130	131	132	135
146	147	148	154	156	159	165				136	138	139	140	141	143	144	145	147	148
										152	154	156	159	165					

TABLE 4

Species worth considering for Mean Annual Rainfall 1000-1600 mm

Mean Annual Temperature (Altitude)																													
24°C and above (0-600 metres)										22-24°C (600-1000 metres)										20-22°C (1000-1400 metres)									
22. Anacardium occidentale										7. Acacia mangium										7. Acacia mangium									
43. Chlorophora excelsa										18. Albizia lebbek										18. Albizia lebbek									
120. Peltophorum pterocarpum										20. Alnus nepalensis										20. Alnus nepalensis									
160. Sesbania grandiflora										25. Araucaria cunninghamii										25. Araucaria cunninghamii									
										29. Bombacopsis quinata										29. Bombacopsis quinata									
										32. Calliandra calothyrsus										38. Casuarina equisetifolia									
										38. Casuarina equisetifolia										47. Cordia alliodora									
										40. Casuarina junghuhniana										51. Cupressus lusitanica (including C. benthamii)									
										43. Chlorophora excelsa										53. Cupressus torulosa									
										47. Cordia alliodora										54. Dalbergia sissoo									
										54. Dalbergia sissoo										54. Dalbergia sissoo									
										55. Delonix regia										55. Delonix regia									
										61. Eucalyptus citriodora										61. Eucalyptus citriodora									
										63. Eucalyptus cloeziana										63. Eucalyptus cloeziana									
										71. Eucalyptus grandis										71. Eucalyptus grandis									
										98. Ficus benghalensis										75. Eucalyptus maidenii									
										99. Gleditsia triacanthos										98. Ficus benghalensis									
										100. Gliricidia sepium										99. Gleditsia triacanthos									
										101. Gmelina arborea										105. Jacaranda copaia									
										105. Jacaranda copaia										106. Jacaranda mimosifolia									
										106. Jacaranda mimosifolia										128. Pinus chiapensis									
										112. Melaleuca leucadendron										129. Pinus elliottii var. elliottii									
										127. Pinus caribaea var. hondurensis										132. Pinus kesiya									
										129. Pinus elliottii var. elliottii										139. Pinus palustris									
										133. Pinus merkusii (Continental Provs.)										141. Pinus patula subsp. tecunumanii									
										157. Samanea saman										159. Schizolobium parahybum									
										160. Sesbania grandiflora										165. Taxodium distichum									
										171. Toona ciliata																			
1	2	3	7	10	15	18	20	23	25	1	2	3	10	15	23	26	28	33	36	1	3	8	15	19	23	26	28	32	33
26	27	28	29	31	32	33	36	38	39	39	41	51	53	57	59	60	70	75	77	36	39	40	41	43	49	52	57	59	60
40	41	44	47	54	55	59	61	63	71	78	82	83	87	88	93	94	95	97	107	70	74	77	78	82	84	86	87	88	93
78	83	87	93	94	95	97	98	99	100	108	109	111	115	117	119	120	125	126	128	94	95	97	100	101	102	107	108	109	110
101	105	106	107	108	109	111	112	115	117	132	137	139	141	152	155	156	159	162	163	111	112	115	119	125	127	133	135	137	138
119	121	125	126	127	129	133	137	152	155	165	166	169	170	172						147	148	152	156	157	160	163	166	171	
157	162	163	166	169	170	171	172																						

TABLE 4 (cont.)

Species worth considering for Mean Annual Rainfall 1000-1600 mm

Mean Annual Temperature (Altitude)	
18-20°C (1400-1800 metres)	18°C and below (1800 metres and above)
7. <i>Acacia mangium</i>	5. <i>Acacia decurrens</i>
8. <i>Acacia mearnsii</i>	8. <i>Acacia mearnsii</i>
19. <i>Alnus acuminata</i>	9. <i>Acacia melanoxylon</i>
20. <i>Alnus nepalensis</i>	19. <i>Alnus acuminata</i>
25. <i>Araucaria cunninghamii</i>	21. <i>Alnus rubra</i>
38. <i>Casuarina equisetifolia</i>	51. <i>Cupressus lusitanica</i> (including <i>C. benthamii</i> )
51. <i>Cupressus lusitanica</i> (including <i>C. benthamii</i> )	53. <i>Cupressus torulosa</i>
52. <i>Cupressus macrocarpa</i>	67. <i>Eucalyptus delegatensis</i>
53. <i>Cupressus torulosa</i>	85. <i>Eucalyptus regnans</i>
54. <i>Dalbergia sissoo</i>	92. <i>Eucalyptus st.-johnii</i>
55. <i>Delonix regia</i>	96. <i>Eucalyptus viminalis</i>
61. <i>Eucalyptus citriodora</i>	136. <i>Pinus montezumae</i>
63. <i>Eucalyptus cloeziana</i>	140. <i>Pinus patula</i> subsp. <i>patula</i>
71. <i>Eucalyptus grandis</i>	146. <i>Pinus radiata</i>
75. <i>Eucalyptus maidenii</i>	
86. <i>Eucalyptus resinifera</i>	
98. <i>Ficus benghalensis</i>	
99. <i>Gleditsia triacanthos</i>	
128. <i>Pinus chiapensis</i>	
129. <i>Pinus elliottii</i> var. <i>elliottii</i>	
132. <i>Pinus kesiya</i>	
135. <i>Pinus michoacana</i>	
139. <i>Pinus palustris</i>	
141. <i>Pinus patula</i> subsp. <i>tecunumanii</i>	
148. <i>Pinus taeda</i>	
159. <i>Schizolobium parahybum</i>	
165. <i>Taxodium distichum</i>	
1 3 5 9 15 18 23 24 26 29	1 3 7 20 24 25 33 38 39 48
33 39 41 47 48 49 57 59 60 68	49 52 54 55 57 60 61 63 65 68
69 70 74 77 82 84 87 88 93 94	69 70 71 74 75 77 79 80 82 84
95 102 105 106 107 108 109 110 119 124	86 87 88 93 94 95 98 99 102 110
136 137 138 140 142 145 146 147 152 156	122 124 128 129 132 135 137 138 139 141
	142 145 147 148 149 152 156 159 165

TABLE 5

Species worth considering for Mean Annual Rainfall 1600 mm and above

Mean Annual Temperature (Altitude)		
24°C and above (0-600 metres)	22-24°C (600-1000 metres)	20-22°C (1000-1400 metres)
27. <i>Aucoumea klaineana</i> 35. <i>Cariniaria pyriformis</i> 44. <i>Cleistopholis glauca</i> 66. <i>Eucalyptus deglupta</i> 104. <i>Hieronyma chocoensis</i> 113. <i>Musanga cecropioides</i> 114. <i>Nauclea diderrichii</i> 116. <i>Octomeles sumatrana</i> 172. <i>Triplochiton scleroxylon</i>	16. <i>Agathis dammara</i> 17. <i>Albizia falcataria</i> 26. <i>Araucaria hunsteinii</i> 35. <i>Cariniaria pyriformis</i> 66. <i>Eucalyptus deglupta</i>  2 7 15 18 20 23 25 29 32 34 38 40 41 43 47 51 53 54 55 61 63 71 75 83 95 98 99 100 101 104 105 106 111 112 114 115 116 119 120 126 127 128 129 132 133 134 139 141 155 157 159 160 162 163 165 166 167 168 169 170 171 172	16. <i>Agathis dammara</i> 26. <i>Araucaria hunsteinii</i> 66. <i>Eucalyptus deglupta</i> 134. <i>Pinus merkusii</i> (Island Provs.)  7 8 15 17 18 19 20 23 25 29 32 35 38 40 41 43 47 49 51 52 53 54 55 61 63 71 75 86 95 98 99 100 101 105 106 111 112 115 119 127 128 129 132 133 135 139 141 148 157 159 160 163 165 166 171
	18-20°C (1400-1800 metres)	18°C and below (1800 metres and above)
2 7 15 16 17 18 20 22 23 25 26 29 32 34 38 40 41 43 47 54 55 61 63 71 83 95 98 99 100 101 105 106 111 112 115 119 120 126 127 129 133 155 157 160 162 163 166 167 168 169 170 171	5 7 8 9 15 16 18 19 20 23 24 25 26 29 38 41 47 48 49 51 52 53 54 55 61 63 66 71 75 86 95 98 99 105 106 119 124 128 129 132 134 135 136 139 140 141 146 148 159 165	5 7 8 9 19 20 21 24 25 38 48 49 51 52 53 54 55 61 63 67 71 75 85 86 92 95 96 98 99 122 124 128 129 132 135 136 139 140 141 146 148 149 159 165

TABLE 6

Species Tolerant of Particular Soil Conditions

Heavy Soils		
2. <i>Acacia auriculiformis</i>	60. <i>Eucalyptus camaldulensis</i> (S. Provs.)	108. <i>Leucaena leucocephala</i> (Hawaiian type)
6. <i>Acacia farnesiana</i>	65. <i>Eucalyptus dalrympleana</i>	109. <i>Leucaena leucocephala</i> (Salvador type)
8. <i>Acacia mearnsii</i>	69. <i>Eucalyptus globulus</i>	110. <i>Liquidambar styraciflua</i>
10. <i>Acacia nilotica</i>	73. <i>Eucalyptus largiflorens</i>	112. <i>Melaleuca leucadendron</i>
11. <i>Acacia pendula</i>	74. <i>Eucalyptus maculata</i>	129. <i>Pinus elliotii</i> var. <i>elliotii</i>
12. <i>Acacia salicina</i>	75. <i>Eucalyptus maidenii</i>	130. <i>Pinus greggii</i>
13. <i>Acacia senegal</i>	76. <i>Eucalyptus melliodora</i>	132. <i>Pinus kesiya</i>
16. <i>Agathis dammara</i>	78. <i>Eucalyptus microtheca</i>	133. <i>Pinus merkusii</i> (Continental Provs.)
17. <i>Albizia falcataria</i>	79. <i>Eucalyptus nitens</i>	135. <i>Pinus michoacana</i>
18. <i>Albizia lebbek</i>	80. <i>Eucalyptus obliqua</i>	137. <i>Pinus occidentalis</i>
19. <i>Alnus acuminata</i>	81. <i>Eucalyptus occidentalis</i>	138. <i>Pinus oocarpa</i>
25. <i>Araucaria cunninghamii</i>	85. <i>Eucalyptus regnans</i>	145. <i>Pinus pseudostrobus</i>
26. <i>Araucaria hunsteinii</i>	87. <i>Eucalyptus robusta</i>	147. <i>Pinus roxburghii</i>
27. <i>Aucoumea klaineana</i>	89. <i>Eucalyptus salmonophloia</i>	148. <i>Pinus taeda</i>
28. <i>Azadirachta indica</i>	91. <i>Eucalyptus sideroxylon</i>	151. <i>Prosopis cineraria</i>
29. <i>Bombacopsis quinata</i>	92. <i>Eucalyptus st.-johnii</i>	152. <i>Prosopis juliflora</i>
32. <i>Calliandra calothyrsus</i>	93. <i>Eucalyptus tereticornis</i>	157. <i>Samanea saman</i>
34. <i>Camnosperma brevipetiolata</i>	95. <i>Eucalyptus urophylla</i>	159. <i>Schizolobium parahybum</i>
35. <i>Cariniaria pyriformis</i>	96. <i>Eucalyptus viminalis</i>	160. <i>Sesbania grandiflora</i>
39. <i>Casuarina glauca</i>	99. <i>Gleditsia triacanthos</i>	162. <i>Swietenia macrophylla</i>
41. <i>Cedrela odorata</i>	101. <i>Gmelina arborea</i>	165. <i>Taxodium distichum</i>
45. <i>Colophospermum mopane</i>	103. <i>Haloxylon aphyllum</i>	166. <i>Tectona grandis</i>
47. <i>Cordia alliodora</i>	104. <i>Hieronyma chocoensis</i>	167. <i>Terminalia brassii</i>
48. <i>Cryptomeria japonica</i>	105. <i>Jacaranda copaia</i>	168. <i>Terminalia calamansarai</i>
57. <i>Eucalyptus botryoides</i>	107. <i>Khaya senegalensis</i>	173. <i>Zizyphus spina-christi</i>
59. <i>Eucalyptus camaldulensis</i> (N. Provs.)		

TABLE 6 (cont.)

Species Tolerant of Particular Soil Conditions

Impeded Drainage/Waterlogging	Saline Soils	
1. <i>Acacia albida</i> 2. <i>Acacia auriculiformis</i> 7. <i>Acacia mangium</i> 10. <i>Acacia nilotica</i> 29. <i>Bombacopsis quinata</i> 34. <i>Camposperma brevipetiolata</i> 38. <i>Casuarina equisetifolia</i> 39. <i>Casuarina glauca</i> 45. <i>Colophospermum mopane</i> 46. <i>Conocarpus lancifolius</i> 54. <i>Dalbergia sissoo</i> 57. <i>Eucalyptus botryoides</i> 59. <i>Eucalyptus camaldulensis</i> (N. Provs.) 60. <i>Eucalyptus camaldulensis</i> (S. Provs.) 73. <i>Eucalyptus largiflorens</i> 78. <i>Eucalyptus microtheca</i>	81. <i>Eucalyptus occidentalis</i> 87. <i>Eucalyptus robusta</i> 91. <i>Eucalyptus sideroxylon</i> 104. <i>Hieronyma chocoensis</i> 105. <i>Jacaranda copaia</i> 112. <i>Melaleuca leucadendron</i> 113. <i>Musanga cecropioides</i> 148. <i>Pinus taeda</i> 151. <i>Prosopis cineraria</i> 153. <i>Prosopis tamarugo</i> 156. <i>Salix babylonica</i> var. <i>sacramenta</i> 157. <i>Samanea saman</i> 160. <i>Sesbania grandiflora</i> 163. <i>Tabebuia rosea</i> 165. <i>Taxodium distichum</i> 167. <i>Terminalia brassii</i>	4. <i>Acacia cyclops</i> 6. <i>Acacia farnesiana</i> 12. <i>Acacia salicina</i> 39. <i>Casuarina glauca</i> 45. <i>Colophospermum mopane</i> 56. <i>Elaeagnus angustifolia</i> 81. <i>Eucalyptus occidentalis</i> 90. <i>Eucalyptus sargentii</i> 99. <i>Gleditsia triacanthos</i> 103. <i>Haloxylon aphyllum</i> 105. <i>Jacaranda copaia</i> 112. <i>Melaleuca leucadendron</i> 153. <i>Prosopis tamarugo</i> 161. <i>Simmondsia chinensis</i> 164. <i>Tamarix aphylla</i>

TABLE 6 (cont.)

Species Tolerant of Particular Soil Conditions

Alkaline Soils		
2. <i>Acacia auriculiformis</i>	58. <i>Eucalyptus brockwayi</i>	110. <i>Liquidambar styraciflua</i>
3. <i>Acacia cyanophylla</i>	59. <i>Eucalyptus camaldulensis</i> (N. Provs.)	112. <i>Melaleuca leucadendron</i>
4. <i>Acacia cyclops</i>	60. <i>Eucalyptus camaldulensis</i> (S. Provs.)	115. <i>Ochroma pyramidale</i>
6. <i>Acacia farnesiana</i>	70. <i>Eucalyptus gomphocephala</i>	118. <i>Parkinsonia aculeata</i>
10. <i>Acacia nilotica</i>	72. <i>Eucalyptus intertexta</i>	123. <i>Pinus brutia</i>
11. <i>Acacia pendula</i>	73. <i>Eucalyptus largiflorens</i>	125. <i>Pinus caribaea</i> var. <i>bahamensis</i>
12. <i>Acacia salicina</i>	76. <i>Eucalyptus melliodora</i>	131. <i>Pinus halepensis</i>
14. <i>Acacia tortilis</i> subsp. <i>raddiana</i>	78. <i>Eucalyptus microtheca</i>	144. <i>Pinus ponderosa</i> var. <i>arizonica</i>
18. <i>Albizia lebbek</i>	81. <i>Eucalyptus occidentalis</i>	150. <i>Prosopis chilensis</i>
30. <i>Brachychiton populneum</i>	89. <i>Eucalyptus salmonophloia</i>	151. <i>Prosopis cineraria</i>
38. <i>Casuarina equisetifolia</i>	90. <i>Eucalyptus sargentii</i>	152. <i>Prosopis juliflora</i>
39. <i>Casuarina glauca</i>	91. <i>Eucalyptus sideroxylon</i>	153. <i>Prosopis tamarugo</i>
40. <i>Casuarina junghuhniana</i>	96. <i>Eucalyptus viminalis</i>	154. <i>Robinia pseudoacacia</i>
42. <i>Ceratonia siliqua</i>	98. <i>Ficus benghalensis</i>	158. <i>Schinus molle</i>
45. <i>Colophospermum mopane</i>	99. <i>Gleditsia triacanthos</i>	161. <i>Simmondsia chinensis</i>
46. <i>Conocarpus lancifolius</i>	100. <i>Gliricidia sepium</i>	162. <i>Swietenia macrophylla</i>
47. <i>Cordia alliodora</i>	103. <i>Haloxylon aphyllum</i>	163. <i>Tabebuia rosea</i>
50. <i>Cupressus arizonica</i>	105. <i>Jacaranda copaia</i>	164. <i>Tamarix aphylla</i>
52. <i>Cupressus macrocarpa</i>	106. <i>Jacaranda mimosifolia</i>	165. <i>Taxodium distichum</i>
53. <i>Cupressus torulosa</i>	108. <i>Leucaena leucocephala</i> (Hawaiian type)	170. <i>Terminalia superba</i>
56. <i>Elaeagnus angustifolia</i>	109. <i>Leucaena leucocephala</i> (Salvador type)	173. <i>Zizyphus spina-christi</i>

## INDEX TO SPECIES

1. *Acacia albida*
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3. *Acacia cyanophylla*
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7. *Acacia mangium*
8. *Acacia mearnsii*
9. *Acacia melanoxylon*
10. *Acacia nilotica*
11. *Acacia pendula*
12. *Acacia salicina*
13. *Acacia senegal*
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29. *Bombacopsis quinata*
30. *Brachychiton populneum*
31. *Butyrospermum paradoxum*
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35. *Cariniaria pyriformis*
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43. *Chlorophora excelsa*
44. *Cleistopholis glauca*
45. *Colophospermum mopane*
46. *Conocarpus lancifolius*
47. *Cordia alliodora*
48. *Cryptomeria japonica*
49. *Cunninghamia lanceolata*
50. *Cupressus arizonica*
51. *Cupressus lusitanica* (including *C. benthamii*)
52. *Cupressus macrocarpa*
53. *Cupressus torulosa*
54. *Dalbergia sissoo*
55. *Delonix regia*
56. *Elaeagnus angustifolia*

57. *Eucalyptus botryoides*
58. *Eucalyptus brockwayi*
59. *Eucalyptus camaldulensis* (Northern Provenances)
60. *Eucalyptus camaldulensis* (Southern Provenances)
61. *Eucalyptus citriodora*
62. *Eucalyptus cladocalyx*
63. *Eucalyptus cloëziana*
64. *Eucalyptus crebra* (Inland Provenances)
65. *Eucalyptus dalrympleana*
66. *Eucalyptus deglupta*
67. *Eucalyptus delegatensis*
68. *Eucalyptus fastigata*
69. *Eucalyptus globulus*
70. *Eucalyptus gomphocephala*
71. *Eucalyptus grandis*
72. *Eucalyptus intertexta*
73. *Eucalyptus largiflorens*
74. *Eucalyptus maculata*
75. *Eucalyptus maidenii*
76. *Eucalyptus melliodora*
77. *Eucalyptus microcorys*
78. *Eucalyptus microtheca*
79. *Eucalyptus nitens*
80. *Eucalyptus obliqua*
81. *Eucalyptus occidentalis*
82. *Eucalyptus paniculata*
83. *Eucalyptus pellita*
84. *Eucalyptus propinqua*
85. *Eucalyptus regnans*
86. *Eucalyptus resinifera*
87. *Eucalyptus robusta*
88. *Eucalyptus saligna*
89. *Eucalyptus salmonophloia*
90. *Eucalyptus sargentii*
91. *Eucalyptus sideroxylon* (Inland Victoria Provenances)
92. *Eucalyptus st.-johnii*
93. *Eucalyptus tereticornis* (Queensland and New Guinea Provenances)
94. *Eucalyptus torelliana*
95. *Eucalyptus urophylla*
96. *Eucalyptus viminalis*
97. *Euphorbia tirucalli*
98. *Ficus benghalensis*
99. *Gleditsia triacanthos*
100. *Gliricidia sepium*
101. *Gmelina arborea*
102. *Grevillea robusta*
103. *Haloxylon aphyllum*
104. *Hieronyma chocoënsis*
105. *Jacaranda copaia*
106. *Jacaranda mimosifolia*
107. *Khaya senegalensis*
108. *Leucaena leucocephala* (Hawaiian type)
109. *Leucaena leucocephala* (Salvador type)
110. *Liquidambar styraciflua*
111. *Maesopsis eminii*
112. *Melaleuca leucadendron*
113. *Musanga cecropioides*
114. *Nauclea diderrichii*

115. *Ochroma pyramidale*
116. *Octomeles sumatrana*
117. *Parkia biglobosa*
118. *Parkinsonia aculeata*
119. *Paulownia tomentosa*
120. *Peltophorum pterocarpum*
121. *Pericopsis elata*
122. *Pinus ayacahuite*
123. *Pinus brutia*
124. *Pinus canariensis*
125. *Pinus caribaea* var. *bahamensis*
126. *Pinus caribaea* var. *caribaea*
127. *Pinus caribaea* var. *hondurensis*
128. *Pinus chiapensis*
129. *Pinus elliottii* var. *elliottii*
130. *Pinus greggii*
131. *Pinus halepensis*
132. *Pinus kesiya*
133. *Pinus merkusii* (Continental Provenances)
134. *Pinus merkusii* (Island Provenances)
135. *Pinus michoacana*
136. *Pinus montezumae*
137. *Pinus occidentalis*
138. *Pinus oocarpa*
139. *Pinus palustris*
140. *Pinus patula* subsp. *patula*
141. *Pinus patula* subsp. *tecunumanii*
142. *Pinus pinaster* (Portuguese Provenances)
143. *Pinus pinea*
144. *Pinus ponderosa* var. *arizonica*
145. *Pinus pseudostrobus*
146. *Pinus radiata*
147. *Pinus roxburghii*
148. *Pinus taeda*
149. *Populus deltoides* var. *deltoides*
150. *Prosopis chilensis*
151. *Prosopis cineraria*
152. *Prosopis juliflora*
153. *Prosopis tamarugo*
154. *Robinia pseudoacacia*
155. *Roseodendron donnell-smithii*
156. *Salix babylonica* var. *sacramenta*
157. *Samanea saman*
158. *Schinus molle*
159. *Schizolobium parahybum*
160. *Sesbania grandiflora*
161. *Simmondsia chinensis*
162. *Swietenia macrophylla*
163. *Tabebuia rosea*
164. *Tamarix aphylla*
165. *Taxodium distichum*
166. *Tectona grandis*
167. *Terminalia brassii*
168. *Terminalia calamansanai*
169. *Terminalia ivorensis*
170. *Terminalia superba*
171. *Toona ciliata*
172. *Triplochiton scleroxylon*
173. *Zizyphus spina-christi*

SYNONYMSSynonymListed Under:

<i>Acacia arabica</i> .....	<i>Acacia nilotica</i> (10)
<i>Acacia auriculaeformis</i> .....	<i>Acacia auriculiformis</i> (2)
<i>Acacia cavenia</i> .....	<i>Acacia farnesiana</i> (6)
<i>Acacia decurrens</i> var. <i>mollis</i> .....	<i>Acacia mearnsii</i> (8)
<i>Acacia decurrens</i> var. <i>normalis</i> .....	<i>Acacia decurrens</i> (5)
<i>Acacia leucophylla</i> .....	<i>Acacia pendula</i> (11)
<i>Acacia raddiana</i> .....	<i>Acacia tortilis</i> subsp. <i>raddiana</i> (14)
<i>Acacia saligna</i> .....	<i>Acacia cyanophylla</i> (3)
<i>Acacia vereck</i> .....	<i>Acacia senegal</i> (13)
<i>Afrormosia elata</i> .....	<i>Pericopsis elata</i> (121)
<i>Agathis alba</i> .....	<i>Agathis dammara</i> (16)
<i>Agati grandiflora</i> .....	<i>Sesbania grandiflora</i> (160)
<i>Albizia falcata</i> .....	<i>Albizia falcataria</i> (17)
<i>Albizia moluccana</i> .....	<i>Albizia falcataria</i> (17)
<i>Alnus jorullensis</i> .....	<i>Alnus acuminata</i> (19)
<i>Alnus oregana</i> .....	<i>Alnus rubra</i> (21)
<i>Anthocephalus cadamba</i> .....	<i>Anthocephalus chinensis</i> (23)
<i>Anthocephalus indicus</i> .....	<i>Anthocephalus chinensis</i> (23)
<i>Araucaria brasiliana</i> .....	<i>Araucaria angustifolia</i> (24)
<i>Araucaria klinkii</i> .....	<i>Araucaria hunsteinii</i> (26)
<i>Bombacopsis sepium</i> .....	<i>Bombacopsis quinata</i> (29)
<i>Butyrospermum niloticum</i> .....	<i>Butyrospermum paradoxum</i> (31)
<i>Butyrospermum parkii</i> .....	<i>Butyrospermum paradoxum</i> (31)
<i>Calliandra confusa</i> .....	<i>Calliandra calothyrsus</i> (32)
<i>Callitris glauca</i> .....	<i>Callitris columellaris</i> (33)
<i>Callitris hugelii</i> .....	<i>Callitris columellaris</i> (33)
<i>Callitris intratropica</i> .....	<i>Callitris columellaris</i> (33)

<i>Cassia florida</i> .....	<i>Cassia siamea</i> (36)
<i>Casuarina lepidophloia</i> .....	<i>Casuarina glauca</i> (39)
<i>Casuarina littoralis</i> .....	<i>Casuarina equisetifolia</i> (38)
<i>Cedrela mexicana</i> .....	<i>Cedrela odorata</i> (41)
<i>Cedrela toona</i> .....	<i>Toona ciliata</i> (171)
<i>Cleistopholis grandiflora</i> .....	<i>Cleistopholis glauca</i> (44)
<i>Copaifera mopane</i> .....	<i>Colophospermum mopane</i> (45)
<i>Cunninghamia sinensis</i> .....	<i>Cunninghamia lanceolata</i> (49)
<i>Cupressus glauca</i> .....	<i>Cupressus lusitanica</i> (51)
<i>Cupressus hartwegii</i> .....	<i>Cupressus macrocarpa</i> (52)
<i>Cupressus lindleyi</i> .....	<i>Cupressus lusitanica</i> (51)
<i>Cybistax donnell-smithii</i> .....	<i>Roseodendron donnell-smithii</i> (155)
<i>Eucalyptus bicolor</i> .....	<i>Eucalyptus largiflorens</i> (73)
<i>Eucalyptus bicostata</i> .....	<i>Eucalyptus st-johnii</i> (92)
<i>Eucalyptus coolabah</i> .....	<i>Eucalyptus microtheca</i> (78)
<i>Eucalyptus gigantea</i> .....	<i>Eucalyptus delegatensis</i> (67)
<i>Eucalyptus hemilampra</i> .....	<i>Eucalyptus resinifera</i> (86)
<i>Eucalyptus multiflora</i> .....	<i>Eucalyptus robusta</i> (87)
<i>Eucalyptus naudiniana</i> .....	<i>Eucalyptus deglupta</i> (66)
<i>Eucalyptus rostrata</i> .....	<i>Eucalyptus camaldulensis</i> (59/60)
<i>Eucalyptus umbellata</i> .....	<i>Eucalyptus tereticornis</i> (93)
<i>Faidherbia albida</i> .....	<i>Acacia albida</i> (1)
<i>Gliricidia maculata</i> .....	<i>Gliricidia sepium</i> (100)
<i>Grevillea umbricata</i> .....	<i>Grevillea robusta</i> (102)
<i>Haloxylon ammondendron</i> .....	<i>Haloxylon aphyllum</i> (103)
<i>Leucaena glauca</i> .....	<i>Leucaena leucocephala</i> (108/109)
<i>Melaleuca leucadendra</i> .....	<i>Melaleuca leucadendron</i> (112)

<i>Melaleuca quinquenervia</i> .....	<i>Melaleuca leucadendron</i> (112)
<i>Melia azadirachta</i> .....	<i>Azadirachta indica</i> (28)
<i>Melia indica</i> .....	<i>Azadirachta indica</i> (28)
<i>Mimosa farnesiana</i> .....	<i>Acacia farnesiana</i> (6)
<i>Mimosa juliflora</i> .....	<i>Prosopis juliflora</i> (152)
<i>Mimosa lebbek</i> .....	<i>Albizia lebbek</i> (18)
<i>Mimosa sirissa</i> .....	<i>Albizia lebbek</i> (18)
<i>Musanga smithii</i> .....	<i>Musanga cecropioides</i> (113)
<i>Ochroma lagopus</i> .....	<i>Ochroma pyramidale</i> (115)
<i>Parkia africana</i> .....	<i>Parkia biglobosa</i> (117)
<i>Peltophorum ferrugineum</i> .....	<i>Peltophorum pterocarpum</i> (120)
<i>Peltophorum inerme</i> .....	<i>Peltophorum pterocarpum</i> (120)
<i>Pinus arizonica</i> .....	<i>Pinus ponderosa</i> var. <i>arizonica</i> (144)
<i>Pinus australis</i> .....	<i>Pinus palustris</i> (139)
<i>Pinus cubensis</i> .....	<i>Pinus occidentalis</i> (137)
<i>Pinus halepensis</i> var. <i>brutia</i> .....	<i>Pinus brutia</i> (123)
<i>Pinus insignis</i> .....	<i>Pinus radiata</i> (146)
<i>Pinus insularis</i> .....	<i>Pinus kesiya</i> (132)
<i>Pinus khasya</i> .....	<i>Pinus kesiya</i> (132)
<i>Pinus longifolia</i> .....	<i>Pinus roxburghii</i> (147)
<i>Pinus maritima</i> .....	<i>Pinus pinaster</i> (142)
<i>Pinus pseudopatula</i> .....	<i>Pinus greggii</i> (130)
<i>Pinus strobus</i> var. <i>chiapensis</i> .....	<i>Pinus chiapensis</i> (128)
<i>Pithecolobium saman</i> .....	<i>Samanea saman</i> (157)
<i>Poinciana regia</i> .....	<i>Delonix regia</i> (55)
<i>Populus deltoides</i> var. <i>missouriensis</i> .....	<i>Populus deltoides</i> var. <i>deltoides</i> (149)
<i>Prosopis spicigera</i> .....	<i>Prosopis cineraria</i> (151)
<i>Rhamnus spina-christi</i> .....	<i>Zizyphus spina-christi</i> (173)
<i>Sarcocephalus trillesii</i> .....	<i>Nauclea diderrichii</i> (114)

*Simmondsia californica* ..... *Simmondsia chinensis* (161)  
*Sterculia diversifolia* ..... *Brachychiton populneum* (30)  
*Tabebuia donnell-smithii* ..... *Roseodendron donnell-smithii* (155)  
*Tamarix articulata* ..... *Tamarix aphylla* (164)  
*Tamarix orientalis* ..... *Tamarix aphylla* (164)

## 6. EXPLANATORY NOTES ON THE SPECIES DATA SHEETS

Note: All characteristics 6-40 include reported experience of the species as an exotic as well as within its natural distribution.

3. Local or Trade Names

In most cases only the accepted English, local or trade names are given.

4. Latitudes

Usually the approximate overall distribution, but in the case of Eucalypts, the latitudes of principal occurrence are quoted.

6. Altitudinal Range

In metres above sea level. The ranges given are those which apply within tropical and subtropical latitudes. Some species, originating from outside this zone, may occur at lower elevations in temperate latitudes.

7. Mean Annual Rainfall

Species may often thrive in rainfalls different from those quoted, but generally more desirable species are available at higher rainfalls.

8. Rainfall Regime

Equatorial, all the year round rainfall has been described as "uniform".

9. Dry Season

Of the many parameters in use, Laurie's (107) definition of a dry month as being one with less than 40 mm precipitation has been applied.

13. Texture

"Heavy" includes clays, clay loams and sandy clays;

"Medium" includes loams and sandy clay loams;

"Light" includes sands and sandy loams.

14. Reaction

- "Acid" - pH 6 and below;  
 "Neutral" - pH 6.1 to 7.4;  
 "Alkaline" - pH 7.5 and above.

19. Form

- "Exceptional" - very suitable for transmission poles.  
 "Acceptable" - can be used for transmission poles; suitable for building poles.  
 "Poor" - cannot be used for transmission poles.

21. Other Silvicultural Characteristics

"Aggressive coloniser" - draws attention to the risk of using species which, when introduced to conditions more favourable than those of their natural distribution, may be capable of rapid, uncontrollable colonisation of the surrounding area.

"Provenance variation" - indicates species in which distinct differences in silvicultural characteristics and production rates exist, between provenances. Production figures will be the mean known provenance performances.

"Fixes nitrogen" - a species which is capable (usually due to mycorrhizal associations) of 'fixing' atmospheric nitrogen ( $N_2$ ) into organic complexes. Growth of such species often improves soil.

"Fire resistant" - a species which either resists serious damage (e.g. thick bark protects cambium), or regenerates quickly, vegetatively, after fire damage.

"Fuelwood rotation" - where rotation lengths are given, the figures represent the usual ranges experienced. Extremes will depend on soil type, use of fertiliser, etc. and have been omitted.

22. Production

The range of production levels reported on suitable sites in well managed stands, but excluding abnormally high or low figures.

23. Rôle in Land Use

Use of the species in afforestation, where the primary object is not production.

24. Density

"S.G." = specific gravity at 12% moisture content.

25. Natural Durability

Natural durability (resistance to attack by fungi and insects) of heartwood. Chudnoff's (1979) 5-point scale has been used:

<u>Durability in contact with ground</u>	<u>Term of durability (years)</u>
Perishable	Less than 5
Non-durable	5-10
Moderately durable	10-15
Durable	15-25
Very durable	More than 25

N.B. Short rotation trees will have higher proportions of sapwood and durability may therefore be lower than usual.

30-31. Utilization

Uses are described by broad categories. For fuelwood, gross calorific value dry basis (kJ/kg) is quoted, when available, as "C.V.".

"Honeyflora" - High yields of nectar suitable for honey production.

33. Seed Sources

Only the principal seed sources are listed. Seed of a large number of species is also available from major commercial seed houses.

34. Seeds per Kilogramme

Average figures or the range of reported values.

35. Seed Storage

Storage in airtight conditions is understood, in addition to the recommendations described. Generally a temperature of 4°C is preferred.

36. Pre-treatment

The most common treatments are:-

- i) Bring water to boil, immerse seed, allow to cool for 24 hours,
- ii) Soak in cold water for the stated period,
- iii) Cold stratify in damp sand for the stated period.

### 37. Planting Stock

"Potted plants" includes all containerised stock, whether in tubes, plastic pots, or other types of container.

### 38. Special Requirements

"Grass stage in seedling" - Important. In early years, tree consists of 'leader' only. Careful weeding is necessary until tree is well established and a 'normal' crown with side branches develops.

"Requires mycorrhizae" - When young trees are introduced to sites new to the species, the soil may need to be 'inoculated' with cultures of the appropriate mycorrhizal organism.

### 39. Germination and Growth

Growth "to plantable size" is only a very approximate indication. It will depend greatly on ambient temperatures and nursery techniques. However, periods are quoted to give some idea of the time required in the nursery, for the planning of species trials timetables.

### 40. Principal Pests and Diseases

Limited to those reported to be of major importance and capable of limiting the use of the species as an exotic. Even in such cases, the attacks may be of regional importance and the pests or diseases may not necessarily present a problem in other parts of the world.

7. COUNTRIES WITH EXPERIENCE OF AFFORESTATION WITH EXOTIC OR LOCAL SPECIES

Local species in parentheses. Some promising trials are included; however, many countries other than those listed, are carrying out trials.

Species	Countries									
1. <i>Acacia albida</i>	I	KEN	NIG	(SA)	SEN	(SUD)	UGA	(ZIM)	ZAM	
2. <i>Acacia auriculiformis</i>	(AUS)	I	IND	MAL	NIG	(PNG)	SAB	UGA	ZAN	
3. <i>Acacia cyanophylla</i>	CHL	CYP	I	MEX	MOR					
4. <i>Acacia cyclops</i>	(AUS)	CYP	PAL	(SA)						
5. <i>Acacia decurrens</i>	ARG	BRA	I	KEN	NZ	(SA)	SLK	TAN	URG	
6. <i>Acacia farnesiana</i>	(ARG)	AUS	(CHL)	CYP	(HAW)	IND	JAM	(MEX)	UGA	(USA)
7. <i>Acacia mangium</i>	(AUS)	MAL	PHI	SAB						
8. <i>Acacia mearnsii</i>	I	KEN	SA	SLK	TAN	ZIM				
9. <i>Acacia melanoxylon</i>	KEN	SLK	TAN							
10. <i>Acacia nilotica</i>	AUS TAN	CYP ZIM	EPT	(I)	IND	(KEN)	(NIG)	(PAK)	SA	(SUD)
11. <i>Acacia pendula</i>	(AUS)									
12. <i>Acacia salicina</i>	CYP	IRA	JOR	KUW						
13. <i>Acacia senegal</i>	(NGR)	(SEN)	(SUD)	(TCH)						
14. <i>Acacia tortilis</i> subsp. <i>raddiana</i>	(ETH)	I	(SR)	(JOR)	KEN	(SA)	(SOM)	(SUD)	(TAN)	(YEM)

Species	Countries										
15. <i>Acrocarpus fraxinifolius</i>	(I)	MAL	NIG	TAN	UGA	ZAM	ZIM				
16. <i>Agathis dammara</i>	(IND)										
17. <i>Albizia falcataria</i>	AUS SLK	BAN SOL	FIJ ZAI	HAW	I	(IND)	IVC	MAL	PHI	SAB	
18. <i>Albizia lebbek</i>	FIJ	(I)	KUW	MAU							
19. <i>Alnus acuminata</i>	(ARG)	(COL)	CR	(ECU)	(PER)						
20. <i>Alnus nepalensis</i>	(CHN)	HAW	(I)	IND							
21. <i>Alnus rubra</i>	(USA)										
22. <i>Anacardium occidentale</i>	AUS	(BRA)	I	JAM	(MEX)	MOZ	(PER)	SA	SLK	ZIM	
23. <i>Anthocephalus chinensis</i>	AUS PR	(BAN) (SAB)	CHI	CR	FIJ	I	(IND)	IVC	(PHI)	(PNG)	
24. <i>Araucaria angustifolia</i>	(ARG)	AUS	(BRA)	KEN	SA	TAN	UGA	ZIM			
25. <i>Araucaria cunninghamii</i>	(AUS) ZIM	I	KEN	MAL	MAU	NIG	(PNG)	TAN	TRI	UGA	
26. <i>Araucaria hunsteinii</i>	KEN	MAL	(PNG)	SOL	TAN						
27. <i>Aucoumea klaineana</i>	(GAB)	GHA	IVC	NIG	SUD	UGA					
28. <i>Azadirachta indica</i>	GHA	(I)	NGR	NIG	SUD	TCH					
29. <i>Bombacopsis quinata</i>	(CR)	(VEN)									

Species	Countries									
30. <i>Brachychiton populneum</i>	(AUS)	CYP								
31. <i>Butyrospermum paradoxum</i>	-									
32. <i>Calliandra calothyrsus</i>	IND	(MEX)								
33. <i>Callitris columellaris</i>	(AUS)	BRA	KEN	MAL	MLW	SA	UGA			
34. <i>Camptosperma brevipetiolata</i>	(PNG)	(SOL)								
35. <i>Cariniaria pyriformis</i>	(COL)									
36. <i>Cassia siamea</i>	GHA	(I)	NIG	SUD	TAN	UGA				
37. <i>Casuarina decaisneana</i>	(AUS)									
38. <i>Casuarina equisetifolia</i>	ARG SLK	BRA TAN	CHL	CHN	EGY	I	KEN	MEX	MAU	PR
39. <i>Casuarina glauca</i>	(AUS)	CYP	I	ISR	KEN	PAL	USA			
40. <i>Casuarina junghuhniana</i>	TAI									
41. <i>Cedrela odorata</i>	ARG NIG	BRA PHI	(COL) SL	CUB SOL	ECU TAN	FIJ TRI	GHA UGA	IND	MAD	MEX
42. <i>Ceratonia siliqua</i>	(ALG) PAL	AUS POR	(CYP) SP	GHA (TUN)	(GRE) USA	I ZIM	KEN	LEB	MEX	MOR
43. <i>Chlorophora excelsa</i>	COB	NIG								
44. <i>Cleistopholis glauca</i>	COB	NIG								

Species	Countries									
45. Colophospermum mopane	I	NIG	(SA)	(ZAM)	(ZIM)					
46. Conocarpus lancifolius	(SOM)	SUD								
47. Cordia alliodora	(BRA) (PR)	COB SL	(COL) SOL	(CR) TRI	(ECU) UGA	FIJ (VEN)	IVC	MAU	NH	NIG
48. Cryptomeria japonica	I	IRA	(JAP)	NZ	SA	TAN				
49. Cunninghamia lanceolata	BRA	(CHN)	I	JPA	MAL	(TWN)	ZIM			
50. Cupressus arizonica	ARG	AUS	IRA	(MEX)	(USA)					
51. Cupressus lusitanica	ARG MLW	AUS POR	BRA PR	CHL SA	COL SP	CR TAN	ECU UGA	I VEN	KEN ZA	(MEX) ZIM
52. Cupressus macrocarpa	COL	KEN	NZ	SA	TAN	UGA				
53. Cupressus torulosa	SA	ZIM								
54. Dalbergia sissoo	ECU	(I)	MEX	(PAK)	SUD	ZIM				
55. Delonix regia	ECU SL	FIJ TAN	I VEN	JAM ZAM	KEN ZIM	(MAD)	MAU	NIG	PAK	SA
56. Elaeagnus angustifolia	CYP	(IRA)	(TUR)	USA						
57. Eucalyptus botryoides	ALG USA	ARG	BRA	HAW	ITA	KEN	MAL	MOR	NZ	SA
58. Eucalyptus brockwayi	ALG	MOR								

Species	Countries									
59. <i>Eucalyptus camaldulensis</i> & 60.	ALG	ANG	ARG	BRA	CHL	COB	CYP	GRE	I	ISR
	ITA	KEN	LBY	MAD	MOR	NIG	PAK	POR	SA	SP
	TAN	TUN	TUR	URG	USA	ZAM	ZIM			
61. <i>Eucalyptus citriodora</i>	ARG	BRA	BUR	CHL	COB	FIJ	GUA	HAW	I	MLW
	POR	SA	SP	TAN	ZAM	ZIM				
62. <i>Eucalyptus cladocalyx</i>	(AUS)	MOR	SA	USA						
63. <i>Eucalyptus cloeziana</i>	BRA	COB	KEN	MAD	NIG	SA	SL	TAN	UGA	ZAM
	ZIM									
64. <i>Eucalyptus crebra</i>	BRA	I	HAW	SA						
65. <i>Eucalyptus dalrympleana</i>	BRA	BOL	PER	SA	USR					
66. <i>Eucalyptus deglupta</i>	BRA	COB	COL	CR	CUB	FIJ	HAW	I	(IND)	IVC
	MAL	NIG	(PHI)	(PNG)	SAB	SL	SLK	SOL	SUR	ZAI
67. <i>Eucalyptus delegatensis</i>	NZ	SA								
68. <i>Eucalyptus fastigata</i>	BRA	NZ	SA							
69. <i>Eucalyptus globulus</i>	ALG	ARG	(AUS)	BRA	CHI	COL	ECU	ETH	I	ITA
	KEN	NZ	PER	POR	SA	SP	TAN	URG	USA	ZIM
70. <i>Eucalyptus gomphocephala</i>	ALG	CYP	ETH	ISR	ITA	LBY	MOR	TUN	TUR	URG
71. <i>Eucalyptus grandis</i>	ANG	ARG	BRA	COB	COL	BRA	I	KEN	MLW	MOZ
	NIG	RWA	SA	SP	TAN	UGA	URG	ZAI	ZAM	ZIM
72. <i>Eucalyptus intertexta</i>	-									

Species	Countries									
73. <i>Eucalyptus largiflorens</i>	I	SA								
74. <i>Eucalyptus maculata</i>	(AUS) TUR	BRA UGA	GHA ZAI	I ZAM	ISR ZIM	KEN	MAD	SA	SL	TAN
75. <i>Eucalyptus maidenii</i>	BRA SA	BUR SP	CAM TAN	HAW ZIM	ITA	KEN	MAD	MLW	PER	NIG
76. <i>Eucalyptus melliodora</i>	SA									
77. <i>Eucalyptus microcorys</i>	BRA ZIM	HAW	KEN	MAD	MAL	SA	SLK	TAN	UGA	ZAI
78. <i>Eucalyptus microtheca</i>	IRA	IRQ	PAK	NIG	SUD					
79. <i>Eucalyptus nitens</i>	ARG	BOL	BRA	NZ	PER	SA	USA	ZIM		
80. <i>Eucalyptus obliqua</i>	I	NZ								
81. <i>Eucalyptus occidentalis</i>	ALG	HAW	ISR	MOR	SLK	TUN				
82. <i>Eucalyptus paniculata</i>	ARG	BRA	HAW	KEN	MAD	SA	SL	UGA	ZAM	ZIM
83. <i>Eucalyptus pellita</i>	BRA	ZIM								
84. <i>Eucalyptus propinqua</i>	BRA	SA								
85. <i>Eucalyptus regnans</i>	KEN	NZ	SA	TAN	UGA					
86. <i>Eucalyptus resinifera</i>	ARG	BRA	HAW	KEN	SA	SLK	TAN	UGA	ZAM	ZIM
87. <i>Eucalyptus robusta</i>	ANG GRE PER	ARG HAW PHI	(AUS) I PNG	BRA IND PR	CHL KEN SA	CHN MAD SLK	CAM MAL UGA	COB MAV ZAI	CR NIG	FIJ NZ

Species	Countries									
88. <i>Eucalyptus saligna</i>	ANG MLW ZAI	ARG MOR ZAM	BRA MOZ ZIM	BUR NIG	CAM NZ	GRE RWA	HAW SA	I TAN	IND UGA	KEN URG
89. <i>Eucalyptus salmonophloia</i>	MOR	SA								
90. <i>Eucalyptus sargentii</i>	MOR									
91. <i>Eucalyptus sideroxylon</i>	(AUS)	BRA	BUR	COB	MOR	SA	ZIM			
92. <i>Eucalyptus st.-johnii</i>	BOL	ECU	KEN	PER						
93. <i>Eucalyptus tereticornis</i>	ARG I PNG	BOT ISR PR	BRA IVC SOL	COB MAD SUD	COL MAL URG	CHL MAU ZAI	CHN MOZ ZAM	ETH PAK ZIM	FIJ PAR	GHA PHI
94. <i>Eucalyptus torelliana</i>	ARG	AUS	FIJ	GHA	I	MAL	NIG	SOL	ZAM	ZIM
95. <i>Eucalyptus urophylla</i>	ARG NIG	AUS PNG	BRA SOL	CAM	COB	FIJ	(IND)	IVC	MAD	MAL
96. <i>Eucalyptus viminalis</i>	ARG SP	BOL	CHL	FRA	GRE	HAW	I	NZ	PER	SA
97. <i>Euphorbia tirucalli</i>	I	MEX								
98. <i>Ficus benghalensis</i>	(I)	PAK	UGA							
99. <i>Gleditsia triacanthos</i>	ARG URG	AUS (USA)	I	ISR	ITA	KEN	SA	SP	TAN	TUR
100. <i>Gliricidia sepium</i>	(BRA)	NIC	NIG	PHI	(PR)	(VEN)				

Species	Countries										
101. <i>Gmelina arborea</i>	BRA SL	CR UGA	FIJ VEN	GHA	I	IVC	MAL	MLW	NIG	PHI	
102. <i>Grevillea robusta</i>	ANG PER	ARG RWA	(AUS) SA	CR SLK	ETH TAN	HAW	I	JAM	KEN	MAD	
103. <i>Haloxylon aphyllum</i>	(CHN)	(USR)									
104. <i>Hieronyma chocoensis</i>	COL	CR	(ECU)								
105. <i>Jacaranda copaia</i>	(BRA)	(HON)	KEN	(NIC)	PAK	TAN	(URG)	(VEN)			
106. <i>Jacaranda mimosifolia</i>	ARG	(BOL)	BRA	MLW	TAN	ZIM					
107. <i>Khaya senegalensis</i>	CAR	(COB)	(GHA)	IND	(IVC)	(NIG)	(SEN)	(SL)	SUD		
108. <i>Leucaena leucocephala</i> & 109.	AUS ZAN	GUA	(HAW)	IND	MAU	(MEX)	NIG	PR	PHI	ZAM	
110. <i>Liquidambar styraciflua</i>	ARG	BRA	(USA)	ZIM							
111. <i>Maesopsis eminii</i>	CR	FIJ	GHA	(KEN)	MAL	SAB	SOL	TAN	(UGA)	(ZAI)	
112. <i>Melaleuca leucadendron</i>	(AUS) (TAI)	CAM	(IND)	LIB	MAD	MAL	MOZ	PNG	(SAB)	SL	
113. <i>Musanga cecropioides</i>	CAM	IVC									
114. <i>Nauclea diderichii</i>	FIJ	(NIG)	UGA								
115. <i>Ochroma pyramidale</i>	(BEL) SLK	(COL)	CR	(ECU)	I	IND	MAL	(PER)	PNG	SAB	
116. <i>Octomeles sumatrana</i>	BRA	(PHI)	(PNG)	SAB	(SOL)						

Species	Countries									
117. <i>Parkia biglobosa</i>	-									
118. <i>Parkinsonia aculeata</i>	CYP	I	ISR	KUW	PAK	SUD				
119. <i>Paulownia tomentosa</i>	ARG	BRA	(JAP)	PAR						
120. <i>Peltophorum pterocarpum</i>	AUS	CAM	HAW	(I)	IND	KAM	(MAL)	(SLK)	USA	
121. <i>Pericopsis elata</i>	(GHA)	(IVC)	NIG	(ZAI)						
122. <i>Pinus ayacahuite</i>	KEN	MLW	SA	TAN	UGA	ZIM				
123. <i>Pinus brutia</i>	AUS	(CYP)	IRA	(ISR)	SA	(TUR)				
124. <i>Pinus canariensis</i>	AUS	ISR	NZ	SA	SP	USA				
125. <i>Pinus caribaea</i> var. <i>bahamensis</i>	AUS	(BAH)	BEL	COB	I	KEN	MAD	SA	ZAI	
126. <i>Pinus caribaea</i> var. <i>caribaea</i>	ARG	AUS	BRA	(CUB)	MAD	SA	SUR	UGA	ZAI	ZAM
127. <i>Pinus caribaea</i> var. <i>hondurensis</i>	AUS	(BEL)	BRA	COB	CR	I	IND	FIJ	JAM	KEN
	LIB	MAD	MAL	MLW	MOZ	NH	NIG	SA	SLK	SUR
	SWZ	TAI	TAN	TRI	UGA	VEN	VN	ZAI	ZIM	
128. <i>Pinus chiapensis</i>	AUS	KEN	MAL	PNG	SA	TAN	UGA	ZAM		
129. <i>Pinus elliottii</i> var. <i>elliottii</i>	ARG	AUS	FIJ	KEN	MAD	MLW	NZ	SA	TAN	UGA
	ZAI	ZIM								
130. <i>Pinus gregii</i>	ARG	SA								

Species	Countries									
131. <i>Pinus halepensis</i>	ARG	AUS	CHL	(GRE)	SA	URG				
132. <i>Pinus kesiya</i>	AUS ZAI	COL ZAM	(I)	IND	KEN	MAD	(PHI)	SA	(TAI)	TAN
133. <i>Pinus merkusii</i>	(IND)	JAM	MAD	MAL	PNG	SA	ZAM			
134. & 135. <i>Pinus michoacana</i>	KEN	MAD	SA	TAN	UGA	ZAM	ZIM			
136. <i>Pinus montezumae</i>	COB	(MEX)	SA	ZIM						
137. <i>Pinus occidentalis</i>	(CUB)	JAM	KEN	TAN						
138. <i>Pinus oocarpa</i>	BRA SOL	COB TAI	COL ZAM	FIJ	IND	LIB	MAL	PR	SA	SLK
139. <i>Pinus palustris</i>	AUS	NZ	SA	UGA	(USA)	ZIM				
140. <i>Pinus patula</i> subsp. <i>patula</i>	ANG SA	ARG SWZ	ECU TAN	I UGA	KEN ZAI	MAD ZIM	MLW	MOZ	NG	PER
141. <i>Pinus patula</i> subsp. <i>tecunumanii</i>	-									
142. <i>Pinus pinaster</i> (Portuguese Provenances)	ARG (TUN)	AUS URG	BRA	CHL	(FR)	(IT)	NZ	(POR)	SA	(SP)
143. <i>Pinus pinea</i>	(ALG)	AUS	(CYP)	(ISR)	(LEB)	(LBY)	(TUN)			
144. <i>Pinus ponderosa</i> var. <i>arizonica</i>	ARG	AUS	NZ							
145. <i>Pinus pseudostrobus</i>	AUS UGA	BRA	COL	I	KEN	MOZ	PNG	SA	TAI	TAN

Species	Countries									
146. <i>Pinus radiata</i>	ARG POR	AUS SA	BOL SP	BRA TAN	CHL UGA	COL URG	ECU ZIM	KEN	MLW	NZ
147. <i>Pinus roxburghii</i>	AUS	(I)	MAU	SA	ZIM					
148. <i>Pinus taeda</i>	ARG	IRA	MAD	MLW	NZ	SA	URG	(USA)	ZIM	
149. <i>Populus deltoides</i> var. <i>deltoides</i>	ARG	MAD	NG	NIG	SA	(USA)	ZIM			
150. <i>Prosopis chilensis</i>	I	SUD	USA							
151. <i>Prosopis cineraria</i>	(I)	PAK								
152. <i>Prosopis juliflora</i>	(ECU) (USA)	I	ISR	KEN	KUW	(MEX)	PAK	(PER)	SUD	UAE
153. <i>Prosopis tamarugo</i>	(CHL)									
154. <i>Robinia pseudoacacia</i>	ARG	CHL	CYP	IRA	ISR	JAP	URG			
155. <i>Roseodendron donnell-smithii</i>	(CR)	(GUA)	(HON)	(MEX)						
156. <i>Salix babylonica</i> var. <i>sacramenta</i>	BRA									
157. <i>Samanea saman</i>	AUS	FIJ	HAW	PHI	SLK					
158. <i>Schinus molle</i>	ARG	CHL	I	KEN	(MEX)	NIG	(PER)	TAN	UGA	USA
159. <i>Schizolobium parahybum</i>	(BRA)	HON	MEX							
160. <i>Sesbania grandiflora</i>	AUS	FIJ	(I)	(IND)	(MAL)	(PHI)	PR			
161. <i>Simmondsia chinensis</i>	I	(MEX)	(USA)							

Species	Countries										
162. <i>Swietenia macrophylla</i>	(BEL) PR	FIJ SLK	HAW TRI	I	IND	MAL	MAR	(MEX)	NIG	PHI	
163. <i>Tabebuia rosea</i>	(BEL)	(COL)	PR	SLK	SOL	(TRI)					
164. <i>Tamarix aphylla</i>	ALG	ISR	KUW	MOR	PAK						
165. <i>Taxodium distichum</i>	ARG										
166. <i>Tectona grandis</i>	BAN MAL	BEN MAU	(KAM) PR	COL SL	CUB SLK	ECU (TAI)	GHA TAN	(I) TOG	IND TRI	IVC VEN	
167. <i>Terminalia brassii</i>	FIJ	NH	PNG	(SOL)							
168. <i>Terminalia calamansanai</i>	MAL	(PHI)	(PNG)	(SOL)							
169. <i>Terminalia ivorensis</i>	FIJ	(GHA)	(IVC)	(NIG)	(SL)	SOL	TAN	TRI	UGA		
170. <i>Terminalia superba</i>	ANG TAN	(CAR) (TOG)	(COB) TRI	FIJ UGA	(GHA) (ZAI)	(IVC)	(LIB)	NH	(NIG)	SOL	
171. <i>Toona ciliata</i>	ARG TAN	AUS UGA	(BAN)	CR	HAW	(I)	KEN	MLW	PNG	PR	
172. <i>Triplochiton scleroxylon</i>	(GHA)	(IVC)	NIG								
172. <i>Zizyphus spina-christi</i>	(EPT)	(SUD)									

## KEY TO COUNTRY ABBREVIATIONS

ALG Algeria	I India	RWA Rwanda
ANG Angola	IND Indonesia	SA South Africa
ARG Argentina	IRA Iran	SAB Sabah
AUS Australia	IRQ Iraq	SEN Senegal
BAH Bahamas	ISR Israel	SL Sierra Leone
BAN Bangladesh	ITA Italy	SLK Sri Lanka
BEL Belize	IVC Ivory Coast	SOL Solomon Islands
BEN Benin	JAM Jamaica	SOM Somalia
BOL Bolivia	JAP Japan	SP Spain
BOT Botswana	JOR Jordan	SUD Sudan
BRA Brazil	KEN Kenya	SUR Surinam
BUR Burundi	KUW Kuwait	SWZ Swaziland
CAM Camerouns	LIBY Libya	TAI Thailand
CAR Central African Republic	LEB Lebanon	TAN Tanzania
CBD Cambodia	LIB Liberia	TCH Tchad
CHL Chile	MAD Madagascar	TOG Togo
CHN China	MAL Malaya	TRI Trinidad
COB Congo	MAR Martinique	TUN Tunisia
COL Colombia	MAU Mauritius	TUR Turkey
CR Costa Rica	MEX Mexico	TWN Taiwan
CUB Cuba	MLW Malawi	UAE United Arab Emirates
CVI Cape Verde Islands	MOR Morocco	UGA Uganda
CYP Cyprus	MOZ Mozambique	URG Uruguay
ECU Ecuador	NEP Nepal	USA U.S.A.
EPT Egypt	NGR Niger	USR U.S.S.R.
ETH Ethiopia	NH New Hebrides	VEN Venezuela
FIJ Fiji	NIG Nigeria	VN Viet Nam
FRA France	NL Netherlands	ZAI Zaire
GAB Gabon	NZ New Zealand	ZAM Zambia
GAM Gambia	PAK Pakistan	ZAN Zanzibar
GHA Ghana	PAR Paraguay	ZIM Zimbabwe
GRE Greece	PER Peru	
GUA Guatemala	PHI Philippines	
HAW Hawaii	PNG Papua New Guinea	
HON Honduras	POR Portugal	
	PR Puerto Rico	

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## SPECIES:

## TAXONOMY:

- 1 FAMILY .....
- 2 SYNONYMS .....
- 3 LOCAL OR TRADE NAMES .

## NATURAL OCCURRENCE:

- 4 LATITUDES .....
- 5 AREAS .....

## CLIMATE:

- 6 ALTITUDINAL RANGE ....
- 7 MEAN ANNUAL RAINFALL .
- 8 RAINFALL REGIME .....
- 9 DRY SEASON .....
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH .....
- 11 MEAN MIN. TEMP.  
COLDEST MONTH .....
- 12 MEAN ANNUAL TEMP. ....

## SOILS:

- 13 TEXTURE .....
- 14 REACTION .....
- 15 DRAINAGE .....
- 16 OTHER CHARACTERISTICS

## SILVICULTURE:

- 17 SIZE .....
- 18 DESCRIPTION .....
- 19 FORM .....
- 20 LIGHT REQUIREMENTS ...
- 21 OTHER CHARACTERISTICS

## PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .....

## ROLE IN LAND USE:

23 .....

## TIMBER:

24 DENSITY .....

25 NATURAL DURABILITY ...

26 PRESERVATION .....

27 SAWING .....

28 SEASONING .....

29 OTHER FEATURES .....

## UTILIZATION:

30 SAW TIMBER .....

31 ROUNDWOOD .....

32 OTHER PRODUCTS .....

## NURSERY:

33 SEED SOURCES .....

34 SEEDS PER KILOGRAMME ,

35 STORAGE .....

36 PRE-TREATMENT .....

37 PLANTING STOCK .....

38 SPECIAL REQUIREMENTS ,

39 GERMINATION AND GROWTH

PRINCIPAL PESTS AND  
DISEASES:

40 .....

## PRINCIPAL REFERENCES:

Appendix IUse of INSPIRE Computer Program

This version of INSPIRE is written for use with an Apple II microcomputer equipped with the following accessories:

1. 5 inch floppy disk drive
2. printer (preferable but not essential)
3. CP/M BASIC language software
4. 80-column screen display with upper and lower case characters

The BASIC interpreter should be loaded into memory to enable simultaneous access to 5 files (i.e. by MBASIC /F:5). The program runs entirely interactively and requires very little external instruction to the user. It is divided into four main sections performing the following functions:

1. to load information about a new species
2. to edit existing information
3. to select species from the database which satisfy given conditions
4. to print the names of all species in the database, or information about an individual species, either to the screen, to the printer or to both.

The program will ask for all information it requires and has many built-in diagnostics. Instructions may be given in upper or lower case characters. Details and advice, and also copies of the complete database on floppy disk, are available on request.

Subsequent pages show a typical program printout of recorded data for an individual species, followed by an example of a typical selection run and the results obtained.

- INSPIRE PROGRAM EXAMPLES -

Species 1      *Acacia albida* Del.

---

altitude (metres)	0 to 2000
mean annual rainfall (mm)	250 to 1000
rainfall regime	winter, summer
dry season (months)	6 to 9
mean max. temp. hottest month (C)	30 to 42
mean min. temp. coldest month (C)	6 to 18
mean annual temperature (C)	18 to 30
soil texture	light, medium
soil reaction	neutral, acid
soil drainage	free draining, seasonally waterlogged
other soil characteristics	*saline
size of tree (metres)	15 to 25
form of tree	poor
light requirements	strongly demanding
other silvic. characteristics	coppices/root suckers, *frost resistant, termite resistant, drought hardy, fixes nitrogen
production potential (m3/ha/an)	-
role in land use	shade and shelter, agroforestry, soil improvement
timber density (S.G.)	.58 to .71
sawtimber utilization	boxes crates etc., furniture, boat building
roundwood utilization	posts, fuel/charcoal, shortfibre pulp, miscellaneous
other timber products	tannins, fodder, gums

HELLO!...and welcome to INSPIRE

Do you want to L)oad E)dit S)elect P)rint or F)inish? s

characteristic of interest?

(give characteristic number or describe in words, put ? for list)  
? ?

- |                                     |                                    |
|-------------------------------------|------------------------------------|
| 1 altitude (metres)                 | 12 size of tree (metres)           |
| 2 mean annual rainfall (mm)         | 13 form of tree                    |
| 3 rainfall regime                   | 14 light requirements              |
| 4 dry season (months)               | 15 other silvic. characteristics   |
| 5 mean max. temp. hottest month (C) | 16 production potential (m3/ha/an) |
| 6 mean min. temp. coldest month (C) | 17 role in land use                |
| 7 mean annual temperature (C)       | 18 timber density (S.G.)           |
| 8 soil texture                      | 19 sawtimber utilization           |
| 9 soil reaction                     | 20 roundwood utilization           |
| 10 soil drainage                    | 21 other timber products           |
| 11 other soil characteristics       |                                    |

characteristic of interest?

(give characteristic number or describe in words, put ? for list)  
? 2

mean annual rainfall (mm)

your value(s) for mean annual rainfall (mm)?

lower value? 450

upper value? (press RETURN if none) 500

Selection 1

39 main species:-	1	3	4	6	10	11	12	13	14	28
	30	31	42	45	46	50	54	56	59	60
	62	73	78	81	89	91	97	117	118	123
	131	143	150	151	152	158	161	164	173	
10 marginal species:-	18	20	22	64	70	90	93	98	99	154

Do you want to C)ontinue the elimination,  
R)ever to a previous selection,  
or F)inish

? c

characteristic of interest?

(give characteristic number or describe in words, put ? for list)  
? temp

\*\* ERROR \*\* wording not unique - which characteristic do you mean please?

5 mean max. temp. hottest month (C)

6 mean min. temp. coldest month (C)

or 7 mean annual temperature (C)

characteristic of interest?

(give characteristic number or describe in words, put ? for list)

? 7

mean annual temperature (C)

-----

your value(s) for mean annual temperature (C)?

lower value? 21

upper value? (press RETURN if none) 23

Selection 2

-----

23 main species:-	1	3	6	12	28	30	42	54	59	62
	73	78	81	89	91	97	118	150	151	152
	161	164	173							
12 marginal species:-	4	13	18	20	45	60	64	70	90	93
	98	99								

Do you want to C)ontinue the elimination,  
R)evert to a previous selection,  
or F)inish

? c

characteristic of interest?

(give characteristic number or describe in words, put ? for list)

? 4

dry season (months)

-----

your value(s) for dry season (months)?

lower value? 5

upper value? (press RETURN if none)

Selection 3

-----

12 main species:-	3	6	12	28	54	59	73	78	81	89
	91	161								
10 marginal species:-	4	18	20	45	60	64	70	93	98	99

Do you want to C)ontinue the elimination,  
R)evert to a previous selection,  
or F)inish

? c

characteristic of interest?

(give characteristic number or describe in words, put ? for list)

? soil reaction

soil reaction

-----

please put 'Y' for choices of interest, otherwise press RETURN

? y alkaline

? neutral

? acid

## Selection 4

-----

## 10 main species:-

- 3 Acacia cyanophylla Lindl.
- 6 Acacia farnesiana (L.) Willd.
- 12 Acacia salicina Lindl.
- 59 Eucalyptus camaldulensis Dehnh. (Northern Provenances)
- 73 Eucalyptus largiflorens F. Muell.
- 78 Eucalyptus microtheca F. Muell.
- 81 Eucalyptus occidentalis Engl.
- 89 Eucalyptus salmonophloia F. Muell.
- 91 Eucalyptus sideroxylon A. Cunn. ex Woolls.
- 161 Simmondsia chinensis (Link) Schneid.

7 marginal species:- 4 18 45 60 70 98 99

Do you want to C)ontinue the elimination,  
R)evert to a previous selection,  
or F)inish

? c

characteristic of interest?

(give characteristic number or describe in words, put ? for list)

? land use

role in land use

-----

please put 'Y' for choices of interest, otherwise press RETURN

- ? shade and shelter
- ? agricultural shade
- ? y windbreaks
- ? y erosion control
- ? y dune/soil stabilisation
- ? agroforestry
- ? land reclamation
- ? soil improvement
- ? ornamental
- ? miscellaneous

Must ALL these conditions be met? (Y/N)? n

## Selection 5

-----

## 7 main species:-

- 3 Acacia cyanophylla Lindl.
- 6 Acacia farnesiana (L.) Willd.
- 12 Acacia salicina Lindl.
- 73 Eucalyptus largiflorens F. Muell.
- 78 Eucalyptus microtheca F. Muell.
- 81 Eucalyptus occidentalis Engl.
- 89 Eucalyptus salmonophloia F. Muell.

## 5 marginal species:-

- 4 Acacia cyclops A. Cunn. ex G. Don.
- 18 Albizia lebbek (L.) Benth.
- 45 Colophospermum mopane (Kirk ex Benth.) Kirk ex J. Leonard
- 70 Eucalyptus gomphocephala DC.
- 99 Gleditsia triacanthos L.

Do you want to C)ontinue the elimination,  
R)evert to a previous selection,  
or F)inish

? c

characteristic of interest?

(give characteristic number or describe in words, put ? for list)

? roundwood

roundwood utilization

-----

please put 'Y' for choices of interest, otherwise press RETURN

? transmission poles  
? building poles/piling  
? y posts  
? y fuel/charcoal  
? shortfibre pulp  
? longfibre pulp  
? veneer/plywood  
? turnery  
? miscellaneous

Must ALL these conditions be met? (Y/N)? y

Selection 6

-----

6 main species:-

6 Acacia farnesiana (L.) Willd.  
12 Acacia salicina Lindl.  
73 Eucalyptus largiflorens F. Muell.  
78 Eucalyptus microtheca F. Muell.  
81 Eucalyptus occidentalis Engl.  
89 Eucalyptus salmonophloia F. Muell.

4 marginal species:-

18 Albizia lebbek (L.) Benth.  
45 Colophospermum mopane (Kirk ex Benth.) Kirk ex J. Leonard  
70 Eucalyptus gomphocephala DC.  
99 Gleditsia triacanthos L.

Do you want to C)ontinue the elimination,  
R)evert to a previous selection,  
or F)inish

? f

Do you want N)o output at all,  
a S)imple list of selected species only,  
or F)ull output for each selected species

? s

Do you want to L)oad E)dit S)elect P)rint or F)inish? f

end of INSPIRE

Thank you....and goodbye

INSPIRE Species Selections  
 \*\*\*\*\*

mean annual rainfall (mm)	450 to 500
mean annual temperature (C)	21 to 23
dry season (months)	5
soil reaction	alkaline
role in land use	windbreaks or erosion control or dune/soil stabilisation
roundwood utilization	posts and fuel/charcoal

Selected Species  
 -----

6 main species:-

- 6 *Acacia farnesiana* (L.) Willd.
- 12 *Acacia salicina* Lindl.
- 73 *Eucalyptus largiflorens* F. Muell.
- 78 *Eucalyptus microtheca* F. Muell.
- 81 *Eucalyptus occidentalis* Engl.
- 89 *Eucalyptus salmonophloia* F. Muell.

4 marginal species:-

- \* 18 *Albizia lebbek* (L.) Benth.
- \* 45 *Colophospermum mopane* (Kirk ex Benth.) Kirk ex J. Leonard
- \* 99 *Gleditsia triacanthos* L.
- \*\* 70 *Eucalyptus gomphocephala* DC.

```

10 RESET
20 REM *** PROGRAM INSPIRE (Autumn 1983) ***
30 REM MAXSTEP = max no. of sel. stages
40 REM MAXCH = no. of characteristics (see DATA statements)
50 REM MAXSEL = max. no. of catagories/sel. char.
60 REM LENSP = max. no. of digits for species code no.
70 REM LENRAN = max. no. of digits for a range value
80 REM LENSPPNAM = max. no. of characters for species name
90 MAXSTEP=15: MAXCH=21: MAXSEL=10: LENSP=4: LENRAN=4: LENSPPNAM=65
100 DIM NC(MAXCH),N$(MAXCH),LN(MAXCH),LC$(MAXCH),LC(MAXCH),CH(MAXSEL)
110 DIM OLDSEL(MAXSTEP,MAXSEL+2)
120 KK$(0)="n": KK$(1)="m": KK$(2)="y"
130 BB$(0)="s": BB$(1)="p": BB$(2)="b"
140 NRANC=0: NSELC=0: FOR I=0 TO MAXCH: READ NC(I)
150 IF NC(I)>0 THEN GOTO 180
160 IF NC(I)<0 THEN GOTO 190
170 NRANC=NRANC+1: LN(I)=NRANC: GOTO 190
180 NSELC=NSELC+1: LN(I)=NSELC
190 NEXT I
200 DIM SN$(NSELC,MAXSEL)
210 FOR I=0 TO MAXCH: READ N$(I): NEXT I
220 S=0
230 FOR I=1 TO MAXCH
240 IF NC(I)=0 THEN GOTO 260
250 S=S+1: FOR J=1 TO NC(I): READ SN$(S,J): NEXT J
260 NEXT I
270 NR=NRANC*LENRAN*2: NS=NSELC*MAXSEL
280 OPEN "R",#1,"RANDATA.RAF",NR
290 OPEN "R",#2,"SELDATA.RAF",NS
300 OPEN "R",#3,"SPNAMES.RAF",LENSPPNAM
310 OPEN "R",#4,"SPNUMS.RAF",LENSP
320 FIELD #1,NR AS R$
330 FIELD #2,NS AS S$
340 FIELD #3,LENSPPNAM AS SPN$
350 FIELD #4,LENSP AS SNU$
360 GET #4,1
370 NSP=VAL(SNU$)
380 MAXSFOP=20
390 DIM IND(NSP),ORD(MAXSFOP)
400 CAT$(1)="1": CAT$(2)="e": CAT$(3)="s": CAT$(4)="p": CAT$(5)="f"
410 HOME: PRINT SPC(20);"HELLO!...and welcome to INSPIRE"
420 PRINT:PRINT
430 PRINT SPC(10);: PRINT "Do you want to L)oad E)dit S)elect ";
440 INPUT "P)rint or F)inish";ANS$
450 GOSUB 5090
460 A$=LEFT$(ANS$,1): FOR ICAT=1 TO 5: IF A$=CAT$(ICAT) THEN GOTO 490
470 NEXT ICAT
480 GOSUB 6090: GOTO 420
490 ON ICAT GOTO 500,1240,2290,4630,5010
500 REM *****
510 REM * LOAD SECTION *
520 REM *****
530 PRINT: PRINT

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540 INPUT "code number for new species? (press RETURN to finish) ",SNO$
550 IF LEN(SNO$)=0 THEN GOTO 5010
560 IF VAL(SNO$)<>0 THEN GOTO 600
570 BEEP 12,20: BEEP 15,20
580 PRINT: PRINT "*** ERROR ** species number must start with a digit - ";
590 PRINT "please try again": GOTO 540
600 IF NSP=0 THEN GOTO 670
610 A$=LEFT$(SNO$+SPACE$(LENSP),LENSP)
620 FOR S=1 TO NSP: GET #4,S+1
630 IF A$=SNU$ THEN GOTO 650
640 NEXT S: GOTO 670
650 BEEP 12,20: BEEP 15,20: PRINT: PRINT "*** ERROR ** species ";SNO$;
660 PRINT " is already recorded - please try again": GOTO 500
670 PRINT: INPUT "name of new species";SNAM$
680 IF LEN(SNAM$)>0 THEN GOTO 700
690 GOSUB 6090: GOTO 670
700 NEWREC=1: IF NSP=0 THEN GOTO 810
710 FOR NEWREC=1 TO NSP: GET #3,NEWREC
720 IF SNAM$<SPN$ THEN GOTO 750
730 NEXT NEWREC: NEWREC=NSP+1: GOTO 810
740 REM if new species not alphabetically on end of list, shift along one
750 FOR I=NSP TO NEWREC STEP -1
760 GET #1,I: RR$=R$: LSET R$=RR$: PUT #1,I+1
770 GET #2,I: SS$=S$: LSET S$=SS$: PUT #2,I+1
780 GET #3,I: SPP$=SPN$: LSET SPN$=SPP$: PUT #3,I+1
790 GET #4,I+1: SNUM$=SNU$: LSET SNU$=SNUM$: PUT #4,I+2
800 NEXT I
810 RR$=SPACE$(NR)
820 SS$=SPACE$(NS)
830 FOR I=1 TO MAXCH
840 PRINT
850 PRINT N$(I): PRINT STRING$(LEN(N$(I)),45)
860 IF NC(I)>0 THEN GOTO 970
870 N1=LN(I)
880 PRINT "lower value";: INPUT A$
890 PRINT "upper value";: INPUT B$
900 IF VAL(A$)<=VAL(B$) THEN GOTO 940
910 BEEP 12,20:BEEP 15,20: PRINT
920 PRINT "*** ERROR ** upper value < lower value - please repeat"
930 PRINT: GOTO 880
940 IC=(N1-1)*LENRAN*2+1: MID$(RR$,IC,LENRAN)=A$+SPACE$(LENRAN)
950 IC=IC+LENRAN: MID$(RR$,IC,LENRAN)=B$+SPACE$(LENRAN)
960 GOTO 1140
970 N2=LN(I)
980 PRINT "define each required category using Y(es) or M(arginal)"
990 PRINT "(or press RETURN or 'N' if not required)": PRINT
1000 FOR K=1 TO NC(I)
1010 PRINT SPC(4);SN$(N2,K)
1020 NEXT K: VTAB VPOS(0)-NC(I)
1030 FOR K=1 TO NC(I)
1040 INPUT ANS$
1050 J=0
1060 IF LEN(ANS$)=0 THEN GOTO 1120
1070 GOSUB 5090
1080 FOR J=0 TO 2: IF LEFT$(ANS$,1)=KK$(J) THEN GOTO 1120

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1090 NEXT J
1100 BEEP 12,20: BEEP 15,20: BEEP 12,20: BEEP 15,20: VTAB VPOS(0)-1
1110 GOTO 1040
1120 IC=(N2-1)*MAXSEL+K: K$=MID$(STR$(J),2): MID$(SS$,IC,1)=K$
1130 NEXT K
1140 NEXT I
1150 NSP=NSP+1
1160 LSET R$=RR$: PUT #1,NEWREC
1170 LSET S$=SS$: PUT #2,NEWREC
1180 LSET SNU$=SNO$: PUT #4,NEWREC+1
1190 LSET SPN$=SNAM$: PUT #3,NEWREC
1200 SNUM$=MID$(STR$(NSP),2): LSET SNU$=SNUM$: PUT #4,1
1210 GOSUB 6570: IF LP=-1 THEN GOTO 540
1220 SREC=NEWREC: GOSUB 5450
1230 GOTO 500
1240 REM *****
1250 REM *      EDIT SECTION      *
1260 REM *****
1270 PRINT: PRINT: PRINT "species to edit? ";
1280 INPUT "(give number or name, press RETURN to finish) ",ANS$
1290 IF LEN(ANS$)=0 THEN GOTO 420
1300 GOSUB 6280: IF IFAIL=1 THEN GOTO 1270
1310 GET #1,SREC: GET #2,SREC: RR$=R$: SS$=S$
1320 EDR=0: EDS=0: EDSNUM=0: EDSNAM=0
1330 PRINT: PRINT "editing species ";SNO$;" ";SPP$
1340 LU=16+LENSP+2+LEN(SPP$): PRINT STRING$(LU,45)
1350 PRINT: PRINT "characteristic to edit?"
1360 PRINT "either describe in words, or give characteristic number,"
1370 PRINT "      or put ? for a list of characteristics,"
1380 PRINT "      or press RETURN to finish"
1390 PRINT "(n.b. 'species number'/'species name' (or char. no. 0) ";
1400 PRINT "can be specified)"
1410 INPUT ANS$
1420 IF LEN(ANS$)>0 THEN GOTO 1730
1430 IF EDSNAM=0 THEN GOTO 1620
1440 A$=" ": IF SREC=1 THEN GOTO 1460
1450 GET #3,SREC-1: A$=SPN$
1460 B$=STRING$(LENSPNAM,122): IF SREC=NSP THEN GOTO 1480
1470 GET #3,SREC+1: B$=SPN$
1480 IF SSN$>A$ AND SSN$<B$ THEN GOTO 1620
1490 A$=SPACE$(LENSPNAM): LSET SPN$=A$: PUT #3,SREC
1500 FOR NEWREC=1 TO NSP: GET #3,NEWREC: A$=SPN$
1510 IF SSN$<A$ THEN GOTO 1530
1520 NEXT NEWREC: NEWREC=NSP+1
1530 IF NEWREC>SREC THEN WAY=1 ELSE WAY=-1
1540 STA=SREC+WAY: IF WAY=1 THEN STO=NEWREC-1 ELSE STO=NEWREC
1550 FOR I=STA TO STO STEP WAY
1560 GET #1,I: A$=R$: LSET R$=A$: PUT #1,I-WAY
1570 GET #2,I: A$=S$: LSET S$=A$: PUT #2,I-WAY
1580 GET #3,I: A$=SPN$: LSET SPN$=A$: PUT #3,I-WAY
1590 J=I+1: GET #4,J: A$=SNU$: LSET SNU$=A$: PUT #4,J-WAY
1600 NEXT I
1610 SREC=STO: EDR=1: EDS=1: EDSNUM=1
1620 IF EDR=0 THEN GOTO 1640
1630 LSET R$=RR$: PUT #1,SREC

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1640 IF EDS=0 THEN GOTO 1660
1650 LSET S$=SS$: PUT #2,SREC
1660 IF EDSNAM=0 THEN GOTO 1680
1670 LSET SPN$=SSN$: PUT #3,SREC
1680 IF EDSNUM=0 THEN GOTO 1700
1690 LSET SNU$=SP$: PUT #4,SREC+1
1700 GOSUB 6570
1710 IF LP>=0 THEN GOSUB 5450
1720 GOTO 1270
1730 IF LEFT$(ANS$,1)<>"?" THEN GOTO 1750
1740 GOSUB 6140: GOTO 1350
1750 GOSUB 5190
1760 IF IFAIL=1 THEN GOTO 1350
1770 IF NC(JJ)>0 THEN GOTO 2100
1780 IF NC(JJ)=0 THEN GOTO 1940
1790 PRINT: PRINT "new species number for ";SNO$;
1800 INPUT "? (press RETURN if OK) ",SP$
1810 IF LEN(SP$)>0 THEN GOTO 1830
1820 SP$=SNO$: GOTO 1880
1830 IF VAL(SP$)<>0 THEN GOTO 1870
1840 BEEP 12,20: BEEP 15,20
1850 PRINT: PRINT "*** ERROR ** species number does not start with a ";
1860 PRINT "digit - please try again": GOTO 1790
1870 EDSNUM=1: SNO$=SP$
1880 PRINT: PRINT "new species name for ";SPP$;"?"
1890 INPUT "(press RETURN if OK) ",SSN$
1900 IF LEN(SSN$)>0 THEN GOTO 1920
1910 SSN$=SPP$: GOTO 1350
1920 EDSNAM=1
1930 GOTO 1350
1940 EDR=1: N1=LN(JJ)
1950 PRINT: PRINT N$(JJ): PRINT STRING$(LEN(N$(JJ)),45):PRINT
1960 PRINT "please give new values or press RETURN if OK:--"
1970 IC1=(N1-1)*LENRAN*2+1
1980 PRINT "lower value: old was ";MID$(RR$,IC1,LENRAN);" new";: INPUT A$
1990 IF LEN(A$)=0 THEN A$=MID$(RR$,IC1,LENRAN)
2000 IC2=IC1+LENRAN
2010 PRINT "upper value: old was ";MID$(RR$,IC2,LENRAN);" new";: INPUT B$
2020 IF LEN(B$)=0 THEN B$=MID$(RR$,IC2,LENRAN)
2030 IF VAL(A$)<=VAL(B$) THEN GOTO 2070
2040 BEEP 12,20: BEEP 15,20: PRINT
2050 PRINT "*** ERROR ** upper value < lower value - please repeat"
2060 PRINT: GOTO 1980
2070 MID$(RR$,IC1,LENRAN)=A$+SPACE$(LENRAN)
2080 MID$(RR$,IC2,LENRAN)=B$+SPACE$(LENRAN)
2090 GOTO 1350
2100 PRINT: PRINT N$(JJ): PRINT STRING$(LEN(N$(JJ)),45): PRINT
2110 PRINT "please confirm category settings (old ones shown in brackets):--"
2120 PRINT "press RETURN if OK, otherwise redefine setting by ";
2130 PRINT "Y)es N)o or M)arginal": PRINT
2140 N2=LN(JJ): IC=(N2-1)*MAXSEL: FOR J=1 TO NC(JJ)
2150 K=VAL(MID$(SS$,IC+J,1))
2160 PRINT "      (";KK$(K);") ";SN$(N2,J)
2170 NEXT J: VTAB VPOS(0)-NC(JJ)
2180 FOR J=1 TO NC(JJ)

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2190 INPUT ANS$
2200 IF LEN(ANS$)=0 THEN GOTO 2270
2210 EDS=1: GOSUB 5090
2220 FOR L=0 TO 2: IF LEFT$(ANS$,1)=KK$(L) THEN GOTO 2260
2230 NEXT L
2240 BEEP 12,20: BEEP 15,20: BEEP 12,20: BEEP 15,20
2250 VTAB VPOS(0)-1: GOTO 2190
2260 K$=MID$(STR$(L),2): MID$(SS$,IC+J,1)=K$
2270 NEXT J
2280 GOTO 1350
2290 REM *****
2300 REM *   SELECT SECTION   *
2310 REM *****
2320 REM state of each species is 1=main, 0=out, -n=marginal by n factors
2330 LSEL=LEN(STR$(MAXSTEP)): N1=128\LSEL: N2=CINT((NSP/N1)+.499)
2340 STO=N1*LSEL
2350 OPEN "R",#5,"SELTRACE.RAF",STO
2360 FIELD #5,STO AS SV$
2370 PPMAIN=10: PPTOT=15
2380 NSTEP=0
2390 FOR J=1 TO NSP: IND(J)=1: NEXT J: GOTO 2500
2400 PRINT "Do you want to C)ontinue the elimination,"
2410 PRINT SPC(16);"R)evert to a previous selection,"
2420 PRINT SPC(13);"or F)inish"
2430 INPUT ANS$: IF LEN(ANS$)>0 THEN GOTO 2450
2440 GOSUB 6090: GOTO 2400
2450 GOSUB 5090: IF LEFT$(ANS$,1)="c" THEN GOTO 2500
2460 IF LEFT$(ANS$,1)="f" THEN GOTO 3990
2470 IF LEFT$(ANS$,1)<>"r" THEN GOTO 2440
2480 PRINT: PRINT "reverting to which selection number? ";
2490 INPUT "(put 0 to restart) ",NSTEP: GOTO 3670
2500 IF NSTEP+1<MAXSTEP THEN GOTO 2550
2510 IF NSTEP=MAXSTEP THEN GOTO 2530
2520 BEEP 15,25: PRINT: PRINT "last selection please!": GOTO 2550
2530 BEEP 15,25: PRINT: PRINT "limit on selection steps reached - ";
2540 PRINT "please F)inish or R)evert ";: GOTO 2430
2550 PRINT: PRINT "characteristic of interest?"
2560 PRINT "(give characteristic number or describe in words, ";
2570 PRINT "put ? for list)": INPUT ANS$
2580 IF LEN(ANS$)>0 THEN GOTO 2600
2590 GOSUB 6090: GOTO 2550
2600 IF LEFT$(ANS$,1)<>"?" THEN GOTO 2620
2610 GOSUB 6140: GOTO 2550
2620 GOSUB 5190
2630 IF IFAIL=1 THEN GOTO 2550
2640 PRINT: PRINT N$(JJ): PRINT STRING$(LEN(N$(JJ)),45)
2650 NSTEP=NSTEP+1
2660 OLDSEL(NSTEP,1)=JJ
2670 NN=LN(JJ): IF NC(JJ)>0 THEN GOTO 2990
2680 PRINT: PRINT "your value(s) for ";N$(JJ);"?"
2690 INPUT "  lower value";RLV
2700 INPUT "  upper value? (press RETURN if nonè) ",ANS$
2710 RUV=VAL(ANS$)
2720 IF LEN(ANS$)=0 THEN RUV=RLV
2730 IF RLV<=RUV THEN GOTO 2770

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2740 BEEP 12,20: BEEP 15,20: PRINT
2750 PRINT "*** ERROR ** upper value < lower value - please repeat"
2760 PRINT: GOTO 2690
2770 OLDSEL(NSTEP,2)=RLV: OLDSEL(NSTEP,3)=RUV
2780 FOR SNO=1 TO NSP
2790 IF IND(SNO)=0 THEN GOTO 2970
2800 GET #1,SNO
2810 IC1=(NN-1)*LENRAN*2+1: LV=VAL(MID$(R$,IC1,LENRAN))
2820 IC2=IC1+LENRAN: UV=VAL(MID$(R$,IC2,LENRAN))
2830 IF LV=0 AND UV=0 THEN GOTO 2960
2840 NIN=0
2850 IF RLV>=LV AND RLV<=UV THEN NIN=NIN+1
2860 IF RUV>=LV AND RUV<=UV THEN NIN=NIN+1
2870 IF NIN=2 THEN GOTO 2890
2880 IF NIN=0 THEN GOTO 2920
2890 IF IND(SNO)<0 THEN GOTO 2940
2900 IF NIN=1 THEN IND(SNO)--1
2910 GOTO 2970
2920 IF RLV>UV OR RUV<LV THEN GOTO 2960
2930 NIN=1: GOTO 2890
2940 IF NIN=1 THEN IND(SNO)=IND(SNO)-1
2950 GOTO 2970
2960 IND(SNO)=0
2970 NEXT SNO
2980 GOTO 3490
2990 PRINT: PRINT "please put 'Y' for choices of interest, ";
3000 PRINT "otherwise press RETURN": PRINT
3010 FOR J=1 TO NC(JJ): PRINT SPC(4);SN$(NN,J): NEXT J
3020 VTAB VPOS(0)-NC(JJ)
3030 NNOS=0
3040 FOR J=1 TO NC(JJ)
3050 INPUT ANS$
3060 IF LEN(ANS$)=0 THEN GOTO 3120
3070 GOSUB 5090: IF LEFT$(ANS$,1)="y" THEN GOTO 3110
3080 BEEP 12,20: BEEP 15,20: BEEP 12,20: BEEP 15,20
3090 VTAB VPOS(0)-1
3100 GOTO 3050
3110 NNOS=NNOS+1: CH(NNOS)=J
3120 NEXT J
3130 IF NNOS>0 THEN GOTO 3170
3140 BEEP 12,20: BEEP 15,20: PRINT
3150 PRINT "*** ERROR ** no choices specified - please try again"
3160 PRINT: GOTO 2990
3170 IOR=1: IF NNOS=1 THEN GOTO 3250
3180 PRINT: PRINT "Must ALL these conditions be met? (Y/N)";
3190 INPUT ANS$
3200 IF LEN(ANS$)>0 THEN GOTO 3220
3210 GOSUB 6090: GOTO 3180
3220 GOSUB 5090: IOR=0: IF LEFT$(ANS$,1)="y" THEN IOR=2
3230 IF LEFT$(ANS$,1)="n" THEN IOR=1
3240 IF IOR=0 THEN GOTO 3210
3250 OLDSEL(NSTEP,2)=IOR
3260 FOR K=1 TO NNOS: OLDSEL(NSTEP,K+2)=CH(K): NEXT K
3270 FOR SNO=1 TO NSP
3280 IF IND(SNO)=0 THEN GOTO 3480

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3290 GET #2,SNO
3300 IC=(NN-1)*MAXSEL
3310 MAIN=0: NZER=0
3320 FOR K=1 TO NNOS
3330 ISET=VAL(MID$(S$,IC+CH(K),1))
3340 IF ISET=0 THEN NZER=NZER+1
3350 IF ISET=2 THEN MAIN=MAIN+1
3360 NEXT K
3370 IF NZER=NNOS THEN GOTO 3470
3380 IF IOR=2 THEN GOTO 3410
3390 MM=1: IF MAIN=0 THEN MM=-1
3400 GOTO 3430
3410 IF NZER>0 THEN GOTO 3470
3420 MM=1: IF MAIN<>NNOS THEN MM=-1
3430 IF IND(SNO)<0 THEN GOTO 3450
3440 IND(SNO)=MM: GOTO 3480
3450 IF MM=-1 THEN IND(SNO)=IND(SNO)-1
3460 GOTO 3480
3470 IND(SNO)=0
3480 NEXT SNO
3490 A$=SPACE$(STO): J=0: K=(NSTEP-1)*N2: FOR I=1 TO NSP
3500 J=J+1: IC=(J-1)*LSEL+1
3510 MID$(A$,IC,LSEL)=STR$(IND(I))
3520 IF J<N1 THEN GOTO 3560
3530 J=0: K=K+1
3540 LSET SV$=A$: PUT #5,K
3550 A$=SPACE$(STO)
3560 NEXT I
3570 IF J=0 THEN GOTO 3590
3580 LSET SV$=A$: K=K+1: PUT #5,K
3590 PRINT: PRINT:PRINT "Selection ";NSTEP: PRINT STRING$(13,45)
3600 MAIN=0: MARG=0
3610 FOR I=1 TO NSP: II=IND(I)
3620 IF II=1 THEN MAIN=MAIN+1
3630 IF II<0 THEN MARG=MARG+1
3640 NEXT I: NSEL=MAIN+MARG: IF NSEL>0 THEN GOTO 3760
3650 BEEP 15,15: PRINT: PRINT "No suitable species found";
3660 PRINT "- reverting to previous selection": NSTEP=NSTEP-1
3670 IF NSTEP=0 THEN GOTO 3750
3680 J=0: K=(NSTEP-1)*N2+1: GET #5,K
3690 FOR I=1 TO NSP
3700 J=J+1: IC=(J-1)*LSEL+1: IND(I)=VAL(MID$(SV$,IC,LSEL))
3710 IF I=NSP THEN GOTO 3590
3720 IF J<N1 THEN GOTO 3740
3730 J=0: K=K+1: GET #5,K
3740 NEXT I: GOTO 3590
3750 PRINT: PRINT: PRINT "Starting from scratch": GOTO 2380
3760 IF MAIN=0 THEN GOTO 3870
3770 PRINT: PRINT USING "###";MAIN;: PRINT " main species:-";
3780 IF MAIN<=PPMAIN OR NSEL<=PPTOT THEN PRINT
3790 FOR I=1 TO NSP: IF IND(I)<>1 THEN GOTO 3860.
3800 GET #3,I: GET #4,I+1
3810 IF MAIN<=PPMAIN OR NSEL<=PPTOT THEN GOTO 3850
3820 IF POS(X)+LENSP+2>80 THEN PRINT TAB(25)
3830 PRINT SPC(1);SNU$;

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3840 GOTO 3860
3850 PRINT SPC(3);SNU$;" ";SPN$
3860 NEXT I
3870 IF MARG=0 THEN GOTO 3980
3880 PRINT: PRINT USING "###";MARG;: PRINT " marginal species:- ";
3890 IF NSEL<=PPTOT THEN PRINT
3900 FOR I=1 TO NSP: IF IND(I)>=0 THEN GOTO 3970
3910 GET #3,I: GET #4,I+1
3920 IF NSEL<=PPTOT THEN GOTO 3960
3930 IF POS(X)+LENSP+2>80 THEN PRINT TAB(25)
3940 PRINT SPC(1);SNU$;
3950 GOTO 3970
3960 PRINT SPC(3);SNU$;" ";SPN$
3970 NEXT I
3980 PRINT: PRINT: GOTO 2400
3990 CLOSE #5: KILL "SELTRACE.RAF"
4000 PRINT: PRINT: PRINT "Do you want  N)o output at all,"
4010 PRINT SPC(11);" a S)imple list of selected species only,"
4020 PRINT SPC(11);"or F)ull output for each selected species"
4030 INPUT AN$
4040 IF LEN(AN$)>0 THEN GOTO 4060
4050 GOSUB 6090: GOTO 3990
4060 GOSUB 5090: AN$=LEFT$(AN$,1): IF AN$="n" THEN GOTO 420
4070 IF AN$="s" OR AN$="f" THEN GOTO 4090
4080 GOSUB 6090: GOTO 3990
4090 LPRINT SPC(10);"INSPIRE Species Selections"
4100 LPRINT SPC(10);STRING$(26,42): LPRINT
4110 FOR I=1 TO NSTEP: LPRINT: NCH=OLDSEL(I,1)
4120 LPRINT N$(NCH);TAB(41): IF NC(NCH)>0 THEN GOTO 4160
4130 RLV=OLDSEL(I,2): RUV=OLDSEL(I,3): LPRINT RLV;
4140 IF RUV>RLV THEN LPRINT " to ";RUV ELSE LPRINT
4150 GOTO 4220
4160 IOR=OLDSEL(I,2): FOR J=1 TO MAXSEL: CH(J)=OLDSEL(I,J+2): NEXT J
4170 N2=LN(NCH): LPRINT SN$(N2,CH(1))
4180 FOR J=2 TO MAXSEL: IF CH(J)=0 THEN GOTO 4210
4190 LPRINT SPC(36);: IF IOR=1 THEN LPRINT " or "; ELSE LPRINT "and ";
4200 LPRINT SN$(N2,CH(J))
4210 NEXT J
4220 NEXT I
4230 LPRINT: LPRINT: LPRINT SPC(10);"Selected Species"
4240 LPRINT SPC(10);STRING$(16,45)
4250 LSP=-1: IF AN$="f" AND NSEL<=MAXSFOP THEN LSP=0
4260 IF MAIN=0 THEN GOTO 4350
4270 LPRINT: LPRINT USING "###";MAIN;
4280 LPRINT " main species:-": FOR J=1 TO NSP
4290 IF IND(J)<>1 THEN GOTO 4340
4300 GET #3,J: GET #4,J+1
4310 LPRINT: LPRINT SPC(8);SNU$;" ";SPN$
4320 IF LSP<0 THEN GOTO 4340
4330 LSP=LSP+1: ORD(LSP)=J
4340 NEXT J
4350 IF MARG=0 THEN GOTO 4500
4360 L=0: I=-1
4370 LPRINT: LPRINT USING "###";MARG;: LPRINT " marginal species:-"
4380 FOR J=1 TO NSP: IF IND(J)<>I THEN GOTO 4480

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4390 GET #3,J: GET #4,J+1: L=L+1
4400 IF LSP<0 THEN GOTO 4420
4410 LSP=LSP+1: ORD(LSP)=J
4420 IF I<-5 THEN GOTO 4460
4430 K=ABS(IND(J))
4440 LL=5-K+1: A$=SPACE$(LL)+STRING$(K,42): LPRINT
4450 LPRINT A$;" ";SNU$;" ";SPN$: GOTO 4470
4460 LPRINT: LPRINT ">***** ";SNU$;" ";SPN$
4470 IF L=MARG THEN GOTO 4500
4480 NEXT J
4490 I=I-1: GOTO 4380
4500 LPRINT STRING$(1,12)
4510 IF AN$<>"f" THEN GOTO 420
4520 IF LSP>0 THEN GOTO 4570
4530 BEEP 12,20: BEEP 15,20: PRINT: PRINT
4540 PRINT "Only";MAXSFOP;"species may be printed in full";
4550 PRINT " - therefore output will not be attempted": PRINT
4560 GOTO 420
4570 LP=1
4580 FOR LS=1 TO LSP
4590 SREC=ORD(LS)
4600 GOSUB 5450
4610 NEXT LS
4620 GOTO 420
4630 REM *****
4640 REM * PRINT SECTION *
4650 REM *****
4660 PRINT: PRINT: PRINT "Do you want to print to the S)creen ";
4670 INPUT "P)rinter or B)oth ";ANS$
4680 IF LEN(ANS$)>0 THEN GOTO 4700
4690 GOSUB 6090: GOTO 4660
4700 GOSUB 5090
4710 REM LP =0 for screen only, =1 for printer only, =2 for both
4720 FOR LP=0 TO 2: IF LEFT$(ANS$,1)=BB$(LP) THEN GOTO 4740
4730 NEXT LP
4740 PRINT: INPUT "Do you want to print A)ll or S)elected species";ANS$
4750 IF LEN(ANS$)>0 THEN GOTO 4770
4760 GOSUB 6090: GOTO 4740
4770 GOSUB 5090
4780 IF LEFT$(ANS$,1)="s" THEN GOTO 4960
4790 IF LEFT$(ANS$,1)<>"a" THEN GOTO 4760
4800 PRINT: INPUT "Do you want F)ull information or N)ames only";ANS$
4810 IF LEN(ANS$)>0 THEN GOTO 4830
4820 GOSUB 6090: GOTO 4800
4830 GOSUB 5090
4840 IF LEFT$(ANS$,1)="f" THEN GOTO 4950
4850 IF LEFT$(ANS$,1)<>"n" THEN GOTO 4820
4860 IF LP<>1 THEN PRINT
4870 FOR SREC=1 TO NSP: GET #3,SREC: GET #4,SREC+1
4880 IF LP=1 THEN GOTO 4920
4890 PRINT SPC(3);SNU$;" ";SPN$: A%=SREC\20
4900 IF SREC-AZ*20<>0 OR SREC=NSP THEN GOTO 4920
4910 PRINT: INPUT "Press RETURN to continue",ANS$: PRINT
4920 IF LP<>0 THEN LPRINT SNU$;" ";SPN$
4930 NEXT SREC: IF LP<>0 THEN LPRINT STRING$(1,12)

```

```

4940 GOTO 420
4950 FOR SREC=1 TO NSP: GOSUB 5450: NEXT SREC: GOTO 420
4960 PRINT: PRINT: PRINT "Species to print? (give number or name, ";
4970 PRINT "press RETURN to finish)": INPUT ANS$
4980 L=LEN(ANS$): IF L=0 THEN GOTO 420
4990 GOSUB 6280: IF IFAIL=1 THEN GOTO 4960
5000 GOSUB 5450: GOTO 4960
5010 REM *****
5020 REM *   FINISH SECTION   *
5030 REM *****
5040 PRINT:PRINT:PRINT: PRINT SPC(30);"end of INSPIRE"
5050 PRINT: PRINT SPC(25);"Thank you....and goodbye"
5060 PRINT: PRINT: PRINT
5070 END
5080 REM -----
5090 REM ROUTINE TO CONVERT TEXT STRINGS TO LOWER CASE
5100 FOR II=1 TO LEN(ANS$)
5110 IA=ASC(MID$(ANS$,II,1))
5120 IF IA >= 65 AND IA <= 90 THEN GOTO 5140
5130 GOTO 5160
5140 IA=IA+32
5150 MID$(ANS$,II,1)=CHR$(IA)
5160 NEXT II
5170 RETURN
5180 REM -----
5190 REM ROUTINE TO IDENTIFY CHARACTERISTIC SELECTION
5200 IFAIL=0
5210 JJ=VAL(ANS$): IF JJ=0 AND ANS$ <> "0" THEN GOTO 5240
5220 IF JJ>=ICAT-2 AND JJ<=MAXCH THEN RETURN
5230 GOTO 5300
5240 GOSUB 5090: NM=0
5250 FOR KK=ICAT-2 TO MAXCH
5260 IF INSTR(N$(KK),ANS$)=0 THEN GOTO 5280
5270 NM=NM+1: JJ=KK: LC(NM)=KK
5280 NEXT KK
5290 IF NM>0 THEN GOTO 5360
5300 IFAIL=1
5310 BEEP 12,20: BEEP 15,20: PRINT
5320 PRINT "*** ERROR ** characteristic not identified - ";
5330 PRINT "please check the list"
5340 GOSUB 6140
5350 RETURN
5360 IF NM=1 THEN RETURN
5370 IFAIL=1: BEEP 12,20: BEEP 15,20: PRINT
5380 PRINT "*** ERROR ** wording not unique - ";
5390 PRINT "which characteristic do you mean please?"
5400 PRINT: FOR J=1 TO NM
5410 IF J<NM THEN PRINT SPC(3); ELSE PRINT "or ";
5420 PRINT USING "  ## ";LC(J);: PRINT " ";N$(LC(J)): NEXT J
5430 RETURN
5440 REM -----
5450 REM ROUTINE TO PRINT ALL INFORMATION ON SPECIES AT RECORD SREC
5460 NL=3: P1=1-LENRAN
5470 GET #1,SREC: GET #2,SREC
5480 GET #3,SREC: GET #4,SREC+1

```

```

5490 IF LP=1 THEN GOTO 5530
5500 PRINT: PRINT: PRINT "Species ";
5510 PRINT SNU$;" ";SPN$: PRINT STRING$(80,45): PRINT
5520 IF LP=0 THEN GOTO 5550
5530 LPRINT "Species ";
5540 LPRINT SNU$;" ";SPN$: LPRINT STRING$(80,45): LPRINT
5550 FOR I=1 TO MAXCH
5560 N2=LN(I): NP=0
5570 IF LP<>1 THEN PRINT N$(I);
5580 IF LP=0 THEN GOTO 5600
5590 LPRINT N$(I);
5600 IF NC(I)>0 THEN GOTO 5790
5610 P1=P1+LENRAN: A$=MID$(R$,P1,LENRAN)
5620 P1=P1+LENRAN: B$=MID$(R$,P1,LENRAN)
5630 IF VAL(A$)<>0 OR VAL(B$)<>0 THEN GOTO 5670
5640 IF LP<>1 THEN PRINT TAB(41);"--"
5650 IF LP<>0 THEN LPRINT TAB(41);"--"
5660 GOTO 5760
5670 IF LP=1 THEN GOTO 5720
5680 PRINT TAB(41);A$;
5690 IF VAL(A$)=VAL(B$) THEN GOTO 5710
5700 PRINT " to ";B$;
5710 PRINT
5720 IF LP=0 THEN GOTO 5760
5730 LPRINT TAB(41);A$;: IF VAL(A$)=VAL(B$) THEN GOTO 5750
5740 LPRINT " to ";B$;
5750 LPRINT: IF LP=1 THEN GOTO 6030
5760 NL=NL+1: IF NL<16 THEN GOTO 6030
5770 PRINT: INPUT "press RETURN to continue",A$: PRINT: NL=0
5780 GOTO 6030
5790 IF LP<>1 THEN PRINT TAB(39)
5800 IF LP<>0 THEN LPRINT TAB(39)
5810 P2=(N2-1)*MAXSEL: FOR J=1 TO NC(I): K=VAL(MID$(S$,P2+J,1))
5820 IF K=0 THEN GOTO 5970
5830 NP=NP+1: IF NP=1 THEN GOTO 5860
5840 IF LP<>1 THEN PRINT ",";
5850 IF LP<>0 THEN LPRINT ",";
5860 IF LP<>1 THEN PX=POS(X) ELSE PX=LPOS(X)
5870 L=LEN(SN$(N2,J))+3: LL=PX+L: IF LP=1 THEN GOTO 5930
5880 IF LL<=80 THEN GOTO 5900
5890 NL=NL+1: PRINT: PRINT TAB(39)
5900 IF K=1 THEN PRINT " *"; ELSE PRINT " ";
5910 PRINT SN$(N2,J);
5920 IF LP=0 THEN GOTO 5970
5930 IF LL<=80 THEN GOTO 5950
5940 LPRINT: LPRINT TAB(39)
5950 IF K=1 THEN LPRINT " *"; ELSE LPRINT " ";
5960 LPRINT SN$(N2,J);
5970 NEXT J: IF LP=1 THEN GOTO 6010
5980 IF NP=0 THEN PRINT " -";
5990 PRINT
6000 IF LP=0 THEN GOTO 5760
6010 IF NP=0 THEN LPRINT " -";
6020 LPRINT: IF LP<>1 THEN GOTO 5760
6030 NEXT I

```

```

6040 IF LP<>0 THEN LPRINT STRING$(1,12)
6050 IF LP=1 OR NL=0 THEN RETURN
6060 PRINT: INPUT "press RETURN to continue",A$
6070 RETURN
6080 REM -----
6090 REM ROUTINE TO PRINT DIAGNOSTIC MESSAGE
6100 BEEP 12,20: BEEP 15,20: PRINT
6110 PRINT "*** ERROR ** invalid reply - please repeat": PRINT
6120 RETURN
6130 REM -----
6140 REM ROUTINE TO PRINT CHARACTERISTICS LIST IN TWO COLUMNS
6150 PRINT: LM=MAXCH+(3-ICAT): LE=(LM+1)/2: NPP=11
6160 IF LE>NPP THEN LE=NPP
6170 NN=1: L=ICAT-2
6180 HT=1
6190 HTAB HT: PRINT USING " ## ";L;: PRINT " ";N$(L)
6200 NN=NN+1: L=L+1: IF L<=MAXCH THEN GOTO 6220
6210 VTAB LV: RETURN
6220 IF NN<=LE THEN GOTO 6190
6230 NN=1: IF LM<=NPP*2 OR HT=1 THEN GOTO 6260
6240 PRINT: INPUT "press return to continue",A$: PRINT
6250 GOTO 6180
6260 LV=VPOS(0): VTAB LV-LE: HT=41: GOTO 6190
6270 REM -----
6280 REM ROUTINE TO FIND SPECIES LOCATION BY NUMBER OR NAME
6290 REM * warning * this routine is v. slow when searching by name
6300 IFAIL=0: IF VAL(ANS$)=0 THEN GOTO 6350
6310 A$=ANS$: B$=LEFT$(ANS$+SPACE$(LENSP),LENSP)
6320 FOR SREC=1 TO NSP: GET #4,SREC+1
6330 IF B$=SNU$ THEN GOTO 6420
6340 NEXT SREC: GOTO 6540
6350 GOSUB 5090: A$=ANS$: NM=0: FOR J=1 TO NSP: GET #3,J
6360 ANS$=SPN$: GOSUB 5090
6370 IF INSTR(ANS$,A$)=0 THEN GOTO 6390
6380 NM=NM+1: IND(NM)=J
6390 NEXT J
6400 IF NM<>1 THEN GOTO 6470
6410 SREC=IND(1): GET #4,SREC+1
6420 SNO$=SNU$: GET #3,SREC
6430 FOR J=LEN(SPN$) TO 1 STEP -1
6440 IF ASC(MID$(SPN$,J,1))<>32 THEN GOTO 6460
6450 NEXT J
6460 SPP$=LEFT$(SPN$,J): RETURN
6470 IF NM=0 THEN GOTO 6540
6480 BEEP 12,20: BEEP 15,20: PRINT: PRINT "*** ERROR ** wording ";
6490 PRINT "not unique - which species do you mean please?": PRINT
6500 FOR J=1 TO NM: JJ=IND(J): GET #3,JJ: GET #4,JJ+1
6510 IF J-(J\15)*15<>1 OR J=1 THEN GOTO 6530
6520 PRINT: INPUT "press RETURN to continue",A$: PRINT
6530 PRINT SPC(3);SNU$;" ";SPN$: NEXT J: IFAIL=1: RETURN
6540 BEEP 12,20: BEEP 15,20: PRINT: PRINT "*** ERROR ** species ";A$;
6550 PRINT " is not recorded - please try again": IFAIL=1: RETURN
6560 REM -----
6570 REM ROUTINE FOR OPTIONAL SPECIES PRINT
6580 LP=-1

```

```

6590 PRINT: PRINT "Do you want to print species ";SNO$;
6600 INPUT "? (Y/N) ",ANS$
6610 IF LEN(ANS$)>0 THEN GOTO 6630
6620 GOSUB 6090: GOTO 6590
6630 GOSUB 5090: IF LEFT$(ANS$,1)="n" THEN RETURN
6640 IF LEFT$(ANS$,1)<>"y" THEN GOTO 6620
6650 PRINT: INPUT "Do you want a copy on the printer? (Y/N) ",ANS$
6660 GOSUB 5090: IF LEFT$(ANS$,1)="n" THEN LP=0
6670 IF LEFT$(ANS$,1)="y" THEN LP=2
6680 IF LP=-1 THEN GOTO 6620
6690 RETURN
6700 REM -----
6710 REM The data here may be varied when setting up the database.
6720 REM The first line contains char. settings - no. of catagories,
6730 REM or 0 if a range, or -1 if species no./name
6740 DATA -1,0,0,3,0,0,0,0,3,3,4,6,0,5,4,10,0,10,0,9,9,9
6750 REM Char. names, & catagory names for selection-type chars.
6760 DATA "species number/species name","altitude (metres)"
6770 DATA "mean annual rainfall (mm)"
6780 DATA "rainfall regime","dry season (months)"
6790 DATA "mean max. temp. hottest month (C)"
6800 DATA "mean min. temp. coldest month (C)"
6810 DATA "mean annual temperature (C)","soil texture","soil reaction"
6820 DATA "soil drainage","other soil characteristics"
6830 DATA "size of tree (metres)","form of tree","light requirements"
6840 DATA "other silvic. characteristics"
6850 DATA "production potential (m3/ha/an)","role in land use"
6860 DATA "timber density (S.G.)"
6870 DATA "sawtimber utilization","roundwood utilization"
6880 DATA "other timber products"
6890 DATA "winter","summer","uniform"
6900 DATA "light","medium","heavy"
6910 DATA "alkaline","neutral","acid"
6920 DATA "free draining","moist","impeded","seasonally waterlogged"
6930 DATA "shallow","deep","fertile","saline"
6940 DATA "adaptable","poor/infertile"
6950 DATA "exceptional","good","acceptable","poor","variable"
6960 DATA "strongly demanding","moderately demanding"
6970 DATA "shade tolerant","shade tolerant in youth"
6980 DATA "coppices/root suckers","fire resistant","frost resistant"
6990 DATA "termite resistant","drought hardy","requires wide spacing"
7000 DATA "fixes nitrogen","windfirm","tolerates salt winds"
7010 DATA "regenerates rapidly"
7020 DATA "shade and shelter","agricultural shade","windbreaks"
7030 DATA "erosion control","dune/soil stabilisation","agroforestry"
7040 DATA "land reclamation","soil improvement","ornamental"
7050 DATA "miscellaneous"
7060 DATA "heavy construction","light construction","boxes crates etc."
7070 DATA "furniture","boat building","carpentry/joinery"
7080 DATA "flooring/panelling","railway sleepers","miscellaneous"
7090 DATA "transmission poles","building poles/piling","posts"
7100 DATA "fuel/charcoal","shortfibre pulp","longfibre pulp"
7110 DATA "veneer/plywood","turnery","miscellaneous"
7120 DATA "resins","tannins","fodder","oils","gums","medicinal products"
7130 DATA "honeyflora","edible fruits/seeds","miscellaneous"

```

Appendix III

Analysis of Mean Annual Temperature Variation  
in Tropical and Sub-Tropical Latitudes 1/.

Data from 1045 meteorological stations 2/. was analysed to investigate the effect of various factors on mean annual temperature between latitudes 30°N and 30°S. The variables studied were; altitude, latitude, mean annual precipitation and distance from the sea. It was not possible to include other possible influences, such as cloud cover, ocean currents, etc., due to lack of data.

The distribution of the stations studied was as follows:

continent	number of stations						
	altitude (m)						
	0 100	101 500	501 1000	1001 1500	1501 2000	2001 3000	over 3000
Americas	120	58	46	25	23	31	16
Africa	81	94	54	62	27	11	0
Asia	236	95	32	20	7	5	2
	latitude (°)						
	20-30N	10-20N	0-10N	0-10S	10-20S	20-30S	
Americas	57	66	52	41	51	52	
Africa	27	48	77	59	61	57	
Asia	97	110	60	43	38	49	

1/. The authors gratefully acknowledge the advice and assistance in the analysis given by Mr. H. L. Wright of C.F.I., Oxford.

2/. The data was derived from Walter, H. and Leith, H. (1967) Klimadiagramm-Weltatlas, Gustav Fischer Verlag, Jena.

The distribution was largely governed by the existence land area, and consequently meteorological data, in the various categories. As a result of the scanty data available at higher altitudes in Asia and Africa, the analysis in these continents was restricted to altitudes of 0-1500 metres and 0-2000 metres respectively. Preliminary analysis of the data also showed that in the arid land masses of northern Africa and Australia no regular trends could be discovered and consequently Africa north of latitude 15°N and Australia south of 15°S were excluded from further analysis.

Within these limitations, multiple regression equations for MAT on the previously mentioned variables were calculated separately for each of the continents. All three regressions were highly significant. In no case did mean annual precipitation or distance from the sea make any significant contribution. The equations were as below, where

MAT = mean annual temperature (°C)  
A = altitude in metres  
L = latitude in degrees

Americas ( $r^2 = 0.942$ )

$$\text{MAT} = 26.75 + 0.06785L - 0.003585A - 0.006844L^2 \\ - 0.0000004714A^2 - 0.00000001086A^2L + 0.000001666AL^2$$

Africa ( $r^2 = 0.869$ )

$$\text{MAT} = 27.00 + 0.07041L - 0.002044A - 0.003546L^2 \\ - 0.000001459A^2 - 0.00000001510A^2L + 0.0000000007832A^2L^2$$

Asia and Pacific ( $r^2 = 0.777$ )

$$\text{MAT} = 27.82 - 0.006527A - 0.005921L^2 + 0.0003830AL \\ - 0.0000002047A^2L - 0.000009918AL^2 + 0.000000006839A^2L^2$$

Use of the above regressions resulted in the estimates of MAT listed below for each continent. As previously explained the calculated values only cover the altitudinal ranges for which sufficient data was analysed and latitudes where the regressions are significant.

Values of Mean Annual Temperature Derived

from Multiple Regression Formulae

AMERICAS

ALTITUDE	(north)					LATITUDE					(south)			
	30.0	25.0	20.0	15.0	10.0	5.0	0.0	-5.0	-10.0	-15.0	-20.0	-25.0	-30.0	
0	23.1	24.6	25.8	26.7	27.2	27.4	27.2	26.7	25.8	24.6	23.1	21.2	19.0	
200	22.6	24.1	25.2	26.0	26.5	26.6	26.5	26.0	25.1	24.0	22.5	20.7	18.6	
400	22.1	23.5	24.5	25.3	25.7	25.9	25.7	25.2	24.4	23.3	21.9	20.2	18.1	
600	21.5	22.8	23.8	24.5	24.9	25.1	24.9	24.4	23.7	22.6	21.3	19.6	17.7	
800	22.1	23.0	23.7	24.1	24.2	24.0	23.6	22.9	22.9	21.9	20.6	19.1	17.2	
1000	20.2	21.3	22.2	22.8	23.2	23.3	23.1	22.7	22.1	21.1	19.9	18.5	16.8	
1200	19.4	20.5	21.3	21.9	22.3	22.4	22.2	21.8	21.2	20.3	19.2	17.9	16.3	
1400	18.6	19.6	20.4	20.9	21.3	21.4	21.3	20.9	20.3	19.5	18.5	17.3	15.8	
1600	17.7	18.6	19.4	19.9	20.2	20.4	20.3	20.0	19.4	18.7	17.8	16.6	15.3	
1800	16.7	17.6	18.3	18.8	19.2	19.3	19.2	19.0	18.5	17.9	17.0	16.0	14.8	
2000	15.7	16.6	17.2	17.7	18.0	18.2	18.1	17.9	17.5	17.0	16.3	15.3	14.3	
2200	14.6	15.4	16.1	16.5	16.9	17.0	17.0	16.9	16.6	16.1	15.5	14.7	13.7	
2400	13.5	14.2	14.8	15.3	15.6	15.8	15.9	15.8	15.5	15.2	14.6	14.0	13.2	
2600	12.3	13.0	13.6	14.0	14.4	14.6	14.7	14.7	14.5	14.2	13.8	13.3	12.6	
2800	11.0	11.7	12.2	12.7	13.1	13.3	13.5	13.5	13.4	13.2	12.9	12.5	12.0	
3000	9.6	10.3	10.9	11.3	11.7	12.0	12.2	12.3	12.3	12.2	12.1	11.8	11.4	

AFRICA

ALTITUDE	(north)			LATITUDE				(south)			
	15.0	10.0	5.0	0.0	-5.0	-10.0	-15.0	-20.0	-25.0	-30.0	
0	27.7	27.8	27.7	27.5	27.0	26.4	25.6	24.6	23.5	22.1	
200	27.3	27.3	27.3	27.0	26.5	25.9	25.1	24.2	23.0	22.1	
400	26.7	26.8	26.7	26.4	25.9	25.3	24.5	23.6	22.4	21.1	
600	26.1	26.1	26.0	25.7	25.2	24.6	23.8	22.9	21.8	20.5	
800	25.4	25.4	25.2	24.9	24.4	23.8	23.0	22.1	21.0	19.7	
1000	24.6	24.5	24.3	23.9	23.5	22.8	22.0	21.1	20.1	18.9	
1200	23.7	23.6	23.3	22.9	22.4	21.7	21.0	20.1	19.1	18.0	
1400	22.8	22.5	22.2	21.7	21.2	20.5	19.8	18.9	18.0	16.9	
1600	21.7	21.4	21.0	20.4	19.9	19.2	18.5	17.6	16.8	15.8	
1800	20.6	20.1	19.6	19.0	18.4	17.7	17.0	16.3	15.4	14.6	
2000	19.4	18.8	18.2	17.5	16.9	16.2	15.5	14.7	14.0	13.2	

ASIA AND PACIFIC

ALTITUDE	(north)					LATITUDE					(south)
	30.0	25.0	20.0	15.0	10.0	5.0	0.0	-5.0	-10.0	-15.0	
0	22.9	24.6	25.9	26.9	27.7	28.1	28.3	28.1	27.7	26.9	
200	22.1	23.9	25.3	26.3	26.9	27.1	27.0	26.4	25.5	24.2	
400	21.4	23.2	24.6	25.5	26.0	26.0	25.7	24.8	23.6	21.9	
600	20.6	22.4	23.7	24.6	25.0	24.9	24.4	23.3	21.9	19.9	
800	19.8	21.5	22.8	23.5	23.9	23.7	23.0	21.9	20.3	18.3	
1000	19.0	20.6	21.7	22.4	22.6	22.4	21.7	20.6	19.1	17.0	
1200	18.2	19.6	20.5	21.1	21.3	21.1	20.4	19.4	18.0	16.2	
1400	17.4	18.5	19.3	19.7	19.8	19.6	19.1	18.3	17.1	15.7	

- SPECIES DATA SHEETS -

SPECIES: Acacia albida Del.

**TAXONOMY:**

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... Faidherbia albida (Del.) A. Chev.  
3 LOCAL OR TRADE NAMES , Kad; Kababu; Ana tree; Winter thorn.

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 35°N-25°S  
5 AREAS ..... Africa from lower Egypt to South Africa (but excluding rain forest zones) and Asia Minor.

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 0-2,000 m  
7 MEAN ANNUAL RAINFALL , 250-1,000 mm  
8 RAINFALL REGIME ..... Winter/Summer  
9 DRY SEASON ..... 6-9 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 30-42°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 6-18°C  
12 MEAN ANNUAL TEMP. .... 18-30°C

**SOILS:**

- 13 TEXTURE ..... Medium/light  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining; tolerates seasonal waterlogging.  
16 OTHER CHARACTERISTICS Requires high water table in lowest rainfall areas; tolerates slight salinity.

**SILVICULTURE:**

- 17 SIZE ..... h = 15-25 m  
18 DESCRIPTION ..... Deciduous; spiny.  
19 FORM ..... Poor; sometimes buttressed.  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; termite resistant; fixes nitrogen; tolerates moderate frosts; drought hardy; substantial provenance variation; leafy during dry season.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

**ROLE IN LAND USE:**

23 ..... Shade and shelter; soil improvement; agroforestry

**TIMBER:**

- 24 DENSITY ..... S.G. 0.58-0.71  
25 NATURAL DURABILITY ... Perishable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Fair  
28 SEASONING ..... Good  
29 OTHER FEATURES ..... Weak; tends to 'spring' after sawing.

**UTILIZATION:**

- 30 SAW TIMBER ..... Furniture; boxes; boat building.  
31 ROUNDWOOD ..... Household utensils; fence posts; cartwheels; fuel c.v. = 19.741 kJ/kg; short fibre pulp.  
32 OTHER PRODUCTS ..... Fodder (leaves and pods; 400-600 kg pods/ha/an; N.B. store pods dry to avoid toxicity); tannin; gum.

**NURSERY:**

- 33 SEED SOURCES ..... Notably Senegal, but also from most dry zone African countries.  
34 SEEDS PER KILOGRAMME , 11,500-20,000 seeds or 3,500 plants/kg of seed.  
35 STORAGE ..... Several years at ambient temperatures  
36 PRE-TREATMENT ..... Soak in cold water for 24 hours  
37 PLANTING STOCK ..... Potted; direct sown.  
38 SPECIAL REQUIREMENTS , None  
39 GERMINATION AND GROWTH 40-60% germination in 6-30 days. Plantable size in 4-5 months.

**PRINCIPAL PESTS AND DISEASES:**

40 ..... None of importance. Bruchid beetles may infest seed.

**PRINCIPAL REFERENCES:**

28 47 69 85 107 118 120 134

SPECIES: Acacia auriculiformis A. Cunn. ex Benth.

TAXONOMY:

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... A. auriculaeformis A. Cunn.  
3 LOCAL OR TRADE NAMES , Tan Wattle

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 20-7°S  
5 AREAS ..... Coastal Queensland, Papua New Guinea and islands of Torres Strait

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-500 m  
7 MEAN ANNUAL RAINFALL , 1,300-1,700 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-24°C  
12 MEAN ANNUAL TEMP, .... 24-29°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Seasonally waterlogged  
16 OTHER CHARACTERISTICS Tolerates shallow soils and is adaptable to most soil conditions

SILVICULTURE:

- 17 SIZE ..... h = 15-25 m; d = 35-60 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices poorly but regenerates rapidly; fixes nitrogen.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-20

ROLE IN LAND USE:

23 ..... Shade and shelter; dune fixation; anti-erosion; soil improvement; ornamental.

TIMBER:

- 24 DENSITY ..... S.G. 0.60-0.75  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Fair  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Small size and form limit use as sawtimber.

UTILIZATION:

- 30 SAW TIMBER ..... Limited use for furniture  
31 ROUNDWOOD ..... Building poles; fence posts; fuel (c.v.=20,110-20,450 kJ/kg) and charcoal; shortfibre pulp.  
32 OTHER PRODUCTS ..... Tannins

NURSERY:

- 33 SEED SOURCES ..... Malaysia, Indonesia and Papua New Guinea.  
34 SEEDS PER KILOGRAMME , 39,000-42,000  
35 STORAGE ..... Dry and airtight for one-two years.  
36 PRE-TREATMENT ..... Boiling water till cool  
37 PLANTING STOCK ..... Potted; direct sown.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH 50% germination in 5-15 days (No information on growth in nursery)

PRINCIPAL PESTS AND

DISEASES:

40 ..... Roots attacked by Ganoderma lucidum, but generally none of importance reported.

PRINCIPAL REFERENCES:

59 120 121 128 149 152 172

SPECIES: Acacia cyanophylla Lindl.

TAXONOMY:

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... Acacia saligna (Labill.) Wendl.  
3 LOCAL OR TRADE NAMES . Orange Wattle; Golden Wreath Wattle; Blue-leafed Wattle.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 33-29°S  
5 AREAS ..... S.W. coastal strip of W. Australia, early introduction to S. Africa.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,500 m  
7 MEAN ANNUAL RAINFALL . 300-1,000 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 4-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 25-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-10°C  
12 MEAN ANNUAL TEMP. .... 16-26°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates shallow or moderately saline soils, and highly alkaline soils.

SILVICULTURE:

- 17 SIZE ..... h = 4-8 m  
18 DESCRIPTION ..... Evergreen shrub or tree  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Moderately tolerant of shade  
21 OTHER CHARACTERISTICS Aggressive coloniser; coppices; fire resistant; tolerates salt winds; fixes nitrogen; drought hardy; frost tender.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 2-5

ROLE IN LAND USE:

23 ..... Windbreaks; dune fixation; anti-erosion.

TIMBER:

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... -  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fuel and charcoal.  
32 OTHER PRODUCTS ..... Fodder; gum.

NURSERY:

- 33 SEED SOURCES ..... Australia  
34 SEEDS PER KILOGRAMME . 50,000-60,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... Boiling water till cool.  
37 PLANTING STOCK ..... Potted; direct sown.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Germinates in 2-7 days.  
Plantable size in 5-6 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

8 52 71 84 95 121 152

SPECIES: Acacia cyclops A. Cunn. ex G. Don.

TAXONOMY:

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Rooikrans; Red-eye.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 25-33°S  
5 AREAS ..... S.W. Australia; naturalised in coastal Africa.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-300 m  
7 MEAN ANNUAL RAINFALL , 250-750 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 8-10°C  
12 MEAN ANNUAL TEMP. .... 22-26°C

SOILS:

- 13 TEXTURE ..... Light  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Well drained  
16 OTHER CHARACTERISTICS Tolerates saline soils

SILVICULTURE:

- 17 SIZE ..... h = 3-8 m  
18 DESCRIPTION ..... Multistemmed, evergreen shrub; phyllodes present  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Light demanding  
21 OTHER CHARACTERISTICS Aggressive coloniser; tolerates salt winds; fixes nitrogen; slightly frost resistant; drought hardy; fuelwood rotation of 7-10 years.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Dune stabilisation; shelterbelts; windbreaks.

TIMBER:

- 24 DENSITY .....  
25 NATURAL DURABILITY ...  
26 PRESERVATION .....  
27 SAWING .....  
28 SEASONING .....  
29 OTHER FEATURES .....

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Building poles; high quality firewood.  
32 OTHER PRODUCTS ..... Fodder (12-60 kg dry wt/tree/year)

NURSERY:

- 33 SEED SOURCES ..... W. Australia, Spain, France, Tunisia, Cyprus.  
34 SEEDS PER KILOGRAMME , 23,000-30,000  
35 STORAGE .....  
36 PRE-TREATMENT ..... Boiling water till cool.  
37 PLANTING STOCK .....  
38 SPECIAL REQUIREMENTS ,  
39 GERMINATION AND GROWTH 50-70% germination.

PRINCIPAL PESTS AND DISEASES:

40 .....

PRINCIPAL REFERENCES:

28 71 121 134

SPECIES: Acacia decurrens Willd.

TAXONOMY:

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... Acacia decurrens var. normalis Benth.  
3 LOCAL OR TRADE NAMES . Green wattle

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 37-25°C  
5 AREAS ..... Australia: Victoria, N.S.W., Queensland.  
Well established in S. Africa.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,000-2,500 m  
7 MEAN ANNUAL RAINFALL . 900-2,000 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 2-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 16-24°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-10°C  
12 MEAN ANNUAL TEMP. .... 12-18°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 10-20 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Shade tolerant  
21 OTHER CHARACTERISTICS Frost resistant; root suckers vigorously;  
15 year firewood rotation.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 6-16 (-20)

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 0.50-0.70  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Fissile

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Building poles; fence posts; fuel (c.v. = 19,430-  
19,470 kJ/kg) and charcoal.  
32 OTHER PRODUCTS ..... Tannins; green manure.

NURSERY:

- 33 SEED SOURCES ..... South Africa; Australia.  
34 SEEDS PER KILOGRAMME . 70,000-80,000  
35 STORAGE ..... Dry, cold and airtight for 1-2 years.  
36 PRE-TREATMENT ..... Boiling water till cool.  
37 PLANTING STOCK ..... Direct sown; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , Direct sow pre-treated at 2 kg/ha.  
39 GERMINATION AND GROWTH Germinates in 7-14 days  
Plantable size in 5-7 months

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Defoliator Acanthopsyche junode (less than  
A. mearnsii)

PRINCIPAL REFERENCES:

49 152

SPECIES: Acacia farnesiana (L.) Willd.

TAXONOMY:

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... A. cavenia Bert.; Mimosa farnesiana L.  
3 LOCAL OR TRADE NAMES . Cassie flower; Opoponax (Southern U.S.A.); Espino blanco; Huisache (Mex.).

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 30°N-40°S  
5 AREAS ..... Tropical Americas from Texas to Chile. Naturalised in parts of E. Africa.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,300 m  
7 MEAN ANNUAL RAINFALL . 400-600 mm  
8 RAINFALL REGIME ..... Winter/summer/uniform  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 25-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-10°C  
12 MEAN ANNUAL TEMP, .... 15-28°C

SOILS:

- 13 TEXTURE ..... Light/(medium/heavy)  
14 REACTION ..... Neutral/acid/alkaline  
15 DRAINAGE ..... Well drained  
16 OTHER CHARACTERISTICS Tolerates poor and saline soils

SILVICULTURE:

- 17 SIZE ..... h = 3-4 m  
18 DESCRIPTION ..... Small, thorny tree; much branched.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Fire resistant; drought hardy; frost tender.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks; hedges.

TIMBER:

- 24 DENSITY ..... S.G. = 0.83  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION .....  
27 SAWING .....  
28 SEASONING .....  
29 OTHER FEATURES ..... Hard; close grained.

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Posts; turnery; fuelwood (c.v. = 19,218 kJ/kg)  
32 OTHER PRODUCTS ..... Fodder (leaves); tannin; gum; toothbrushes; dyes; host for lac insect; perfume.

NURSERY:

- 33 SEED SOURCES ..... Australia, France, Kenya, Sudan, Uruguay, Cyprus.  
34 SEEDS PER KILOGRAMME . 10,000-13,000  
35 STORAGE ..... Ambient temperature for several years.  
36 PRE-TREATMENT ..... Boiling water, soak till cool.  
37 PLANTING STOCK ..... Bare rooted plants; cuttings.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH 70% germination.

PRINCIPAL PESTS AND DISEASES:

40 .....

PRINCIPAL REFERENCES:

10 42 49 71 150

SPECIES: Acacia mangium Willd.

<b>TAXONOMY:</b>	
1 FAMILY .....	Mimosaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES .	-
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	18-1°S
5 AREAS .....	Australia: N. Queensland, Papua New Guinea and Moluccas Islands.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-100 (-720) m
7 MEAN ANNUAL RAINFALL .	1,000-2,100 mm
8 RAINFALL REGIME .....	Winter
9 DRY SEASON .....	3-4 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	30-32°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	13-22°C
12 MEAN ANNUAL TEMP. ....	18-28°C
<b>SOILS:</b>	
13 TEXTURE .....	Medium
14 REACTION .....	Acid/neutral
15 DRAINAGE .....	Moist; tolerates seasonal waterlogging.
16 OTHER CHARACTERISTICS	Tolerates very poor sites and slight salinity; often grows on creek and swamp margins.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 25-30 m
18 DESCRIPTION .....	Fluted bole.
19 FORM .....	Acceptable
20 LIGHT REQUIREMENTS ...	Fairly light demanding.
21 OTHER CHARACTERISTICS	Coppices; fixes nitrogen; competes well with <u>Imperata</u> grass; regenerates freely on disturbed sites.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	20-46
<b>ROLE IN LAND USE:</b>	
23 .....	Plantation of water catchments; firebreaks; reforestation after shifting cultivation.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. = 0.63-0.69
25 NATURAL DURABILITY ...	-
26 PRESERVATION .....	Easy
27 SAWING .....	Easy
28 SEASONING .....	Fair
29 OTHER FEATURES .....	-
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	General construction; furniture, boxes.
31 ROUNDWOOD .....	Veneer/plywood; shortfibre pulp; particle board.
32 OTHER PRODUCTS .....	Fodder; medicines.
<b>NURSERY:</b>	
33 SEED SOURCES .....	Papua New Guinea; Queensland, Australia.
34 SEEDS PER KILOGRAMME .	40,000-70,000
35 STORAGE .....	Cold, sealed.
36 PRE-TREATMENT .....	-
37 PLANTING STOCK .....	Bare-rooted plants.
38 SPECIAL REQUIREMENTS .	-
39 GERMINATION AND GROWTH	-
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	Seedlings attacked by insects in nursery.
<b>PRINCIPAL REFERENCES:</b>	
	1 156 157

SPECIES: Acacia mearnsii De Wild.

**TAXONOMY:**

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... A. decurrens var. mollis Lindl.  
3 LOCAL OR TRADE NAMES , Black wattle; Tan wattle.

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 43-25°S  
5 AREAS ..... Australia; Tasmania, Victoria, N.S.W.,  
S. Australia and non-tropical Queensland.  
Well established in S. Africa.

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 100-2,500 m  
7 MEAN ANNUAL RAINFALL , 700-2,000 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 2-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 18-24°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-8°C  
12 MEAN ANNUAL TEMP, .... 12-20°C

**SOILS:**

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on deep fertile soils.

**SILVICULTURE:**

- 17 SIZE ..... h = 7-10 (up to 20) m; d = 10-60 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Shade tolerant  
21 OTHER CHARACTERISTICS Aggressive coloniser; coppices poorly;  
tolerates salt winds; fixes nitrogen;  
moderately drought hardy; moderately frost  
tender.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-25

**ROLE IN LAND USE:**

23 ..... Shade and shelter; windbreaks; anti-erosion;  
soil improvement.

**TIMBER:**

- 24 DENSITY ..... S.G. 0.65-0.85  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Fair  
27 SAWING ..... -  
28 SEASONING ..... Fair; tendency to warp.  
29 OTHER FEATURES ..... Fissile

**UTILIZATION:**

- 30 SAW TIMBER ..... Flooring  
31 ROUNDWOOD ..... Building poles; fence posts; fuel and charcoal;  
shortfibre pulp; mining timber.  
32 OTHER PRODUCTS ..... Tannins

**NURSERY:**

- 33 SEED SOURCES ..... South Africa; East Africa; Australia.  
34 SEEDS PER KILOGRAMME , 66,000-80,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... Boiling water till cool.  
37 PLANTING STOCK ..... Potted; direct sown.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH 75% germination in 7-14 days.  
Plantable size in 4-6 months.

**PRINCIPAL PESTS AND**

**DISEASES:** Serious attack by defoliator Acanthopsyche  
40 ..... junode. Susceptible to fungal and insect  
attack in high rainfall conditions.

**PRINCIPAL REFERENCES:**

16 42 49 52 121 128 148 152

SPECIES: Acacia melanoxyton R. Br.

TAXONOMY:

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Australian Blackwood

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 43-34°S  
5 AREAS ..... S.E. Australia and Tasmania.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,500-2,500 m  
7 MEAN ANNUAL RAINFALL , 900-2,700 mm  
8 RAINFALL REGIME ..... Winter/summer/uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 16-22°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-12°C  
12 MEAN ANNUAL TEMP, .... 12-18°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on deep soils; tolerates some salinity.

SILVICULTURE:

- 17 SIZE ..... h = 18-30 m; d = 80-90 cm  
18 DESCRIPTION ..... Evergreen; often buttressed.  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Shade tolerant in youth.  
21 OTHER CHARACTERISTICS Coppices; termite resistant; tolerates salt winds; fixes nitrogen; root suckers vigorously.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 5-12

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks; ornamental.

TIMBER:

- 24 DENSITY ..... S.G. 0.60-0.70  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Fissile; decorative; good bending properties.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; fine furniture; boat building; casks.  
31 ROUNDWOOD ..... Fence posts; fuel and charcoal; veneer/plywood; shortfibre pulp.  
32 OTHER PRODUCTS ..... Fodder (leaves); gums.

NURSERY:

- 33 SEED SOURCES ..... Australia and East Africa.  
34 SEEDS PER KILOGRAMME , 65,000-70,000  
35 STORAGE ..... Dry, cold and airtight for 5 months to 1 year.  
36 PRE-TREATMENT ..... Boiling water, soak till cool.  
37 PLANTING STOCK ..... Potted; stumps.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH -

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Seriously attacked by Armillaria root disease and Loranthus in E. Africa.

PRINCIPAL REFERENCES:

16 52 57 71 82 128 152

SPECIES: Acacia nilotica (L.) Willd. ex Del.

**TAXONOMY:**

- 1 FAMILY ..... Mimosaceae  
 2 SYNONYMS ..... A. arabica (L.) Willd.  
 3 LOCAL OR TRADE NAMES , Egyptian thorn; babul; kikar (India); sunt (Arabic).

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 30°N-20°S  
 5 AREAS ..... Western India and Pakistan (sub species indica); Africa from Sudan to Senegal and Botswana (sub species nilotica).

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 0-500 m  
 7 MEAN ANNUAL RAINFALL , 200-1,000 mm  
 8 RAINFALL REGIME ..... Summer  
 9 DRY SEASON ..... 6-9 months  
 10 MEAN MAX. TEMP.  
     HOTTEST MONTH ..... 32-42°C  
 11 MEAN MIN. TEMP.  
     COLDEST MONTH ..... 15-23°C  
 12 MEAN ANNUAL TEMP, .... 24-28°C

**SOILS:**

- 13 TEXTURE ..... Heavy/medium/light  
 14 REACTION ..... Acid/neutral/alkaline  
 15 DRAINAGE ..... Thrives on seasonal waterlogging.  
 16 OTHER CHARACTERISTICS Adaptable; tolerates poor and alkaline soils.

**SILVICULTURE:**

- 17 SIZE ..... h = 10-15 m  
 18 DESCRIPTION ..... Spiny; open crowned; deciduous.  
 19 FORM ..... Poor  
 20 LIGHT REQUIREMENTS ... Strongly demanding  
 21 OTHER CHARACTERISTICS Aggressive coloniser; very weak coppice; fixes nitrogen; drought hardy; retains leaves during dry season; short-lived; 20 year rotation.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

**ROLE IN LAND USE:**

23 ..... Shade and shelter; agroforestry; erosion control.

**TIMBER:**

- 24 DENSITY ..... S.G. 0.67-0.85  
 25 NATURAL DURABILITY ... Durable  
 26 PRESERVATION ..... Fair  
 27 SAWING ..... Difficult  
 28 SEASONING ..... Easy  
 29 OTHER FEATURES ..... Resistant to termites; frequent knots; siliceous.

**UTILIZATION:**

- 30 SAW TIMBER ..... Buildings; carts; boats; furniture; floors.  
 31 ROUNDWOOD ..... Fuel (c.v. = 16,896-20,790 kJ/kg) and charcoal; sleepers; mine timbers; shortfibre pulp.  
 32 OTHER PRODUCTS ..... Fodder (pods); tannins; gums; toothbrushes.

**NURSERY:**

- 33 SEED SOURCES ..... Sudan; Nigeria; India; Pakistan; Kenya; France.  
 34 SEEDS PER KILOGRAMME . 5,000-10,000  
 35 STORAGE ..... Ambient conditions for 1-2 years.  
 36 PRE-TREATMENT ..... Boiling water till cool or 1 hr in conc. H<sub>2</sub>SO<sub>4</sub>.  
 37 PLANTING STOCK ..... Direct sown; rarely potted; cuttings.  
 38 SPECIAL REQUIREMENTS , Care of long taproot.  
 39 GERMINATION AND GROWTH 75-95% germination in one week.

**PRINCIPAL PESTS AND DISEASES:**

40 ..... Most serious pests are Bruchidius beetles attacking seeds; tree liable to attack by various wood borers. Root boring beetle Coelosterna scabrata.

**PRINCIPAL REFERENCES:**

12 28 46 70 71 76 95 101 121 128 141 150 152

SPECIES: Acacia pendula A. Cunn. ex G. Don

**TAXONOMY:**

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... A. leucophylla Lindl.  
3 LOCAL OR TRADE NAMES . Myall; Weeping myall; Boree.

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 35-20°S  
5 AREAS ..... Australia (Queensland and New South Wales).

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 0-500 m  
7 MEAN ANNUAL RAINFALL . 250-700 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 2-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-10°C  
12 MEAN ANNUAL TEMP. .... 15-20°C

**SOILS:**

- 13 TEXTURE ..... Heavy  
14 REACTION ..... Neutral/alkaline  
15 DRAINAGE ..... Moist  
16 OTHER CHARACTERISTICS -

**SILVICULTURE:**

- 17 SIZE ..... h = 6-13 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Light demanding  
21 OTHER CHARACTERISTICS Frost resistant; fixes nitrogen; drought hardy.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

**ROLE IN LAND USE:**

23 ..... Windbreaks

**TIMBER:**

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... -  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Dark; hard.

**UTILIZATION:**

- 30 SAW TIMBER ..... Furniture.  
31 ROUNDWOOD ..... Turnery; wheel spokes; fuelwood; posts.  
32 OTHER PRODUCTS ..... Fodder (leaves).

**NURSERY:**

- 33 SEED SOURCES ..... Australia; France.  
34 SEEDS PER KILOGRAMME . 43,000-48,000  
35 STORAGE ..... Dry, cold and airtight for one to two years.  
36 PRE-TREATMENT ..... Boiling water, soak till cool.  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH 70-90% germination; rapid seedling growth.

**PRINCIPAL PESTS AND**

**DISEASES:**  
40 ..... Protect from grazing animals until 45 cm high.  
'Bag caterpillars' (Liparidae) defoliate tree.

**PRINCIPAL REFERENCES:** 4 134 150 152

SPECIES: Acacia salicina Lindl.

<b>TAXONOMY:</b>	
1 FAMILY .....	Mimosaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES .	Cooba
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	28-20°C
5 AREAS .....	Semi-arid zones of N.S.W.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-2,000 m
7 MEAN ANNUAL RAINFALL .	300-700 mm
8 RAINFALL REGIME .....	Winter/summer/uniform
9 DRY SEASON .....	4-8 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	28-36°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	4-14°C
12 MEAN ANNUAL TEMP. ....	16-26°C
<b>SOILS:</b>	
13 TEXTURE .....	Medium/heavy
14 REACTION .....	Alkaline/neutral
15 DRAINAGE .....	Moderately free drainage
16 OTHER CHARACTERISTICS	Tolerates saline soils
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 10-16 m
18 DESCRIPTION .....	Evergreen; open-crowned.
19 FORM .....	Acceptable
20 LIGHT REQUIREMENTS ...	Moderately demanding
21 OTHER CHARACTERISTICS	Moderately frost resistant

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	3-5
<b>ROLE IN LAND USE:</b>	
23 .....	Shade and shelter; windbreaks; ornamental.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.75-0.80
25 NATURAL DURABILITY ...	Moderately durable.
26 PRESERVATION .....	-
27 SAWING .....	-
28 SEASONING .....	-
29 OTHER FEATURES .....	Tough; decorative.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	-
31 ROUNDWOOD .....	Fence posts; fuel and charcoal.
32 OTHER PRODUCTS .....	Fodder
<b>NURSERY:</b>	
33 SEED SOURCES .....	Australia
34 SEEDS PER KILOGRAMME .	22,000-26,000
35 STORAGE .....	Dry, cold and airtight for several years.
36 PRE-TREATMENT .....	Boiling water till cool.
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS .	-
39 GERMINATION AND GROWTH	Germinates in 12-14 days. Plantable size in 4-6 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	None of importance reported.
<b>PRINCIPAL REFERENCES:</b> 84 95 152	

SPECIES: Acacia senegal (L.) Willd.

<b>TAXONOMY:</b>	
1 FAMILY .....	Mimosaceae
2 SYNONYMS .....	<u>Acacia verec</u> Guill. and Perr.
3 LOCAL OR TRADE NAMES ,	Gommier; Goma; Gum arabic.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	11-18°N
5 AREAS .....	Sahel zone of Africa from Mauretania to Sudan and Somalia.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-500 m
7 MEAN ANNUAL RAINFALL ,	200-500 mm
8 RAINFALL REGIME .....	Summer
9 DRY SEASON .....	6-8 months
10 MEAN MAX. TEMP.,	
HOTTEST MONTH .....	30-40°C
11 MEAN MIN. TEMP.,	
COLDEST MONTH .....	16-28°C
12 MEAN ANNUAL TEMP. ....	22-32°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium/heavy
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Free draining
16 OTHER CHARACTERISTICS	-
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 2-5 (up to 13) m
18 DESCRIPTION .....	Spiny; open-crowned.
19 FORM .....	Poor
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Aggressive coloniser; coppices; substantial provenance variation; requires wide spacing; shortlived.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	4-7
<b>ROLE IN LAND USE:</b>	
23 .....	Dune fixation; anti-erosion; agroforestry.
<b>TIMBER:</b>	
24 DENSITY .....	-
25 NATURAL DURABILITY ...	-
26 PRESERVATION .....	-
27 SAWING .....	-
28 SEASONING .....	-
29 OTHER FEATURES .....	-
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	-
31 ROUNDWOOD .....	Fuel and charcoal.
32 OTHER PRODUCTS .....	Gum arabic; fodder; honeyflora.
<b>NURSERY:</b>	
33 SEED SOURCES .....	Sudan; Nigeria; Senegal.
34 SEEDS PER KILOGRAMME .	7,000-12,000
35 STORAGE .....	Shortlived viability
36 PRE-TREATMENT .....	Boiling water till cool; soak cold water 24 hours.
37 PLANTING STOCK .....	Potted; direct sown.
38 SPECIAL REQUIREMENTS ,	-
39 GERMINATION AND GROWTH	No information available on germination. Plantable size in 4-5 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	None of importance reported, but roots susceptible to attack by termites and young plants liable to browsing damage.
<b>PRINCIPAL REFERENCES:</b> 69 70 71 95 121 128 152	

SPECIES: Acacia tortilis (Forsk.) Hayne subsp. raddiana (Savi) Brenan

TAXONOMY:

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... A. raddiana Savi  
3 LOCAL OR TRADE NAMES . Karamoja; umbrella thorn (Africa); seyal (Arabic).

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 15-30°N  
5 AREAS ..... N.E. African deserts; New East; Saudi Arabia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,000 m  
7 MEAN ANNUAL RAINFALL . 100-800 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 6-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 32-45°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-10°C  
12 MEAN ANNUAL TEMP. .... 26-28°C

SOILS:

- 13 TEXTURE ..... Light  
14 REACTION ..... Alkaline  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Thrives on poor shallow soils, often bordering deserts.

SILVICULTURE:

- 17 SIZE ..... h = 4-13 m  
18 DESCRIPTION ..... Deciduous; thorny, savanna tree.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Coppices; drought hardy; one of four distinct sub-species from different ecological zones. Frost tender when young; 10 year fuelwood rotation.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Dune stabilisation.

TIMBER:

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... -  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Posts; tools; firewood (c.v. = 18,390 kJ/kg) and charcoal (4-5 tonnes/ha/an).  
32 OTHER PRODUCTS ..... Fodder; branches for fencing; honey flora.

NURSERY:

- 33 SEED SOURCES ..... France; Kenya; Netherlands.  
34 SEEDS PER KILOGRAMME . 12,000-15,000  
35 STORAGE ..... Dry, cold, airtight.  
36 PRE-TREATMENT ..... Soak in water 24 hrs; or conc. H<sub>2</sub>SO<sub>4</sub> for 40 mins.  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS . Pit planting on calcareous pan soils; initial weeding.  
39 GERMINATION AND GROWTH 40% germination in 4 days. Plantable size in 12 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Bruchid beetles attack seed.

PRINCIPAL REFERENCES:

67 71 94 120 121

SPECIES: Acrocarpus fraxinifolius Wight

TAXONOMY:

- 1 FAMILY ..... Caesalpiniaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Shingle tree; Indian Ash.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 23-27°N  
5 AREAS ..... Western India, Assam and Burma.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,500 m  
7 MEAN ANNUAL RAINFALL , 1,100-1,600 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 0-4 months  
10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 28-35°C  
11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 12-18°C  
12 MEAN ANNUAL TEMP. .... 19-28°C

SOILS:

- 13 TEXTURE ..... Medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-50 m; d = 100-250 cm  
18 DESCRIPTION ..... Deciduous/evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Moderately demanding  
21 OTHER CHARACTERISTICS Frost tender; requires wide spacing; susceptible to drought.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... Up to 10

ROLE IN LAND USE:

23 ..... Shade and shelter; ornamental.

TIMBER:

- 24 DENSITY ..... S.G. 0.63  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture; boxes.  
31 ROUNDWOOD ..... Fuel and charcoal; fence posts.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... India and Kenya.  
34 SEEDS PER KILOGRAMME . 26,000-30,000  
35 STORAGE ..... Cold  
36 PRE-TREATMENT ..... Boiling water, soak till cool.  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , Use large planting stock.  
39 GERMINATION AND GROWTH Sporadic; 10 days-3 months.  
Plantable size in 3-4 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Termites attack young plants.

PRINCIPAL REFERENCES:

4 5 107 120 137 152 170

SPECIES: Agathis dammara (A.B. Lamb.) L.C. Richard

TAXONOMY:

- 1 FAMILY ..... Araucariaceae  
2 SYNONYMS ..... A. loranthifolia R.A. Salisbury  
3 LOCAL OR TRADE NAMES . Damar; Malayan Kauri.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 11°S-20°N  
5 AREAS ..... Malaya, Indonesia, Philippines, New Guinea and New Britain (3 sub-species).

CLIMATE:

- 6 ALTITUDINAL RANGE .... 100-1,600 m  
7 MEAN ANNUAL RAINFALL . 2,000-4,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 12-22°C  
12 MEAN ANNUAL TEMP. .... 19-28°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Better growth on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 45-60 m; d = 100-200 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Shade tolerant in youth.  
21 OTHER CHARACTERISTICS Windfirm; suitable for line planting.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-20

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.45-0.50  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Spiral grain; blue stains easily.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes; boat building; furniture.  
31 ROUNDWOOD ..... Longfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... Gums ("copal")

NURSERY:

- 33 SEED SOURCES ..... Indonesia  
34 SEEDS PER KILOGRAMME . 16,000-21,000  
35 STORAGE ..... Short viability  
36 PRE-TREATMENT ..... Soak in cold water for 1-2 days.  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS . Seedlings require shade.  
39 GERMINATION AND GROWTH Germinates in 7-14 days.  
Plantable size in 12-18 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Dieback due to Corticium salmonicolor infection through wounds. Termite attack reported from Java.

PRINCIPAL REFERENCES:

12 34 171

SPECIES: Albizia falcataria (L.) Fosberg

TAXONOMY:

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... A. moluccana Miq.; and A. falcata (L.) Backer  
3 LOCAL OR TRADE NAMES . Batai, Mara.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 10°S-3°N  
5 AREAS ..... North Moluccas, Indonesia; naturalized in much of Far East.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,000 m  
7 MEAN ANNUAL RAINFALL . 2,000-4,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 30-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-24°C  
12 MEAN ANNUAL TEMP. .... 22-29°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Adaptable

SILVICULTURE:

- 17 SIZE ..... h = 25-45 m; d = 50-90 cm  
18 DESCRIPTION ..... Deciduous; open-crowned.  
19 FORM ..... Acceptable; variable.  
20 LIGHT REQUIREMENTS ... Strongly demanding.  
21 OTHER CHARACTERISTICS Coppices; fixes nitrogen; very fire tender; easily wind damaged; 8 year rotation for pulpwood.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-40

ROLE IN LAND USE:

23 ..... Soil improvement; agricultural shade; agroforestry.

TIMBER:

- 24 DENSITY ..... S.G. 0.30-0.46  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Soft and non-fissile; vulnerable to termite attack.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes; furniture.  
31 ROUNDWOOD ..... Shortfibre pulp; veneer/plywood; fuelwood (c.v. = 19525 - 20585 kJ/kg)  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Malaya; Fiji; Sabah; Hawaii; Indonesia; Philippines.  
34 SEEDS PER KILOGRAMME . 38,000-44,000  
35 STORAGE ..... Airtight for 1-2 years  
36 PRE-TREATMENT ..... Boiling water till cool.  
37 PLANTING STOCK ..... Potted; stumps.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germination begins in 2-5 days; 65% germination of fresh seed. Plantable size in 4-6 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Defoliation in plantation, by Eurema and Semiothisa, is a problem in Malaysia.

PRINCIPAL REFERENCES: 43 59 100 120 142 152

SPECIES: Albizia lebbek (L.) Benth.

**TAXONOMY:**

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... Mimosa lebeck L.; M. sirissa Roxb.  
3 LOCAL OR TRADE NAMES . Siris; Kokko; E. Indian Walnut.

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 11-27°N  
5 AREAS ..... Burma, India and Andaman Islands.

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 0-1,400 m  
7 MEAN ANNUAL RAINFALL , 500-2,500 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 2-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 26-36°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 10-26°C  
12 MEAN ANNUAL TEMP, .... 20-28°C

**SOILS:**

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Adaptable

**SILVICULTURE:**

- 17 SIZE ..... h = 15-30 m; d = 60-90 cm  
18 DESCRIPTION ..... Deciduous; open-crowned.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Moderately demanding  
21 OTHER CHARACTERISTICS Coppices; termite resistant; tolerates salt winds; fixes nitrogen; moderately frost resistant when established; root suckers vigorously; drought hardy; not wind firm; rotation of 10-15 years.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... 5

**ROLE IN LAND USE:**

23 ..... Shade and shelter; windbreaks; ornamental; anti-erosion; green manure; dune stabilisation.

**TIMBER:**

- 24 DENSITY ..... S.G. 0.55-0.90  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Fair  
27 SAWING ..... Fair  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... Interlocked grain; decorative.

**UTILIZATION:**

- 30 SAW TIMBER ..... Light construction; furniture; flooring.  
31 ROUNDWOOD ..... Fuel (c.v. = 21,340-21,350 kJ/kg) and charcoal; veneer/plywood; posts.  
32 OTHER PRODUCTS ..... Fodder (leaves); gums; tannin; medicinal products.

**NURSERY:**

- 33 SEED SOURCES ..... India  
34 SEEDS PER KILOGRAMME . 8,000-11,000  
35 STORAGE ..... Ambient temperature for several years.  
36 PRE-TREATMENT ..... Boiling water till cool.  
37 PLANTING STOCK ..... Stumps; direct sown.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH 60-90% germination in 1-2 months. Plantable size in 4-7 months.

**PRINCIPAL PESTS AND**

**DISEASES:** None of importance reported but liable to browsing damage.  
40 .....

**PRINCIPAL REFERENCES:**

16 57 61 69 71 95 100 109 120 121 128 152

SPECIES: Alnus acuminata O. Kuntze

**TAXONOMY:**

- 1 FAMILY ..... Betulaceae  
2 SYNONYMS ..... Alnus jorullensis H.B.K.  
3 LOCAL OR TRADE NAMES . Aliso; Jaul.

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 18°N-28°S  
5 AREAS ..... Medium altitudes of mountain ranges in Central and South America from Mexico to Argentina.

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 1,000-3,000 m  
7 MEAN ANNUAL RAINFALL . 1,000-3,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 22-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-14°C  
12 MEAN ANNUAL TEMP, .... 12-20°C

**SOILS:**

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS On steep slopes; develops best on deep soils.

**SILVICULTURE:**

- 17 SIZE ..... h = 15-30 m  
18 DESCRIPTION ..... Deciduous  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Aggressive coloniser of bare soils; coppices; fixes nitrogen; tolerates occasional frost; surface rooting; rotation of 18-22 years.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-15

**ROLE IN LAND USE:**

23 ..... Sylvopastoral systems; anti-erosion; soil improvement; agroforestry.

**TIMBER:**

- 24 DENSITY ..... S.G. 0.50-0.60  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Semi-decorative

**UTILIZATION:**

- 30 SAW TIMBER ..... Light construction; furniture; boxes.  
31 ROUNDWOOD ..... Fuel and charcoal; shortfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... -

**NURSERY:**

- 33 SEED SOURCES ..... Costa Rica, Colombia, Ecuador and Peru.  
34 SEEDS PER KILOGRAMME . 650,000-4,400,000  
35 STORAGE ..... Seed quickly loses viability after 1 month.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Bare rooted plants; root cuttings.  
38 SPECIAL REQUIREMENTS . Inoculate soil of new sites with nitrogen-fixing actinomycetes.  
39 GERMINATION AND GROWTH 50-70% germination.  
Plantable size in 1-2 years.

**PRINCIPAL PESTS AND**

**DISEASES:**

40 ..... None of importance reported.

**PRINCIPAL REFERENCES:**

52 56 121

SPECIES: Alnus nepalensis D. Don

TAXONOMY:

- 1 FAMILY ..... Betulaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Utis (Bengal); Maibau (Burma); Indian alder.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 15-28°N  
5 AREAS ..... Burma; N. India; W. China.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 100-3,000 m  
7 MEAN ANNUAL RAINFALL , 500-2,500 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 4-8 months  
10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 19-32°C  
11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 2-8°C  
12 MEAN ANNUAL TEMP. .... 13-26°C

SOILS:

- 13 TEXTURE ..... Medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free-draining; moist.  
16 OTHER CHARACTERISTICS Better growth on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 15-33 m  
18 DESCRIPTION ..... Deciduous  
19 FORM ..... Poor/acceptable  
20 LIGHT REQUIREMENTS ... Shade bearing  
21 OTHER CHARACTERISTICS Coppices; fixes nitrogen; frost tender; best growth in humid climates.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Water-catchment plantations; erosion control.

TIMBER:

- 24 DENSITY ..... S.G. = 0.32-0.37  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... Good  
29 OTHER FEATURES ..... Frequent knots.

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fuelwood (c.v. = 20,479 kJ/kg).  
32 OTHER PRODUCTS ..... Fodder

NURSERY:

- 33 SEED SOURCES ..... Burma; India.  
34 SEEDS PER KILOGRAMME , 1,600,000-2,300,00 pure or 400,000 with chaff.  
35 STORAGE ..... 3-4 months sealed at 1-3°C  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Direct sown; bare rooted plants.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH 70% germination in 4-6 weeks.  
Plantable size 4-5 months. Good weed competitor.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Batocera spp. stem borers are a bad pest.  
Easily damaged by wind.

PRINCIPAL REFERENCES:

16 67 121 168

SPECIES: Alnus rubra Bong.

<b>TAXONOMY:</b>	
1 FAMILY .....	Betulaceae
2 SYNONYMS .....	<u>A. oregana</u> Nutt.
3 LOCAL OR TRADE NAMES	Western red alder; Oregon alder; Erle; Aune.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	30-60°N
5 AREAS .....	N. America: up to 2,000 km inland from Pacific Coast.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-1,000 m
7 MEAN ANNUAL RAINFALL .	800-2,600 mm
8 RAINFALL REGIME .....	Winter
9 DRY SEASON .....	2-4 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	25-28°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	-1-+2°C
12 MEAN ANNUAL TEMP. ....	10-17°C
<b>SOILS:</b>	
13 TEXTURE .....	Medium
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Moist but free draining.
16 OTHER CHARACTERISTICS	-
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 13-35 m
18 DESCRIPTION .....	Deciduous
19 FORM .....	Good
20 LIGHT REQUIREMENTS ...	Light demanding
21 OTHER CHARACTERISTICS	Aggressive coloniser; young trees coppice; fixes nitrogen; substantial provenance variation; adapts to a wide variety of environments; withstands occasional extremes of temperature.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	10-11
<b>ROLE IN LAND USE:</b>	
23 .....	Soil improver; reclamation of eroded or derelict land.
<b>TIMBER:</b>	
24 DENSITY .....	0.33-0.48
25 NATURAL DURABILITY ...	Non-durable
26 PRESERVATION .....	-
27 SAWING .....	Easy
28 SEASONING .....	-
29 OTHER FEATURES .....	Blue stains easily; wears poorly.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Furniture; panelling.
31 ROUNDWOOD .....	Turnery; plywood; firewood (c.v. = 19,020 kJ/kg).
32 OTHER PRODUCTS .....	-
<b>NURSERY:</b>	
33 SEED SOURCES .....	N.W. America; avoid Haney II provenance (poor viability).
34 SEEDS PER KILOGRAMME .	1,200,000-430,000
35 STORAGE .....	Cold, sealed up to one year.
36 PRE-TREATMENT .....	Soak 24 hrs in cold water; or cold stratify 8 days
37 PLANTING STOCK .....	Potted; bare-rooted plants.
38 SPECIAL REQUIREMENTS .	Cool temperatures during seedling establishment.
39 GERMINATION AND GROWTH	70-90% germination; competes well with weeds.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	Few serious pests in native habitat. <u>Fomes igniarius</u> ; <u>Malacosoma pluvialis</u> (forest tent caterpillars).
<b>PRINCIPAL REFERENCES:</b> 13 62 121 132	

SPECIES: Anacardium occidentale L.

TAXONOMY:	
1 FAMILY .....	Anacardiaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES .	Cashew; Mkorosho; Mkanju; Acajú.
NATURAL OCCURRENCE:	
4 LATITUDES .....	30°N-25°S
5 AREAS .....	Tropical Americas, Mexico to Peru and Brazil, West Indies; naturalised in Africa and Mozambique.
CLIMATE:	
6 ALTITUDINAL RANGE ....	0-1,000 m
7 MEAN ANNUAL RAINFALL .	500-1,600 (-3,000) mm
8 RAINFALL REGIME .....	Summer/uniform
9 DRY SEASON .....	4-6 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	28-35°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	9-23°C
12 MEAN ANNUAL TEMP. ....	27-33°C
SOILS:	
13 TEXTURE .....	Light
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Good
16 OTHER CHARACTERISTICS	Tolerates poor soils; thrives on coastal soils if fresh ground water available.
SILVICULTURE:	
17 SIZE .....	h = 5-15 m
18 DESCRIPTION .....	Evergreen
19 FORM .....	Poor
20 LIGHT REQUIREMENTS ...	Light demanding
21 OTHER CHARACTERISTICS	Termite resistant; drought hardy; substantial provenance variation; requires wide spacing; frost sensitive; benefits from intercropping with legumes.

PRODUCTION:	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	-
ROLE IN LAND USE:	
23 .....	Erosion control; dune stabilisation; windbreaks.
TIMBER:	
24 DENSITY .....	-
25 NATURAL DURABILITY ...	Durable
26 PRESERVATION .....	-
27 SAWING .....	-
28 SEASONING .....	-
29 OTHER FEATURES .....	Termite resistant.
UTILIZATION:	
30 SAW TIMBER .....	-
31 ROUNDWOOD .....	Fence posts; fuel.
32 OTHER PRODUCTS .....	Nut (shell poisonous until roasted) 800-3000 kg nuts/ha/an; edible fruit stalk; oil ("cardol") with many industrial uses; gum; medicine; ink; fodder.
NURSERY:	
33 SEED SOURCES .....	Thailand; Tropical America; Burma; France, India, Sri Lanka.
34 SEEDS PER KILOGRAMME .	138-300
35 STORAGE .....	Up to one year, dried and sealed.
36 PRE-TREATMENT .....	Soak 24 hours in water.
37 PLANTING STOCK .....	Potted; stumps; direct sown; air layering.
38 SPECIAL REQUIREMENTS .	Care of long tap root; water daily for 1 month.
39 GERMINATION AND GROWTH	60-70% germination in 4-7 weeks; transplant at one year old.
PRINCIPAL PESTS AND DISEASES:	
40 .....	<u>Helopeltis</u> spp. main pest. <u>Plocaederus ferrugineus</u> - a cerambycid root/shoot-boring beetle; <u>Crimissa cruralis</u> Brazil, chrysomelid bug.
PRINCIPAL REFERENCES:	
	67 107 117 124 134 135 152

SPECIES: Anthocephalus chinensis (Lamk.) Rich. ex Walp.

TAXONOMY:

- 1 FAMILY ..... Rubiaceae  
2 SYNONYMS ..... A. indicus Rich; A. cadamba (Roxb.) Miq.  
3 LOCAL OR TRADE NAMES , Kadam; Laran.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 9°S-27°N  
5 AREAS ..... Assam; Benegal; Burma; Sri Lanka; Philippines; Indonesia and New Guinea.

CLIMATE:

- 6 ALTITUDINAL RANGE ... 0-1,300 m  
7 MEAN ANNUAL RAINFALL , 1,300-4,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-34 °C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 16-26 °C  
12 MEAN ANNUAL TEMP. .... 20-32 °C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Adaptable

SILVICULTURE:

- 17 SIZE ..... h = 20-30 m; d = 50-100 cm  
18 DESCRIPTION ..... Deciduous; open-crowned.  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Frost tender; 6-8 year pulp rotation.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-40

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.35-0.40  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Lyctus susceptible.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes.  
31 ROUNDWOOD ..... Shortfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Puerto Rico; Bangladesh; Sabah.  
34 SEEDS PER KILOGRAMME , Over 6,000,000  
35 STORAGE ..... Dry, cold and airtight for up to 4 months.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , 30% shade in the nursery.  
39 GERMINATION AND GROWTH 90% germination of fresh seed in 7-14 days.  
Plantable size in 3-4 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Defoliators including Arthroschista hilaralis.  
Susceptible to damping off in the nursery.

PRINCIPAL REFERENCES:

16 23 59 152

SPECIES: Araucaria angustifolia (Bert.) O. Kuntze

TAXONOMY:

- 1 FAMILY ..... Araucariaceae  
2 SYNONYMS ..... A. brasiliiana A. Rich.  
3 LOCAL OR TRADE NAMES , Parana pine

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 30-20°S  
5 AREAS ..... Southern Brazil, principally Parana.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,500-2,000 m  
7 MEAN ANNUAL RAINFALL , 1,250-2,200 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 18-23°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 9-16°C  
12 MEAN ANNUAL TEMP. .... 12-18°C

SOILS:

- 13 TEXTURE ..... Medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining but moist  
16 OTHER CHARACTERISTICS Better growth on fertile and deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 25-40 m; d = 100-150 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Frost resistant; fairly drought hardy.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-23

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.45-0.57  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy/Fair  
29 OTHER FEATURES ..... Thick barked

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction;  
furniture; boxes.  
31 ROUNDWOOD ..... Transmission poles; fence posts; longfibre  
pulp; plywood/veneer.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Brazil and Kenya.  
34 SEEDS PER KILOGRAMME . 100-120  
35 STORAGE ..... Short viability  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , Requires fifty per cent shade.  
39 GERMINATION AND GROWTH Germinates in 60-100 days.  
Plantable size in 21-27 months.

PRINCIPAL PESTS AND  
DISEASES:

40 ..... Liable to butt rot.

PRINCIPAL REFERENCES:

25 34 52 100 124 134 152

SPECIES: Araucaria cunninghamii D. Don

TAXONOMY:

- 1 FAMILY ..... Araucariaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Hoop pine

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 32-0°S  
5 AREAS ..... Papua New Guinea and tropical N.E. Australia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,000 m  
7 MEAN ANNUAL RAINFALL . 1,000-1,800 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 2-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 15-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 16-23°C  
12 MEAN ANNUAL TEMP. .... 16-26°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on fertile and deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 40-70 m; d = 100-200 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding; shade tolerant in youth.  
21 OTHER CHARACTERISTICS Windfirm; tolerates salt winds; moderately frost resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-18

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.50-0.55  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Thick barked

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; furniture; boxes.  
31 ROUNDWOOD ..... Transmission poles; fence posts; longfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Papua New Guinea and Australia (Queensland).  
34 SEEDS PER KILOGRAMME . 2,400-2,800  
35 STORAGE ..... Short viability  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS . Requires 50% shade.  
39 GERMINATION AND GROWTH No information available on germination. Plantable size in 18-24 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Termites cause stem collapse; Hoop pine weevil Vanapa oberthuri attacks stem. Damping off in nursery.

PRINCIPAL REFERENCES:

4 34 56 82 107 124 128 152 169

SPECIES: Araucaria hunsteinii K. Schum.

<b>TAXONOMY:</b>	
1 FAMILY .....	Araucariaceae
2 SYNONYMS .....	<u>A. klinkii</u> Lauterbach
3 LOCAL OR TRADE NAMES ,	Klinki pine
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	10-5°S
5 AREAS .....	New Guinea in same area as <u>A. cunninghamii</u> .
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	200-1,800 m
7 MEAN ANNUAL RAINFALL .	1,600-4,600 mm
8 RAINFALL REGIME .....	Uniform
9 DRY SEASON .....	0-2 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	24-32°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	12-24°C
12 MEAN ANNUAL TEMP. ....	20-27°C
<b>SOILS:</b>	
13 TEXTURE .....	Medium/heavy
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Free draining but moist.
16 OTHER CHARACTERISTICS	Better growth on deep soils.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 40-80 m; d = 200-400 cm
18 DESCRIPTION .....	Evergreen
19 FORM .....	Exceptional
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Frost tender

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	20-30
<b>ROLE IN LAND USE:</b>	
23 .....	-
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.40-0.48
25 NATURAL DURABILITY ...	Non-durable
26 PRESERVATION .....	Easy
27 SAWING .....	Easy
28 SEASONING .....	Easy
29 OTHER FEATURES .....	-
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Heavy construction; light construction; furniture; boxes; joinery; flooring; aircraft frames.
31 ROUNDWOOD .....	Transmission poles; fence posts; longfibre pulp; veneer/plywood; matches.
32 OTHER PRODUCTS .....	-
<b>NURSERY:</b>	
33 SEED SOURCES .....	New Guinea
34 SEEDS PER KILOGRAMME .	1,700-1,800 (2,000-2,500 de-winged)
35 STORAGE .....	Short viability (5-6 weeks), cold, moist, sealed.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS ,	Requires 75% shade in early months.
39 GERMINATION AND GROWTH	No information available on germination. Plantable size in 18-21 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	Similar to <u>A. cunninghamii</u> ; <u>Armillaria mellea</u> attacks roots.
<b>PRINCIPAL REFERENCES:</b>	
	34 56 87 124 169

SPECIES: Aucoumea klaineana Pierre

TAXONOMY:

- 1 FAMILY ..... Burseraceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Gaboon mahogany; Okoumé.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 2°S-2°N  
5 AREAS ..... Rain forests of Gabon and Congo.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-500 m  
7 MEAN ANNUAL RAINFALL . 1,600-3,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-36°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-26°C  
12 MEAN ANNUAL TEMP. .... 25-33°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Adaptable

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m; d = 90-250 cm  
18 DESCRIPTION ..... Buttressed  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 15-30

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.40-0.46  
25 NATURAL DURABILITY ... Perishable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Wood contains silica.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes; joinery.  
31 ROUNDWOOD ..... Shortfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Gabon and Congo.  
34 SEEDS PER KILOGRAMME . 9,000-12,000  
35 STORAGE ..... Short viability  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Striplings; direct sown.  
38 SPECIAL REQUIREMENTS . Requires 50% shade for some weeks.  
39 GERMINATION AND GROWTH No information available on germination.  
Plantable size in 3-4 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Very susceptible to borer attack both as a tree and as timber.

PRINCIPAL REFERENCES: 38 49 57 100 128 143

SPECIES: Azadirachta indica A. Juss.

**TAXONOMY:**

- 1 FAMILY ..... Meliaceae  
2 SYNONYMS ..... Melia azadirachta L.; Melia indica Brand.  
3 LOCAL OR TRADE NAMES . Neem; Nim; Margosa; Marrango.

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 10-25°N  
5 AREAS ..... Drier parts of India, Burma, Thailand and Cambodia.

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 0-1,000 m  
7 MEAN ANNUAL RAINFALL , 450-1,200 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON , ..... 5-7 months  
10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 26-38°C  
11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 14-24°C  
12 MEAN ANNUAL TEMP. .... 21-32°C

**SOILS:**

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on deep soils.

**SILVICULTURE:**

- 17 SIZE ..... h = 20-25 m; d = 100-150 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Moderately demanding; shade tolerant in youth.  
21 OTHER CHARACTERISTICS Aggressive coloniser; vigorous coppice; drought hardy; long tap root; frost and fire tender; fuelwood rotation of 8 years.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... 5-18

**ROLE IN LAND USE:**

23 ..... Shade and shelter; windbreaks; soil improvement; waste-land reclamation.

**TIMBER:**

- 24 DENSITY ..... S.G. 0.60-0.70  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Resistant to termite and insect attack; interlocked grain.

**UTILIZATION:**

- 30 SAW TIMBER ..... Light construction; furniture; boxes.  
31 ROUNDWOOD ..... Building poles; fence posts; fuel (c.v. = 20,895 kJ/kg) and charcoal; transmission poles.  
32 OTHER PRODUCTS ..... Fodder; leaves and seeds contain 'azadirachtin', a promising new insect repellent; medicine; green manure; oil from seeds; tannin.

**NURSERY:**

- 33 SEED SOURCES ..... India; Nigeria; Sudan.  
34 SEEDS PER KILOGRAMME , 4,000-4,500  
35 STORAGE ..... Short viability (2-3 weeks).  
36 PRE-TREATMENT ..... Soak in cold water for one-two days.  
37 PLANTING STOCK ..... Potted; stumps; direct sown.  
38 SPECIAL REQUIREMENTS , Light shade recommended; careful weeding.  
39 GERMINATION AND GROWTH 55% germination of fresh seed in 10-12 days. Plantable size in 11-14 months.

**PRINCIPAL PESTS AND DISEASES:**

40 ..... Termites attack trees of all ages.

**PRINCIPAL REFERENCES:**

16 69 71 93 95 107 109 121 128 152

SPECIES: Bombacopsis quinata (Jacq.) Dugand

TAXONOMY:

- 1 FAMILY ..... Bombacaceae
- 2 SYNONYMS ..... B. sepium Pittier
- 3 LOCAL OR TRADE NAMES . Pochote

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 6-14°N
- 5 AREAS ..... Central and South America, from Honduras to Venezuela.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-800 m
- 7 MEAN ANNUAL RAINFALL . 800-1,600 mm
- 8 RAINFALL REGIME ..... Summer
- 9 DRY SEASON ..... 3-5 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 26-32°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 16-24°C
- 12 MEAN ANNUAL TEMP, .... 20-27°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy
- 14 REACTION ..... Neutral/acid
- 15 DRAINAGE ..... Free draining; seasonally waterlogged.
- 16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m
- 18 DESCRIPTION ..... Deciduous; spiny; buttressed.
- 19 FORM ..... Acceptable
- 20 LIGHT REQUIREMENTS ... Strongly demanding; shade tolerant in youth.
- 21 OTHER CHARACTERISTICS Coppices

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.38-0.42
- 25 NATURAL DURABILITY ... Non-durable
- 26 PRESERVATION ..... Difficult
- 27 SAWING ..... Easy
- 28 SEASONING ..... Slow, but little degrade.
- 29 OTHER FEATURES ..... Resembles cedar.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture.
- 31 ROUNDWOOD ..... Plywood/veneer; pulp; firewood.
- 32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Venezuela and Costa Rica.
- 34 SEEDS PER KILOGRAMME , 2,300-2,700
- 35 STORAGE ..... -
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Stumps
- 38 SPECIAL REQUIREMENTS , -
- 39 GERMINATION AND GROWTH -

PRINCIPAL PESTS AND DISEASES:

40 ..... Very susceptible to beetle and weevil attack.

PRINCIPAL REFERENCES:

25

SPECIES: Brachychiton populneum (Schott) R.Br.

TAXONOMY:

- 1 FAMILY ..... Sterculiaceae  
2 SYNONYMS ..... Sterculia diversifolia D. Don  
3 LOCAL OR TRADE NAMES , Kurrajong; bottle tree.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 20-40°S  
5 AREAS ..... South-eastern Australia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,000 m  
7 MEAN ANNUAL RAINFALL , 250-760 mm  
8 RAINFALL REGIME ..... Winter/summer  
9 DRY SEASON ..... 8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 38°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 13-17°C  
12 MEAN ANNUAL TEMP. .... 16-25°C

SOILS:

- 13 TEXTURE ..... Light  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining but moist.  
16 OTHER CHARACTERISTICS Intolerant of poor soils; tolerates slight salinity.

SILVICULTURE:

- 17 SIZE ..... h = 8-15 m  
18 DESCRIPTION ..... Evergreen; bole swollen at base.  
19 FORM ..... Good above basal swelling.  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Drought resistant; frost tender; withstands lopping.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Shade

TIMBER:

- 24 DENSITY ..... S.G. 0.36-0.40  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Boxes  
31 ROUNDWOOD ..... Fuelwood; woodwool.  
32 OTHER PRODUCTS ..... Fodder (leaves and branches); fibres; edible fruit, (N.B. large amounts of seed can poison cattle); honey flora.

NURSERY:

- 33 SEED SOURCES ..... Australia; Cyprus.  
34 SEEDS PER KILOGRAMME , 6,700-10,000  
35 STORAGE ..... At ambient temperature.  
36 PRE-TREATMENT ..... Boiling water, soak till cool.  
37 PLANTING STOCK ..... Potted seedlings; direct sown; cuttings.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH 50-70% germination.

PRINCIPAL PESTS AND DISEASES:

40 ..... -

PRINCIPAL REFERENCES:

14 71 134 152

SPECIES: Butyrospermum paradoxum (Gaertn. f.) Hepper

TAXONOMY:

- 1 FAMILY ..... Sapotaceae  
2 SYNONYMS ..... B. niloticum kotschy; B. parkii (G.Don.)  
kotschy  
3 LOCAL OR TRADE NAMES , Shea butter tree; imuru; lulu (Arabic).

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 10-20°N  
5 AREAS ..... Central and West African savannas.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-300 m  
7 MEAN ANNUAL RAINFALL , 300-1,000 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 35-40°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH .....  
12 MEAN ANNUAL TEMP. .... 26-29°C

SOILS:

- 13 TEXTURE ..... Medium  
14 REACTION ..... -  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 7-15 m  
18 DESCRIPTION ..... Deciduous; spreading crown.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Light demanding  
21 OTHER CHARACTERISTICS Fire resistant; long taproot.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Agroforestry

TIMBER:

- 24 DENSITY ..... S.G. = 1.28  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... Difficult  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Hard; resistant to termite attack.

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... -  
32 OTHER PRODUCTS ..... Edible fats and 'shea' oil in seed kernels;  
(25-40 kg fruit/tree/year); medicine.

NURSERY:

- 33 SEED SOURCES ..... West Africa.  
34 SEEDS PER KILOGRAMME . -  
35 STORAGE ..... None: fresh seed essential.  
36 PRE-TREATMENT ..... -  
37 PLANTING STOCK ..... Direct sown.  
38 SPECIAL REQUIREMENTS , Care of taproot if transplanting.  
39 GERMINATION AND GROWTH Fruit borne at 12-15 years after planting.

PRINCIPAL PESTS AND  
DISEASES:

40 ..... -

PRINCIPAL REFERENCES: 44

SPECIES: Calliandra calothyrsus Meissn.

<b>TAXONOMY:</b>	
1 FAMILY .....	Mimosaceae
2 SYNONYMS .....	<u>Calliandra confusa</u> Sprague & Riley
3 LOCAL OR TRADE NAMES .	Calliandra
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	10-18°N
5 AREAS .....	Central America but well established in Indonesia.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	150-1,500 m
7 MEAN ANNUAL RAINFALL .	1,000-3,000 mm
8 RAINFALL REGIME .....	Uniform
9 DRY SEASON .....	2-4 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	24-30°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	18-24°C
12 MEAN ANNUAL TEMP. ....	22-28°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium/heavy
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Moist, moderately free draining.
16 OTHER CHARACTERISTICS	Tolerates infertile and compacted soils.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 8-10 m
18 DESCRIPTION .....	Small shrub
19 FORM .....	Poor
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Aggressive coloniser; vigorous coppice; fixes nitrogen; withstands long drought; annual coppicing can be carried out for 15-20 years; requires very close spacing in plantation; suppresses weeds including <u>Imperata cylindrica</u> .

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	5-20 in first year after planting; 35-65 thereafter.
<b>ROLE IN LAND USE:</b>	
23 .....	Anti-erosion; soil improvement; firebreaks; ornamental; green manure.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.51-0.78
25 NATURAL DURABILITY ...	-
26 PRESERVATION .....	-
27 SAWING .....	Easy
28 SEASONING .....	-
29 OTHER FEATURES .....	Strong
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	-
31 ROUNDWOOD .....	Fuelwood (c.v. = 18,900 - 19,950 kJ/kg); tool handles.
32 OTHER PRODUCTS .....	Fodder (7-10 tonnes dry leaves/ha/an); honey flora.
<b>NURSERY:</b>	
33 SEED SOURCES .....	Indonesia
34 SEEDS PER KILOGRAMME .	-
35 STORAGE .....	-
36 PRE-TREATMENT .....	Hot water then soak in cold for 24 hours.
37 PLANTING STOCK .....	Direct sown; bare rooted plants; large cuttings.
38 SPECIAL REQUIREMENTS .	-
39 GERMINATION AND GROWTH	Plantable size in 4-6 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	None reported.
<b>PRINCIPAL REFERENCES:</b> 47 120 121	

SPECIES: Callitris columellaris F. Muell.

TAXONOMY:

- 1 FAMILY ..... Cupressaceae  
2 SYNONYMS ..... C. glauca R. Br. ex R.T. Bak. & H.G. Sm.;  
C. intratropica F. Muell. ex R.T. Bak. & H.G.  
Sm.; C. hugelii (Carr.) Franco.  
3 LOCAL OR TRADE NAMES . White Cypress Pine; (Northern Cypress pine)

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 35°-15°S (-12°S for Northern provenances).  
5 AREAS ..... Australia: Northern Cypress pine being the  
provenance from the Northern Territories.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1800 m  
7 MEAN ANNUAL RAINFALL . 750-1,500 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 27-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 8-15°C  
12 MEAN ANNUAL TEMP, .... 17-24°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Acid/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on deep fertile soils; tolerates  
slight salinity.

SILVICULTURE:

- 17 SIZE ..... h = 18-28 m; d = 45-60 cm  
18 DESCRIPTION ..... Evergreen; light crowned.  
19 FORM ..... Acceptable; exceptional in Africa as an exotic.  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; termite resistant; fairly frost  
resistant; very drought hardy; substantial  
provenance variation; (Northern provenances  
have higher rainfall tolerance and greater  
termite resistance).

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 2-5 (-10)

ROLE IN LAND USE:

23 ..... Windbreaks

TIMBER:

- 24 DENSITY ..... S.G. 0.46-0.80  
25 NATURAL DURABILITY ... Very durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Frequent live knots; termite resistant; fissile;  
aromatic; decorative; irritant dust.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; flooring; boat-building;  
boxes; furniture.  
31 ROUNDWOOD ..... Transmission poles; fence posts; fuelwood;  
veneer/plywood; turnery.  
32 OTHER PRODUCTS ..... Christmas trees; tannins.

NURSERY:

- 33 SEED SOURCES ..... Queensland, Australia; South Africa.  
34 SEEDS PER KILOGRAMME . 60,000-120,000  
35 STORAGE ..... Dry, cold, airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS . Careful weeding  
39 GERMINATION AND GROWTH 30-40% germination (5-20% of Northern  
provenance); growth slow.

PRINCIPAL PESTS AND  
DISEASES:

40 ..... Fomes robustus may occur in trees over 20  
years old.

PRINCIPAL REFERENCES:

4 9 34 63 71 82 84 95 101 107 128 133  
152 160

SPECIES: Camnosperma brevipetiolata Volkens

TAXONOMY:

- 1 FAMILY ..... Anacardiaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Terentang; Ketekete

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 8°S-2°N  
5 AREAS ..... Solomon Islands; Moluccas; New Guinea; Indonesia and Malaysia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-500 m  
7 MEAN ANNUAL RAINFALL , 2,000-5,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-24°C  
12 MEAN ANNUAL TEMP. .... 23-28°C

SOILS:

- 13 TEXTURE ..... Heavy/medium  
14 REACTION ..... Acid  
15 DRAINAGE ..... Moist; seasonally waterlogged.  
16 OTHER CHARACTERISTICS Better growth on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m; d = 60-100 cm  
18 DESCRIPTION ..... Evergreen; buttressed.  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS -

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-20

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.28-0.41  
25 NATURAL DURABILITY ... Perishable  
26 PRESERVATION ..... Moderate  
27 SAWING ..... Easy  
28 SEASONING ..... Some difficulty  
29 OTHER FEATURES ..... Susceptible to insect fungal attack.

UTILIZATION:

- 30 SAW TIMBER ..... Boxes and light construction.  
31 ROUNDWOOD ..... Shortfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Solomon Islands and Papua New Guinea.  
34 SEEDS PER KILOGRAMME , 2,200-3,300  
35 STORAGE ..... Short viability  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Plantable size in 4 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Only pest of importance reported is Ambleypelta cocophaga which causes death or dieback in young trees.

PRINCIPAL REFERENCES:

59 111 112 158 163

SPECIES: Cariniaria pyriformis Miers

TAXONOMY:

- 1 FAMILY ..... Lecythidaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Albarco; Colombian mahogany; Jequitibá.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 1-9°N  
5 AREAS ..... Northern Colombia and Venezuela.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-600 m  
7 MEAN ANNUAL RAINFALL . 2,000-4,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 25-28°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-25°C  
12 MEAN ANNUAL TEMP. .... 22-30°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 40-50 m; d = 100-300 cm  
18 DESCRIPTION ..... Evergreen; buttressed.  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Moderately shade tolerant.  
21 OTHER CHARACTERISTICS -

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-20

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.50-0.75  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... Heartwood difficult; sapwood easy.  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ....., Silica in wood; termite resistant.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction;  
furniture; flooring.  
31 ROUNDWOOD ..... Veneer/plywood; turnery.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Colombia  
34 SEEDS PER KILOGRAMME . 1,000  
35 STORAGE ..... Dry, cold and airtight for up to one year  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; striplings; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 8-20 days.  
No information on growth in nursery.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

19 25 100

SPECIES: Cassia siamea Lam.

<b>TAXONOMY:</b>	
1 FAMILY .....	Caesalpinaceae
2 SYNONYMS .....	<u>C. florida</u> Vahl
3 LOCAL OR TRADE NAMES .	Cassia; Waa.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	1-5°N
5 AREAS .....	S.E. Asia, including India, Sri Lanka and Malaya; but widely established as an exotic.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-1,000 m
7 MEAN ANNUAL RAINFALL .	650-1,500 mm
8 RAINFALL REGIME .....	Summer
9 DRY SEASON .....	4-6 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	23-35°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	13-24°C
12 MEAN ANNUAL TEMP. ....	21-28°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Free draining
16 OTHER CHARACTERISTICS	Better growth on deep soils.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 8-10 (up to 20) m
18 DESCRIPTION .....	Evergreen
19 FORM .....	Poor/acceptable
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Coppices; termite resistant; tolerates salt winds; root suckers vigorously; drought hardy; moderately frost resistant; rotation of 10 years for firewood.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	8-12
<b>ROLE IN LAND USE:</b>	
23 .....	Windbreaks; ornamental; agroforestry.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.60-0.80
25 NATURAL DURABILITY ...	Durable
26 PRESERVATION .....	-
27 SAWING .....	Moderate
28 SEASONING .....	Moderate
29 OTHER FEATURES .....	-
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Fine furniture in larger sizes.
31 ROUNDWOOD .....	Building poles; fuel (c.v. = 19,380 kJ/kg) and charcoal; veneer/plywood.
32 OTHER PRODUCTS .....	Fodder (not for pigs).
<b>NURSERY:</b>	
33 SEED SOURCES .....	Most tropical countries.
34 SEEDS PER KILOGRAMME .	34,000-40,000
35 STORAGE .....	Dry, ambient temperature for several years.
36 PRE-TREATMENT .....	Boiling water till cool.
37 PLANTING STOCK .....	Potted; stumps; direct sown.
38 SPECIAL REQUIREMENTS .	-
39 GERMINATION AND GROWTH	Good (90%) and uniform after 7 days. Plantable size in 12-24 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	A serious disease is <u>Phaeolus manihotis</u> which kills roots causing dieback. Also susceptible to attack by scale insects and liable to browsing damage.
<b>PRINCIPAL REFERENCES:</b>	
	69 71 95 107 109 120 121 128 134 152

SPECIES: Casuarina decaisneana F. Muell.

TAXONOMY:

- 1 FAMILY ..... Casuarinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Desert she-oak.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 27-21.5°S  
5 AREAS ..... Central Australia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 250-700 m  
7 MEAN ANNUAL RAINFALL , 200-250 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-35°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 10-20°C  
12 MEAN ANNUAL TEMP. .... 18-26°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Acid/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Deep soils

SILVICULTURE:

- 17 SIZE ..... h = 9-15 m; d = 25-30 cm  
18 DESCRIPTION ..... Evergreen; needle-like branchlets with reduced leaves.  
19 FORM ..... Acceptable/exceptional  
20 LIGHT REQUIREMENTS ... Light demanding  
21 OTHER CHARACTERISTICS Fire resistant; frost resistant; fixes nitrogen; drought hardy.

PRODUCTION:

- 22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-12

ROLE IN LAND USE:

- 23 ..... Shade and shelter

TIMBER:

- 24 DENSITY ..... S.G. 1.05-1.12  
25 NATURAL DURABILITY ... Moderately durable.  
26 PRESERVATION ..... -  
27 SAWING ..... Difficult  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... Termite resistant

UTILIZATION:

- 30 SAW TIMBER ..... Light construction.  
31 ROUNDWOOD ..... Fuel; fence posts; turnery.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia  
34 SEEDS PER KILOGRAMME , 70,000-85,000  
35 STORAGE ..... Ambient temperature for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; bare-rooted seedlings; cuttings.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germination of 60-90%.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... None of major importance.

PRINCIPAL REFERENCES:

26 41 55 121

SPECIES: Casuarina equisetifolia L.

**TAXONOMY:**

- 1 FAMILY ..... Casuarinaceae  
2 SYNONYMS ..... C. littoralis Salisb.  
3 LOCAL OR TRADE NAMES , Coast or Beach She-oak.

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 31.5-12°S and 18-22°N  
5 AREAS ..... Coastal dunes of S.E. Asia and Australia.

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 0-1,400 m  
7 MEAN ANNUAL RAINFALL , 750-2,500 mm  
8 RAINFALL REGIME ..... Winter/summer  
9 DRY SEASON ..... 3-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-35°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 10-20°C  
12 MEAN ANNUAL TEMP. .... 18-28°C

**SOILS:**

- 13 TEXTURE ..... Light  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Seasonally waterlogged  
16 OTHER CHARACTERISTICS Tolerates slightly saline soils and poor, dry soils.

**SILVICULTURE:**

- 17 SIZE ..... h = 10-40 m; d = 40-45 cm  
18 DESCRIPTION ..... Evergreen; light crowned; dioecious.  
19 FORM ..... Exceptional/acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Weak coppice; termite resistant; tolerates salt winds; fixes nitrogen; requires wide spacing; frost tender; fire sensitive; short-lived (20-40 years); rotations of 8-15 years for fuelwood.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... 5-18

**ROLE IN LAND USE:**

23 ..... Windbreaks; soil improvement; ornamental; anti-erosion; dune stabilisation.

**TIMBER:**

- 24 DENSITY ..... S.G. 0.80-1.20  
25 NATURAL DURABILITY ... Moderately durable.  
26 PRESERVATION ..... Fair  
27 SAWING ..... Difficult  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... Very hard; attractive figure when quartersawn.

**UTILIZATION:**

- 30 SAW TIMBER ..... Heavy construction; boat building.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel (c.v. 19,580 - 20,560 kJ/kg) and charcoal; shortfibre pulp.  
32 OTHER PRODUCTS ..... Tannins; dyes; medicine; 'Cones' (1.8 t/ha/an) for fuel.

**NURSERY:**

- 33 SEED SOURCES ..... Nearly all tropical and sub-tropical coastal areas.  
34 SEEDS PER KILOGRAMME , 700,000-800,000  
35 STORAGE ..... Sealed at 4°C for up to 8 months.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; bare-rooted plants; cuttings.  
38 SPECIAL REQUIREMENTS , Shade in nursery. Inoculate soil of new plantation sites with crushed root nodules.  
39 GERMINATION AND GROWTH Germinates in 20-40 days (60-70% of fresh seed). 5-25% germination after 12 months storage. Plantable size in 4-8 months.

**PRINCIPAL PESTS AND DISEASES:**

40 ..... Usually free from pests and diseases.

**PRINCIPAL REFERENCES:**

40 52 60 71 95 109 121 128 152

SPECIES: Casuarina glauca Sieb. ex Spreng.

**TAXONOMY:**

- 1 FAMILY ..... Casuarinaceae  
2 SYNONYMS ..... C. lepidophloia F. Muell.  
3 LOCAL OR TRADE NAMES , Swamp she-oak; Muinji; Longleaf ironwood.

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 36.5-23°S  
5 AREAS ..... Coastal Eastern Australia.

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 0-30 m  
7 MEAN ANNUAL RAINFALL , 900-1,150 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 3-4 months  
10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 20-30°C  
11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 10-20°C  
12 MEAN ANNUAL TEMP. .... 18-24°C

**SOILS:**

- 13 TEXTURE ..... Heavy/medium  
14 REACTION ..... Neutral/alkaline  
15 DRAINAGE ..... Seasonally waterlogged.  
16 OTHER CHARACTERISTICS Saline and swampy; also tolerates shallow, dry soils.

**SILVICULTURE:**

- 17 SIZE ..... h = 10-20 m; d = 50-75 cm  
18 DESCRIPTION ..... Swamp tree; evergreen; buttressed.  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Aggressive coloniser; coppices; tolerates salt winds; slightly frost resistant; root suckers vigorously; fixes nitrogen; drought resistant.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-12

**ROLE IN LAND USE:**

23 ..... Swamp reclamation; stabilisation of canal banks; windbreaks.

**TIMBER:**

- 24 DENSITY ..... 0.90-0.98  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... Fiar/difficult  
29 OTHER FEATURES ..... Fissile; tough; decorative; strong.

**UTILIZATION:**

- 30 SAW TIMBER ..... Wharf timbers  
31 ROUNDWOOD ..... Fuelwood; posts; turnery.  
32 OTHER PRODUCTS ..... Tannin.

**NURSERY:**

- 33 SEED SOURCES ..... Australia, Cyprus; France; Kenya; Netherlands.  
34 SEEDS PER KILOGRAMME , 8000,000-1,050,000  
35 STORAGE ..... Ambient temperature.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; root cuttings.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germination of 50-65%; fast growth in nursery.

**PRINCIPAL PESTS AND DISEASES:**

40 ..... None

**PRINCIPAL REFERENCES:**

10 27 54 71 121 152

SPECIES: Casuarina junghuhniana Miq.

TAXONOMY:

- 1 FAMILY ..... Casuarinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . -

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 5°N-2°S  
5 AREAS ..... Central and East Java.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,100 m  
7 MEAN ANNUAL RAINFALL . 750-2,000 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 25-28°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 19-22°C  
12 MEAN ANNUAL TEMP. .... 22-26°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Acid/neutral/(alkaline)  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Adapts to various sites.

SILVICULTURE:

- 17 SIZE ..... h = 15-20 m; d = 15 cm  
18 DESCRIPTION ..... Dioecious  
19 FORM ..... Acceptable/exceptional  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Root suckers vigorously; fixes nitrogen; drought resistant; 5-8 year rotation for roundwood.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 7-11

ROLE IN LAND USE:

23 ..... Shade and shelter; ornamental.

TIMBER:

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... Very durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Fissile

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Underground piling for construction; fuel and charcoal.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... -  
34 SEEDS PER KILOGRAMME . -  
35 STORAGE ..... -  
36 PRE-TREATMENT ..... -  
37 PLANTING STOCK ..... Cuttings; air-layering.  
38 SPECIAL REQUIREMENTS , 50% shade in nursery.  
39 GERMINATION AND GROWTH Plantable size in 2-3 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of major importance.

PRINCIPAL REFERENCES:

24

SPECIES: Cedrela odorata L.

TAXONOMY:

- 1 FAMILY ..... Meliaceae
- 2 SYNONYMS ..... Cedrela mexicana M.J. Roem.
- 3 LOCAL OR TRADE NAMES , West Indian Cedar; Cedro.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 28°S-26°N
- 5 AREAS ..... Central and South America from Mexico to Bolivia and Argentina.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,500 m
- 7 MEAN ANNUAL RAINFALL . 1,200-2,500 mm
- 8 RAINFALL REGIME ..... Summer/uniform
- 9 DRY SEASON ..... 2-4 months
- 10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 27-36°C
- 11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 11-22°C
- 12 MEAN ANNUAL TEMP. .... 20-32°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy
- 14 REACTION ..... Neutral
- 15 DRAINAGE ..... Free draining
- 16 OTHER CHARACTERISTICS Better growth on fertile soils.

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m; d = 100-300 cm
- 18 DESCRIPTION ..... Deciduous; buttressed.
- 19 FORM ..... Acceptable/exceptional.
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS -

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 11-22

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.37-0.60
- 25 NATURAL DURABILITY ... Moderately durable
- 26 PRESERVATION ..... Difficult
- 27 SAWING ..... Easy
- 28 SEASONING ..... Fair
- 29 OTHER FEATURES ..... Decorative; scented; termite resistant.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture; boxes; boat-building; musical instruments.
- 31 ROUNDWOOD ..... Veneer/plywood; fuelwood.
- 32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... South and Central America; Trinidad.
- 34 SEEDS PER KILOGRAMME . 45,000-60,000
- 35 STORAGE ..... Dry, cold and airtight for one-two years.
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Potted; striplings.
- 38 SPECIAL REQUIREMENTS , Benefits from some shade in nursery.
- 39 GERMINATION AND GROWTH Germinates in 14-28 days.  
Plantable size in 12-15 months.

PRINCIPAL PESTS AND DISEASES:

- 40 ..... The shoot borer Hypsipyla grandella is a major pest. Attack in the Americas can only be avoided by maintaining optimum vigour and mixing with other species.

PRINCIPAL REFERENCES:

1 25 52 57 59 100 103 128 152

SPECIES: Ceratonia siliqua L.

<b>TAXONOMY:</b>	
1 FAMILY .....	Caesalpiniaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES	Carob; St. John's Bread; Locust bean.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	27°-42°N
5 AREAS .....	Mediterranean Basin; naturalised in N. India. Coasts, up to 25 km inland, best.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-1,000 m
7 MEAN ANNUAL RAINFALL .	200-800 mm
8 RAINFALL REGIME .....	Winter
9 DRY SEASON .....	4 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	27-32°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	5-10°C
12 MEAN ANNUAL TEMP. ....	13-27°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium
14 REACTION .....	Neutral/alkaline
15 DRAINAGE .....	Good
16 OTHER CHARACTERISTICS	Calcareous soils and dunes; tolerates thin soils and up to 3% salinity.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 8-17 m
18 DESCRIPTION .....	Small, evergreen tree; dioecious (some hermaphrodite).
19 FORM .....	Poor; heavy branching.
20 LIGHT REQUIREMENTS ...	-
21 OTHER CHARACTERISTICS	Coppices; heat and fire resistant; windfirm; termite resistant; tolerates salt winds; moderately frost resistant; drought hardy; four varieties; requires wide spacing; penetrating root system; long lived; slow growing

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	-
<b>ROLE IN LAND USE:</b>	
23 .....	Erosion control; agroforestry; windbreak.
<b>TIMBER:</b>	
24 DENSITY .....	-
25 NATURAL DURABILITY ...	-
26 PRESERVATION .....	-
27 SAWING .....	-
28 SEASONING .....	-
29 OTHER FEATURES .....	-
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	-
31 ROUNDWOOD .....	Fuelwood
32 OTHER PRODUCTS .....	Pods (2.5 tonnes/ha/an) yield gum, syrup and industrial extractives; pods are valuable fodder (not for poultry).
<b>NURSERY:</b>	
33 SEED SOURCES .....	Cyprus (var. Tylliria); USA (vars. Bolser, Horne, Santa Fe); France; S. Africa; Lebanon.
34 SEEDS PER KILOGRAMME .	4,000-6,000
35 STORAGE .....	Up to 5 years fumigated, cold and sealed.
36 PRE-TREATMENT .....	Boiling water till cool; or cold stratification 10 weeks.
37 PLANTING STOCK .....	Potted; direct sown; cuttings.
38 SPECIAL REQUIREMENTS .	Care of long tap-root.
39 GERMINATION AND GROWTH	80% germination.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	Rodents - eat roots; carob-fly <u>Asphodylia gennadii</u> in Mediterranean; withstands browsing.
<b>PRINCIPAL REFERENCES:</b>	
	31 42 71 72 89 174

SPECIES: Chlorophora excelsa (Welw.) Benth.

TAXONOMY:

- 1 FAMILY ..... Moraceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Iroko; Mvule.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 5°S-10°N  
5 AREAS ..... Tropical Africa from Ghana to East Coast.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,200 m  
7 MEAN ANNUAL RAINFALL , 1,000-1,800 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 23-33°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-26°C  
12 MEAN ANNUAL TEMP. .... 22-33°C

SOILS:

- 13 TEXTURE ..... Medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Moderately free draining.  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 35-40 m  
18 DESCRIPTION ..... Deciduous; similar to C. regia, West of Ghana.  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; root suckers vigorously; requires wide spacing.

PRODUCTION:

- 22 VOLUME (M<sup>3</sup>/HA/AN) .... 5-8

ROLE IN LAND USE:

- 23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.55-0.66  
25 NATURAL DURABILITY ... Very durable.  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... High quality; interlocked grain; calcite crystals in wood.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; furniture; boat building; joinery.  
31 ROUNDWOOD ..... Veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Most tropical African countries.  
34 SEEDS PER KILOGRAMME , 300,000-480,000  
35 STORAGE ..... Dry, cold, airtight - shortlived viability.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Striplings; stumps.  
38 SPECIAL REQUIREMENTS , Plant large stumps.  
39 GERMINATION AND GROWTH Germinates in 14-18 days.  
Plantable size in 12-18 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Phytoloma sp. is important: causing galls on and devastating shoots. The Giant Snail Achatina has proved a pest in E. Africa.

PRINCIPAL REFERENCES:

- 4 5 49 57 100 107 128 152 155

SPECIES: Cleistopholis glauca Pierre ex Engl. & Diels.

TAXONOMY:

- 1 FAMILY ..... Annonaceae  
2 SYNONYMS ..... C. grandiflora de Wild  
3 LOCAL OR TRADE NAMES , Ovok; Montole.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 6°S-5°N  
5 AREAS ..... Tropical Central Africa from Zaire to Cabinda and Angola.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-200 m  
7 MEAN ANNUAL RAINFALL , 1,600-5,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-36°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-26°C  
12 MEAN ANNUAL TEMP. .... 25-30°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Moist; free draining.  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS -

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 25-40

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... 0.25-0.40  
25 NATURAL DURABILITY ... Non-durable.  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Whitewood; straight grained.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; joinery; boxes.  
31 ROUNDWOOD ..... Shortfibre pulp; core veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Zaire; Solomon Islands; Congo.  
34 SEEDS PER KILOGRAMME , 1,200-1,500  
35 STORAGE ..... Cold, sealed for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , None  
39 GERMINATION AND GROWTH Germinates in 28-40 days.  
Plantable size within 6 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

58 111 112 159

SPECIES: Colophospermum mopane (Kirk ex Benth.) Kirk ex J. Léonard

**TAXONOMY:**

- 1 FAMILY ..... Caesalpiniaceae  
 2 SYNONYMS ..... Copaifera mopane Kirk ex Benth.  
 3 LOCAL OR TRADE NAMES , Mopane; musaru; lipani; turpentine tree; Rhodesian ironwood.

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 10°N-25°S  
 5 AREAS ..... Central and Southern Africa; naturalised in arid zones of India.

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 0-1,200 m  
 7 MEAN ANNUAL RAINFALL , 200-750 mm  
 8 RAINFALL REGIME ..... Summer  
 9 DRY SEASON ..... 5-8 months  
 10 MEAN MAX. TEMP.,  
     HOTTEST MONTH ..... 34-36°C  
 11 MEAN MIN. TEMP.,  
     COLDEST MONTH ..... 12-16°C  
 12 MEAN ANNUAL TEMP. .... 22-28°C

**SOILS:**

- 13 TEXTURE ..... Heavy/medium  
 14 REACTION ..... Neutral/alkaline  
 15 DRAINAGE ..... Moist/waterlogging tolerated.  
 16 OTHER CHARACTERISTICS Tolerates dry saline sites. Grey, calcareous "mopane" soils are specific to pure natural stands

**SILVICULTURE:**

- 17 SIZE ..... h = 10-20 m  
 18 DESCRIPTION ..... Deciduous, savanna tree.  
 19 FORM ..... Good  
 20 LIGHT REQUIREMENTS ... Light demander  
 21 OTHER CHARACTERISTICS Coppices vigorously after fire, frost or felling; fixes nitrogen; very drought hardy; casts little shade; slow growing.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

**ROLE IN LAND USE:**

23 ..... Soil stabilisation.

**TIMBER:**

- 24 DENSITY ..... S.G. over 1.0  
 25 NATURAL DURABILITY ... Very durable.  
 26 PRESERVATION ..... -  
 27 SAWING ..... Difficult  
 28 SEASONING ..... Difficult  
 29 OTHER FEATURES ..... Felling difficult. Heavy, dark wood, black gum. Termite and Lyctus resistant.

**UTILIZATION:**

- 30 SAW TIMBER ..... Furniture; railway sleepers; flooring; heavy construction; boat building.  
 31 ROUNDWOOD ..... Mine props; turnery; fence posts; bridge piles; firewood.  
 32 OTHER PRODUCTS ..... Fodder (fruit and leaves).

**NURSERY:**

- 33 SEED SOURCES ..... -  
 34 SEEDS PER KILOGRAMME , -  
 35 STORAGE ..... -  
 36 PRE-TREATMENT ..... None required.  
 37 PLANTING STOCK ..... Seedlings.  
 38 SPECIAL REQUIREMENTS , Seeds must be planted in pod.  
 39 GERMINATION AND GROWTH Slow early growth; weed carefully.

**PRINCIPAL PESTS AND**

**DISEASES:** Gonombrasia belina (mopane worm) feeds on leaves; caterpillars eaten in many African countries. Elephants destroy the woodlands.  
 40 .....

**PRINCIPAL REFERENCES:** 9 28 85 121

SPECIES: Conocarpus lancifolius Engl.

TAXONOMY:

- 1 FAMILY ..... Combretaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Damas

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 10-11°N  
5 AREAS ..... Somalia

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-800 m  
7 MEAN ANNUAL RAINFALL , 250-600 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 6-8 months  
10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 25-39°C  
11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 22-25°C  
12 MEAN ANNUAL TEMP. .... 24-30°C

SOILS:

- 13 TEXTURE ..... Light  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Seasonally waterlogged.  
16 OTHER CHARACTERISTICS Tolerates moderately saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 15-18 m  
18 DESCRIPTION ..... Evergreen; light crowned.  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Frequently used in irrigated plantations.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 5-10

ROLE IN LAND USE:

23 ..... Shade and shelter.

TIMBER:

- 24 DENSITY ..... S.G. 0.81  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Interlocked grain.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boat building.  
31 ROUNDWOOD ..... Building poles; fence posts; fuel and charcoal.  
32 OTHER PRODUCTS ..... Fodder.

NURSERY:

- 33 SEED SOURCES ..... Somalia and Sudan.  
34 SEEDS PER KILOGRAMME , 1,000,000-2,000,000  
35 STORAGE ..... -  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; striplings; stumps.  
38 SPECIAL REQUIREMENTS , Low germination capacity. Sow uncovered.  
Difficult to raise.  
39 GERMINATION AND GROWTH Germinates in 18-25 days.  
Plantable size in 12-18 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Susceptible to damping off.

PRINCIPAL REFERENCES:

7 60 107 166

SPECIES: Cordia alliodora (Ruiz and Pav.) Cham.

<b>TAXONOMY:</b>	
1 FAMILY .....	Boraginaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES .	Laurel; Salmwood.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	25°S-20°N
5 AREAS .....	Central America, West Indies, South America to Peru and Brazil.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-1,500 m
7 MEAN ANNUAL RAINFALL .	1,000-4,000 mm
8 RAINFALL REGIME .....	Uniform
9 DRY SEASON .....	0-4 months
10 MEAN MAX. TEMP. HOTTEST MONTH .....	26-32°C
11 MEAN MIN. TEMP. COLDEST MONTH .....	16-25°C
12 MEAN ANNUAL TEMP, ....	20-27°C
<b>SOILS:</b>	
13 TEXTURE .....	Medium/heavy
14 REACTION .....	Alkaline/neutral
15 DRAINAGE .....	Free draining
16 OTHER CHARACTERISTICS	-
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 25-30 m; d = 60-70 cm
18 DESCRIPTION .....	Deciduous; buttressed when adult.
19 FORM .....	Acceptable
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Coppices; requires wide spacing.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	10-20
<b>ROLE IN LAND USE:</b>	
23 .....	Agricultural shade.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.45-0.55
25 NATURAL DURABILITY ...	Durable
26 PRESERVATION .....	Fair
27 SAWING .....	Easy
28 SEASONING .....	Easy
29 OTHER FEATURES .....	Some resistance to termites and marine borers.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Light construction; furniture; flooring; boats.
31 ROUNDWOOD .....	Veneer/plywood; fuelwood.
32 OTHER PRODUCTS .....	-
<b>NURSERY:</b>	
33 SEED SOURCES .....	Tropical, South and Central America and West Indies.
34 SEEDS PER KILOGRAMME .	20,000-30,000
35 STORAGE .....	Dry, cold, airtight - short viability.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Stumps; direct sown.
38 SPECIAL REQUIREMENTS .	-
39 GERMINATION AND GROWTH	Germinates in 15-30 days. Plantable size in 9-12 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	Very susceptible to various defoliators and canker-forming <u>Puccinia cordiae</u> in South America. Unidentified canker reported from Pacific.
<b>PRINCIPAL REFERENCES:</b>	
	4 5 52 59 92 100 152

SPECIES: Cryptomeria japonica (L.f.) Don

TAXONOMY:

- 1 FAMILY ..... Taxodiaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Sugi; Japanese Cedar.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 30-40°N  
5 AREAS ..... China and Japan.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 650-2,400 m  
7 MEAN ANNUAL RAINFALL . 1,500-2,500 mm  
8 RAINFALL REGIME ..... Winter/summer/uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 18-25°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-13°C  
12 MEAN ANNUAL TEMP. .... 10-18°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Better growth on fertile and deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 35-50 m; d = 100-300 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Shade tolerant  
21 OTHER CHARACTERISTICS Tolerates salt winds; frost resistant;  
substantial provenance variation.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-33

ROLE IN LAND USE:

23 ..... Windbreaks; agricultural shade.

TIMBER:

- 24 DENSITY ..... S.G. 0.25-0.35  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Soft

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes.  
31 ROUNDWOOD ..... Veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Japan and New Zealand.  
34 SEEDS PER KILOGRAMME . 330,000-400,000  
35 STORAGE ..... -  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; cuttings.  
38 SPECIAL REQUIREMENTS . Use large plants.  
39 GERMINATION AND GROWTH Germinates in 14-28 days; low germination  
capacity. Plantable size in 12 months.

PRINCIPAL PESTS AND  
DISEASES:

40 ..... Resistant to Cypress canker.

PRINCIPAL REFERENCES: 4 34 128 133 152 154

SPECIES: Cunninghamia lanceolata (Lamb.) Hook.

TAXONOMY:

- 1 FAMILY ..... Taxodiaceae  
2 SYNONYMS ..... C. sinensis Rich.  
3 LOCAL OR TRADE NAMES , Chinese fir.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 23-27°N  
5 AREAS ..... S. China and Taiwan. Wide latitudinal range as an exotic.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 500-1,800 m  
7 MEAN ANNUAL RAINFALL , 1,100-1,900 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 3-5 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 22-27°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-9°C  
12 MEAN ANNUAL TEMP. .... 15-20°C

SOILS:

- 13 TEXTURE ..... Light  
14 REACTION ..... Acid/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 20-50 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional/acceptable  
20 LIGHT REQUIREMENTS ... Light demanding  
21 OTHER CHARACTERISTICS Coppices; frost tolerant; self pruning; fire sensitive when young; pulp rotation of 15 years; timber rotation of 50 years.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... Up to 36

ROLE IN LAND USE:

23 ..... Windbreaks

TIMBER:

- 24 DENSITY ..... S.G. = 0.4  
25 NATURAL DURABILITY ... Very durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Scented timber.

UTILIZATION:

- 30 SAW TIMBER ..... Construction; carpentry; boat building; boxes.  
31 ROUNDWOOD ..... Longfibre pulp.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... France; Netherlands; Brazil; China; India.  
34 SEEDS PER KILOGRAMME . 202,700  
35 STORAGE ..... Dry for up to one year.  
36 PRE-TREATMENT ..... -  
37 PLANTING STOCK ..... Bare rooted plants; stumps; cuttings.  
38 SPECIAL REQUIREMENTS . Careful weeding. Shade young trees lightly.  
39 GERMINATION AND GROWTH 50% germination in three weeks.  
Plantable size in 1 year.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Fusarium and Rhizoctonia wilts infect nursery stock. Agrobacterium tumefaciens root disease.

PRINCIPAL REFERENCES: 2 4 56 152

SPECIES: Cupressus arizonica Greene

TAXONOMY:

- 1 FAMILY ..... Cupressaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Arizona cypress.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 25-35°N  
5 AREAS ..... Southern Arizona and New Mexico, and Northern Mexico.

CLIMATE:

- 6 ALTITUDINAL RANGE ... 1,000-2,800 m  
7 MEAN ANNUAL RAINFALL , 250-750 mm  
8 RAINFALL REGIME ..... Winter/uniform/summer  
9 DRY SEASON ..... 4-7 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-35°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-5°C  
12 MEAN ANNUAL TEMP. .... 15-18°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates slightly saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 10-20 m  
18 DESCRIPTION ..... Evergreen; open-crowned.  
19 FORM ..... Moderate  
20 LIGHT REQUIREMENTS ... Shade tolerant  
21 OTHER CHARACTERISTICS Frost resistant; drought hardy.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 3-5

ROLE IN LAND USE:

23 ..... Windbreaks; anti-erosion.

TIMBER:

- 24 DENSITY ..... S.G. 0.45-0.55  
25 NATURAL DURABILITY ... Moderately durable.  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Termite susceptible.

UTILIZATION:

- 30 SAW TIMBER ..... Furniture; boxes.  
31 ROUNDWOOD ..... Fence posts; fuel and charcoal.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... USA and Mexico.  
34 SEEDS PER KILOGRAMME , 88,000-200,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... Stratify in damp sand for thirty days.  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Low germination capacity (25%).  
Germinates in 18-30 days.  
Plantable size in 15-18 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

16 34 52 71 84 95 134 166

SPECIES: Cupressus lusitanica Mill. (including C. benthamii Endl.)

TAXONOMY:

- 1 FAMILY ..... Cupressaceae  
2 SYNONYMS ..... C. lindleyi Klotzsch; C. glauca Lam.  
3 LOCAL OR TRADE NAMES . Mexican cypress; Portuguese cedar; Kenya cypress.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 15-27°N  
5 AREAS ..... Mountains of Mexico and Guatemala.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,300-3,300 m  
7 MEAN ANNUAL RAINFALL . 1,000-2,500 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 2-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-14°C  
12 MEAN ANNUAL TEMP. .... 12-22°C

SOILS:

- 13 TEXTURE ..... Medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Better growth on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 25-30 m; d = 60-100 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Shade tolerant  
21 OTHER CHARACTERISTICS Tolerates salt winds; frost resistant;  
substantial provenance variation; responds well  
to fertilisers.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 15-40

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks; hedging.

TIMBER:

- 24 DENSITY ..... S.G. 0.43-0.48  
25 NATURAL DURABILITY ... Moderately durable.  
26 PRESERVATION ..... Fair  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Fissile; fine softwood.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction;  
joinery; furniture; boxes.  
31 ROUNDWOOD ..... Building poles; longfibre pulp; plywood;  
fuelwood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Kenya; Tanzania; Mexico and Guatemala.  
34 SEEDS PER KILOGRAMME . 170,000-320,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... Stratify in damp sand for thirty days.  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS . Frost tender in nursery; careful weeding.  
39 GERMINATION AND GROWTH Germinates in 35 days.  
Plantable size in 12-24 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Canker Monochaetia unicornis attacks some  
provenances. Timber borer Oemida gahani enters  
via pruning wounds, degrading timber.

PRINCIPAL REFERENCES:

25 34 52 53 71 85 128 152

SPECIES: Cupressus macrocarpa Hartweg

TAXONOMY:

- 1 FAMILY ..... Cupressaceae  
2 SYNONYMS ..... C. hartwegii Carrière  
3 LOCAL OR TRADE NAMES , Monterey cypress.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 36.5°N  
5 AREAS ..... Limited area at Monterey on Californian coast.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 500-3,500 m  
7 MEAN ANNUAL RAINFALL , 700-1,600 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 2-4 months  
10 MEAN MAX. TEMP,  
HOTTEST MONTH ..... 20-32°C  
11 MEAN MIN. TEMP,  
COLDEST MONTH ..... 0-11°C  
12 MEAN ANNUAL TEMP, .... 14-20°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates moderately saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 15-25 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Shade tolerant  
21 OTHER CHARACTERISTICS Tolerates salt winds; frost resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 11-25

ROLE IN LAND USE:

23 ..... Windbreaks; dune fixation.

TIMBER:

- 24 DENSITY ..... S.G. 0.47-0.50  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Branching leads to knotty timber if not pruned.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction.  
31 ROUNDWOOD ..... Building poles; fence posts; fuel and charcoal;  
vener/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... USA and New Zealand.  
34 SEEDS PER KILOGRAMME , 140,000-150,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... Stratify in damp sand for thirty days.  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 20-26 days; low germination  
capacity. Plantable size in 24 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Very susceptible to various cankers wherever  
grown. Timber borer Oemida gahani enters via  
pruning wounds, degrading timber.

PRINCIPAL REFERENCES:

34 71 109 128 152

SPECIES: Cupressus torulosa Don

TAXONOMY:

- 1 FAMILY ..... Cupressaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Bhutan cypress.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 28-32°N  
5 AREAS ..... Western Himalayas to Bhutan.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,000-2,800 m  
7 MEAN ANNUAL RAINFALL , 650-1,600 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 3-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-12°C  
12 MEAN ANNUAL TEMP. .... 12-22°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid/alkaline  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS  
Adaptable to most soil conditions but better  
growth on fertile, moist sites.

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Moderately demanding  
21 OTHER CHARACTERISTICS Frost resistant

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 12-17 (on best sites).

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 0.48-0.52  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... Knotty unless pruned.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction.  
31 ROUNDWOOD ..... Building poles; fence posts; fuelwood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Kenya; Pakistan and India.  
34 SEEDS PER KILOGRAMME , 160,000-280,000  
35 STORAGE ..... Dry, cold and airtight for 1-2 years.  
36 PRE-TREATMENT ..... Stratify in damp sand.  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH 40-60% germination in 14-28 days.  
Plantable size in 12-24 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Reported to be less susceptible to Monochaetia unicornis than other Cupresses.

PRINCIPAL REFERENCES:

16 34 49 133 152 154 162

SPECIES: Dalbergia sissoo Roxb.

TAXONOMY:

- 1 FAMILY ..... Papilionaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Shisham; sissoo.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 23-30°N  
5 AREAS ..... Indus to Assam; Himalayas.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,500 m  
7 MEAN ANNUAL RAINFALL . 500-4,000 mm (200 mm if irrigated).  
8 RAINFALL REGIME ..... Summer monsoon.  
9 DRY SEASON ..... Up to 6 months.  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 35-45°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... -2-+5°C  
12 MEAN ANNUAL TEMP. .... 18-26°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acidic  
15 DRAINAGE ..... Good; seasonally inundated.  
16 OTHER CHARACTERISTICS River beds and river flats.

SILVICULTURE:

- 17 SIZE ..... h = 30 m  
18 DESCRIPTION ..... Deciduous  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; frost resistant; drought hardy.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 5-8

ROLE IN LAND USE:

23 ..... Agroforestry (gives minimal root and shade competition); erosion control in gullies and dunes.

TIMBER:

- 24 DENSITY ..... S.G. 0.78-0.83  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... Sapwood easily treated.  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Black heartwood figured; good bending properties.

UTILIZATION:

- 30 SAW TIMBER ..... Carpentry; furniture; carriages.  
31 ROUNDWOOD ..... Veneer; wheels; fuelwood (c.v. = 20,450kJ/kg); transmission poles; fence posts.  
32 OTHER PRODUCTS ..... Fodder (leaves for silage); honey flora.

NURSERY:

- 33 SEED SOURCES ..... India; Pakistan; Sudan; Kenya; Cyprus.  
34 SEEDS PER KILOGRAMME . 45,000-55,000  
35 STORAGE ..... Dry, cold, sealed for 1-2 years. Protect from rodents.  
36 PRE-TREATMENT ..... Soak in water, 48 hours.  
37 PLANTING STOCK ..... Potted; stumps; root suckers; branch cuttings.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH 85-95% germination in 7-15 days.  
Plantable size in 12-15 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Mixed species plantations recommended to combat weeds and pests. Browsing damage by porcupines. Termites attack young plants. Tapinanthus dodoneifolius, mistletoe.

PRINCIPAL REFERENCES:

16 61 65 71 82 84 134 141 152

SPECIES: Delonix regia (Boj. ex Hook.) Raf.

**TAXONOMY:**

- 1 FAMILY ..... Caesalpinaceae  
 2 SYNONYMS ..... Poinciana regia Boj. ex Hook.  
 3 LOCAL OR TRADE NAMES , Flamboyant; Poinciana; Krishna chura (Bengal).

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 12-25°s  
 5 AREAS ..... Madagascar. Naturalised in Jamaica and widely cultivated throughout the tropics.

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 0-2,000 m  
 7 MEAN ANNUAL RAINFALL , 700-1,800 mm  
 8 RAINFALL REGIME ..... Summer  
 9 DRY SEASON ..... 6 months  
 10 MEAN MAX. TEMP.  
 HOTTEST MONTH ..... 22-35°C  
 11 MEAN MIN. TEMP.  
 COLDEST MONTH ..... 6-18°C  
 12 MEAN ANNUAL TEMP. .... 14-26°C

**SOILS:**

- 13 TEXTURE ..... Light  
 14 REACTION ..... -  
 15 DRAINAGE ..... Free draining  
 16 OTHER CHARACTERISTICS Tolerates slight salinity; tolerates a wide variety of soils.

**SILVICULTURE:**

- 17 SIZE ..... h = 8-17 m  
 18 DESCRIPTION ..... Briefly deciduous; buttressed.  
 19 FORM ..... Acceptable above buttresses; spreading crown.  
 20 LIGHT REQUIREMENTS ... -  
 21 OTHER CHARACTERISTICS Tolerates salt winds; frost tender; spreading root system; good natural regeneration; fast growing.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

**ROLE IN LAND USE:**

23 ..... Shade and shelter; ornamental.

**TIMBER:**

- 24 DENSITY ..... -  
 25 NATURAL DURABILITY ... -  
 26 PRESERVATION ..... -  
 27 SAWING ..... -  
 28 SEASONING ..... -  
 29 OTHER FEATURES ..... Weak; soft.

**UTILIZATION:**

- 30 SAW TIMBER ..... -  
 31 ROUNDWOOD ..... Fuelwood.  
 32 OTHER PRODUCTS ..... Edible seed pod.

**NURSERY:**

- 33 SEED SOURCES ..... Kenya; Venezuela; Zambia; Nigeria; France; Pakistan.  
 34 SEEDS PER KILOGRAMME , 1,600-3,700 (-9,300)  
 35 STORAGE ..... For up to 4 years.  
 36 PRE-TREATMENT ..... Conc. H<sub>2</sub>SO<sub>4</sub> for 3 hours; or soak in hot water 24 hours.  
 37 PLANTING STOCK ..... Potted seedlings; stumps; branch cuttings.  
 38 SPECIAL REQUIREMENTS , -  
 39 GERMINATION AND GROWTH 50-80% germination in 6-9 weeks.  
 Plantable size in 4 months (10 for stumps).

**PRINCIPAL PESTS AND DISEASES:**

40 ..... Susceptible to termites and shoot borers.

**PRINCIPAL REFERENCES:**

16 55 71 152 173

SPECIES: Elaeagnus angustifolia L.

TAXONOMY:

- 1 FAMILY ..... Elaeagnaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Russian olive.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 30-44°N  
5 AREAS ..... Southern Europe; Middle East; Central Asia to Himalayas.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,600-2,500 m  
7 MEAN ANNUAL RAINFALL . 250-600 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 6-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-10°C  
12 MEAN ANNUAL TEMP. .... 8-14°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 4-8 m  
18 DESCRIPTION ..... Deciduous; spiny.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; frost resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 3-5

ROLE IN LAND USE:

23 ..... Windbreaks; dune fixation; anti-erosion.

TIMBER:

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Only useful as fuel.

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fuel and charcoal.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... USA; Turkey; Israel; Iran.  
34 SEEDS PER KILOGRAMME . 10,000-12,000  
35 STORAGE ..... Ambient temperature for several years.  
36 PRE-TREATMENT ..... Stratify in damp sand for sixty days.  
37 PLANTING STOCK ..... Potted; cuttings.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Germinates in 30-40 days.  
Plantable size in 6-8 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

95 154

SPECIES: Eucalyptus botryoides Sm.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Southern mahogany; Bangalay.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 39-32°S  
5 AREAS ..... Australia: Coastal Victoria and New South Wales.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 800-1,800 m  
7 MEAN ANNUAL RAINFALL . 650-1,000 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 23-29°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-9°C  
12 MEAN ANNUAL TEMP. .... 16-22°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Acid  
15 DRAINAGE ..... Seasonally waterlogged.  
16 OTHER CHARACTERISTICS Tolerates moderately saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-40 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; termite resistant; tolerates salt winds; moderately frost resistant; 8-12 year fuelwood rotation.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 15-35

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 0.61-0.70  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Fair  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.  
31 ROUNDWOOD ..... Transmission poles; fence posts; fuel and charcoal; shortfibre pulp.  
32 OTHER PRODUCTS ..... Honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia; Argentina; Italy.  
34 SEEDS PER KILOGRAMME . 300,000-400,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Germinates in 10 days.  
Plantable size in 6 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported. Resists Coniapterus beetle attack.

PRINCIPAL REFERENCES:

82 83 91 130 152

SPECIES: Eucalyptus brockwayi C.A. Gardn.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae
- 2 SYNONYMS ..... -
- 3 LOCAL OR TRADE NAMES , Dundas mahogany.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 33-31°S
- 5 AREAS ..... Restricted area in Western Australia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,500 m
- 7 MEAN ANNUAL RAINFALL , 250-400 mm
- 8 RAINFALL REGIME ..... Winter
- 9 DRY SEASON ..... 6-8 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-34°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-10°C
- 12 MEAN ANNUAL TEMP. .... 19-25°C

SOILS:

- 13 TEXTURE ..... Light/medium
- 14 REACTION ..... Alkaline/neutral
- 15 DRAINAGE ..... Free draining
- 16 OTHER CHARACTERISTICS Tolerates moderately saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 15-22 m
- 18 DESCRIPTION ..... Evergreen
- 19 FORM ..... Acceptable
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Coppices

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 4-5

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 0.75-0.85
- 25 NATURAL DURABILITY ... Moderately durable
- 26 PRESERVATION ..... -
- 27 SAWING ..... -
- 28 SEASONING ..... -
- 29 OTHER FEATURES ..... Tough

UTILIZATION:

- 30 SAW TIMBER ..... -
- 31 ROUNDWOOD ..... Building poles; fence posts; fuel and charcoal.
- 32 OTHER PRODUCTS ..... Tannins

NURSERY:

- 33 SEED SOURCES ..... Australia; Morocco.
- 34 SEEDS PER KILOGRAMME . 350,000-400,000 (viable).
- 35 STORAGE ..... Dry and airtight in ambient temperature.
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Potted
- 38 SPECIAL REQUIREMENTS , -
- 39 GERMINATION AND GROWTH Germinates in 12-16 days.  
Plantable size in 6-9 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

83 84 95 91 120 152

SPECIES: Eucalyptus camaldulensis Dehnh. (Northern Provenances)

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
 2 SYNONYMS ..... E. rostrata Schlecht.  
 3 LOCAL OR TRADE NAMES , River Red gum.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 32-15°S  
 5 AREAS ..... Australia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,500 m  
 7 MEAN ANNUAL RAINFALL . 250-1,250 mm  
 8 RAINFALL REGIME ..... Summer  
 9 DRY SEASON ..... 4-8 months  
 10 MEAN MAX. TEMP.  
     HOTTEST MONTH ..... 28-36°C  
 11 MEAN MIN. TEMP.  
     COLDEST MONTH ..... 10-22°C  
 12 MEAN ANNUAL TEMP. .... 19-26°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
 14 REACTION ..... Alkaline/neutral  
 15 DRAINAGE ..... Seasonally waterlogged.  
 16 OTHER CHARACTERISTICS Tolerates moderately saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-40 m; d = 80-200 cm  
 18 DESCRIPTION ..... Evergreen  
 19 FORM ..... Acceptable  
 20 LIGHT REQUIREMENTS ... Strongly demanding  
 21 OTHER CHARACTERISTICS Coppices; drought hardy; substantial provenance variation (Petford-QL, and Katherine-NT are generally outstanding provenances for tropical climates, Wiluna-WA for alkaline soils); frost tender; 6-10 year coppice rotation.

PRODUCTION:

- 22 VOLUME (M<sup>3</sup>/HA/AN) .... 15-25

ROLE IN LAND USE:

- 23 ..... Swamp reclamation; shade and shelter.

TIMBER:

- 24 DENSITY ..... S.G. 0.75-1.0  
 25 NATURAL DURABILITY ... Durable  
 26 PRESERVATION ..... Fair  
 27 SAWING ..... Easy  
 28 SEASONING ..... Difficult  
 29 OTHER FEATURES ..... Tough; interlocked grain; termite resistant.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; railway sleepers.  
 31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel (c.v. = 19,737 kJ/kg) and charcoal; shortfibre pulp.  
 32 OTHER PRODUCTS ..... Honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia specifying provenance.  
 34 SEEDS PER KILOGRAMME . 700,000-800,000 (plus chaff); or 190,000 plants/kg of seed.  
 35 STORAGE ..... Dry, cold and airtight for several years.  
 36 PRE-TREATMENT ..... None  
 37 PLANTING STOCK ..... Potted  
 38 SPECIAL REQUIREMENTS . -  
 39 GERMINATION AND GROWTH Germinates in 4-15 days.  
     Plantable size in 4 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Young plants liable to termite attack.  
     Susceptible to attack by Conioperus beetle.

PRINCIPAL REFERENCES:

- 4 16 46 71 82 83 84 91 95 96 107  
 109 121 128 130 152

SPECIES: Eucalyptus camaldulensis Dehnh. (Southern Provenances)

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... E. rostrata Schlecht.  
3 LOCAL OR TRADE NAMES , River Red gum.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 38-32°S  
5 AREAS ..... Australia, excluding Tasmania.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 500-2,000 m  
7 MEAN ANNUAL RAINFALL , 400-1,000 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 22-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 8-14°C  
12 MEAN ANNUAL TEMP. .... 16-22°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining; seasonally waterlogged.  
16 OTHER CHARACTERISTICS Tolerates shallow soils.

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m; d = 80-200 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; moderately frost resistant; drought hardy; substantial provenance variation (Lake Albacutya-VIC is generally outstanding provenance for Mediterranean climates); 6-10 year coppice rotation.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-22

ROLE IN LAND USE:

23 ..... Shade and shelter.

TIMBER:

- 24 DENSITY ..... S.G. 0.70-0.90  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Fair  
27 SAWING ..... Easy  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... Tough; interlocked grain; resists termites.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; railway sleepers.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel (c.v. 19,737 kJ/kg) and charcoal; shortfibre pulp.  
32 OTHER PRODUCTS ..... Honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia specifying provenance.  
34 SEEDS PER KILOGRAMME , 700,000-800,000 (plus chaff); or 190,000 plants/kg of seed.  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , Early shade beneficial.  
39 GERMINATION AND GROWTH Germinates in 4-15 days.  
Plantable size in 4-6 months.

PRINCIPAL PESTS AND

- DISEASES:  
40 ..... Young plants liable to termite attack.  
Susceptible to attack by Gonipterus beetle.

PRINCIPAL REFERENCES:

4 46 71 82 83 84 91 95 96 107  
109 121 128 130 152

SPECIES: Eucalyptus citriodora Hook.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Spotted gum; Lemon-scented gum.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 25-15°S  
5 AREAS ..... Australia: Central and Northern coastal Queensland.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,800 m  
7 MEAN ANNUAL RAINFALL , 650-1,600 mm  
8 RAINFALL REGIME ..... Winter/summer  
9 DRY SEASON ..... 2-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 8-12°C  
12 MEAN ANNUAL TEMP. .... 17-24°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m; d = 60-120 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Weak coppice; moderately frost resistant; drought hardy; tolerates salt winds.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-21

ROLE IN LAND USE:

23 ..... Ornamental

TIMBER:

- 24 DENSITY ..... S.G. 0.80-1.03  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... Fair  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Strong; tough; Lyctus susceptible.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel and charcoal; shortfibre pulp.  
32 OTHER PRODUCTS ..... Oils; honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia and many tropical countries.  
34 SEEDS PER KILOGRAMME , 140,000-220,000; or 55,000 plants/kg of seed.  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 4-19 days.  
Plantable size in 5-6 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Liable to attack by termites when young, but less attacked by Atta ants than most eucalypts. Resists attack by Coniapterus beetle.

PRINCIPAL REFERENCES:

4 82 83 91 95 107 109 128 130 148

SPECIES: Eucalyptus cladocalyx F. Muell.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Sugar gum

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 36-32°S  
5 AREAS ..... Discontinuous occurrence in S. Australia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,000 m  
7 MEAN ANNUAL RAINFALL , 400-650 mm  
8 RAINFALL REGIME ..... Winter/summer  
9 DRY SEASON ..... 3-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 22-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-10°C  
12 MEAN ANNUAL TEMP. .... 15-25°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Moderately free draining  
16 OTHER CHARACTERISTICS  
Tolerates shallow soils and is adaptable to most soil conditions; tolerates slight salinity.

SILVICULTURE:

- 17 SIZE ..... h = 25-30 m; d = 200 cm  
18 DESCRIPTION ..... Evergreen; light crowned.  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS  
Coppices; tolerates salt winds; drought hardy; frost tender.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 13-22

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks; ornamental.

TIMBER:

- 24 DENSITY ..... S.G. 1.00-1.10  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Lyctus susceptible.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel and charcoal.  
32 OTHER PRODUCTS ..... Fodder (leaves); honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia; A. Africa.  
34 SEEDS PER KILOGRAMME , 100,000-200,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH  
Germinates in 13-21 days.  
Plantable size in 6-12 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Immune to attack by Gonipterus beetle and generally resistant to pests and diseases.

PRINCIPAL REFERENCES:

4 49 82 83 84 91 130 133 152 166

SPECIES: Eucalyptus cloëziana F.Muell.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae
- 2 SYNONYMS ..... -
- 3 LOCAL OR TRADE NAMES . Gympie messmate.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 26-16°S
- 5 AREAS ..... Australia: discontinuous occurrence in Queensland.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,500 m
- 7 MEAN ANNUAL RAINFALL , 900-1,650 mm
- 8 RAINFALL REGIME ..... Summer
- 9 DRY SEASON ..... 0-2 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-32°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 6-14°C
- 12 MEAN ANNUAL TEMP. .... 18-26°C

SOILS:

- 13 TEXTURE ..... Medium
- 14 REACTION ..... Neutral/acid
- 15 DRAINAGE ..... Free draining; moist.
- 16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 35-45 m; d = 100-300 cm
- 18 DESCRIPTION ..... Evergreen
- 19 FORM ..... Exceptional
- 20 LIGHT REQUIREMENTS ... Shade tolerant
- 21 OTHER CHARACTERISTICS Coppices; substantial provenance variation; 6-12 year rotation for poles.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 15-34

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.80-0.90
- 25 NATURAL DURABILITY ... Very durable
- 26 PRESERVATION ..... Easy
- 27 SAWING ..... Easy
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... Termite resistant.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction.
- 31 ROUNDWOOD ..... Building poles; transmission poles; fuelwood.
- 32 OTHER PRODUCTS ..... Honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia; S. Africa; Zambia.
- 34 SEEDS PER KILOGRAMME . 140,000-160,000 (viable); or 33,000 plants/kg of seed.
- 35 STORAGE ..... Dry, cold and airtight for several years.
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Potted
- 38 SPECIAL REQUIREMENTS . Often susceptible to damping off.
- 39 GERMINATION AND GROWTH Germinative capacity often poor. Plantable size in 4-5 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Seedlings attacked by termites; resists attack by Coniapterus beetle.

PRINCIPAL REFERENCES:

4 82 83 91 107 130 133 152

SPECIES: Eucalyptus crebra F. Muell. (Inland Provenances)

TAXONOMY:

- 1 FAMILY ..... Myrtaceae
- 2 SYNONYMS ..... -
- 3 LOCAL OR TRADE NAMES , Narrow-leaved ironbark.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 33-23°C
- 5 AREAS ..... Inland tropical N.W.S. and Queensland.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,400 m
- 7 MEAN ANNUAL RAINFALL , 500-900 mm
- 8 RAINFALL REGIME ..... Summer
- 9 DRY SEASON ..... 5-6 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 26-36°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 6-18°C
- 12 MEAN ANNUAL TEMP. .... 18-26°C

SOILS:

- 13 TEXTURE ..... Light/medium
- 14 REACTION ..... Neutral/acid
- 15 DRAINAGE ..... Moderately free draining
- 16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 20-25 m
- 18 DESCRIPTION ..... Evergreen
- 19 FORM ..... Acceptable
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Resists termites; moderately frost resistant; drought hardy.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 3-8

ROLE IN LAND USE:

23 ..... Windbreaks

TIMBER:

- 24 DENSITY ..... S.G. 1.05-1.12
- 25 NATURAL DURABILITY ... Very durable
- 26 PRESERVATION ..... Difficult
- 27 SAWING ..... Difficult
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... Timber rarely sawn.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction.
- 31 ROUNDWOOD ..... Building poles; fence posts; fuel (c.v. = 20,093 kJ/kg) and charcoal.
- 32 OTHER PRODUCTS ..... Honeyflora; tannin.

NURSERY:

- 33 SEED SOURCES ..... Australia.
- 34 SEEDS PER KILOGRAMME , 640,000-680,000 (viable).
- 35 STORAGE ..... Dry, cold and airtight for several years.
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Potted
- 38 SPECIAL REQUIREMENTS , -
- 39 GERMINATION AND GROWTH Germinates in 6-21 days.  
Plantable size in 5-6 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... None of importance reported. Resists attack by Gonipterus beetle.

PRINCIPAL REFERENCES:

4 82 83 81 91 130 152

SPECIES: Eucalyptus dalrympleana Maiden

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Mountain gum.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 42-32°C  
5 AREAS ..... S.E. New South Wales, Victoria and Tasmania.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,000-2,500 m  
7 MEAN ANNUAL RAINFALL . 750-1,500 mm  
8 RAINFALL REGIME ..... Winter/summer/uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 18-24°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-1°C  
12 MEAN ANNUAL TEMP. .... 10-14°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Moderately free draining  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; frost resistant.

PRODUCTION:

- 22 VOLUME (M<sup>3</sup>/HA/AN) .... 8-10

ROLE IN LAND USE:

- 23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.53-0.60  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Fissile

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes.  
31 ROUNDWOOD ..... Shortfibre pulp; posts.  
32 OTHER PRODUCTS ..... Honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia.  
34 SEEDS PER KILOGRAMME , 180,000-280,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 6-25 days.  
Plantable size in 6-8 months.

PRINCIPAL PESTS AND DISEASES:

- 40 ..... None of importance reported.

PRINCIPAL REFERENCES:

82 83 91 130 152

SPECIES: Eucalyptus deglupta Blume

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... E. naudiniana F. Muell.  
3 LOCAL OR TRADE NAMES , Mindanao gum; Kamarere (Papua New Guinea).

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 11°S-9°N  
5 AREAS ..... Philippines; Sulawesi; Papua New Guinea; New Britain.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,500 m  
7 MEAN ANNUAL RAINFALL . 2,000-5,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-1 month  
10 MEAN MAX. TEMP,  
HOTTEST MONTH ..... 24-32°C  
11 MEAN MIN. TEMP,  
COLDEST MONTH ..... 21-26°C  
12 MEAN ANNUAL TEMP. .... 20-32°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on fertile deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 35-70 m; d = 100-250 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Weak coppice; moderately termite resistant; sensitive to fire; frost tender; 20 year rotation for sawlogs; 6-7 year pulpwood rotation.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 14-50

ROLE IN LAND USE:

23 ..... Ornamental

TIMBER:

- 24 DENSITY ..... S.G. 0.40 (plantation) 0.70 (natural).  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Easy/fair  
29 OTHER FEATURES ..... Lighter than most eucalypts.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; furniture; boat building.  
31 ROUNDWOOD ..... Fuel (c.v. = 21,107 kJ/kg) and charcoal; shortfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Papua New Guinea; Fiji and many tropical countries.  
34 SEEDS PER KILOGRAMME . 2,000,000-4,000,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for one-two years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; root cuttings.  
38 SPECIAL REQUIREMENTS , Requires shade.  
39 GERMINATION AND GROWTH Germinates in 4-20 days.  
Plantable size in 3-4 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Ambleyelta cocophaga shoot borer can cause widespread death and dieback in young plantations. Shoot borer Zeuzera coffea is a serious pest in Malaya. Susceptible to damping off in nursery.

PRINCIPAL REFERENCES:

4 59 73 77 82 83 130 152

SPECIES: Eucalyptus delegatensis R.T. Baker

TAXONOMY:

- 1 FAMILY ..... Myrtaceae
- 2 SYNONYMS ..... E. gigantea Hook
- 3 LOCAL OR TRADE NAMES , Alpine ash.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 42-35°S
- 5 AREAS ..... Australia: S.E. New South Wales, Victoria and Tasmania.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,500 m
- 7 MEAN ANNUAL RAINFALL , 1,000-3,500 mm
- 8 RAINFALL REGIME ..... Winter
- 9 DRY SEASON ..... 0-2 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 19-22°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-6°C
- 12 MEAN ANNUAL TEMP. .... 12-15°C

SOILS:

- 13 TEXTURE ..... Medium
- 14 REACTION ..... Acid
- 15 DRAINAGE ..... Free draining
- 16 OTHER CHARACTERISTICS Better growth on deep, fertile soils.

SILVICULTURE:

- 17 SIZE ..... h = 50-60 m
- 18 DESCRIPTION ..... Evergreen
- 19 FORM ..... Acceptable
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Frost resistant; 15-20 year rotation for saw timber.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-25

ROLE IN LAND USE:

23 ..... Windbreaks

TIMBER:

- 24 DENSITY ..... S.G. 0.58-0.68
- 25 NATURAL DURABILITY ... Moderately durable
- 26 PRESERVATION ..... Difficult
- 27 SAWING ..... Easy
- 28 SEASONING ..... Fair
- 29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture; boxes.
- 31 ROUNDWOOD ..... Transmission poles; shortfibre pulp; veneer/plywood.
- 32 OTHER PRODUCTS ..... Honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia; New Zealand.
- 34 SEEDS PER KILOGRAMME , 90,000-100,000 (viable).
- 35 STORAGE ..... Dry, cold and airtight for several years.
- 36 PRE-TREATMENT ..... Stratify in damp sand for thirty days.
- 37 PLANTING STOCK ..... Potted
- 38 SPECIAL REQUIREMENTS , Soil may require inoculation with mycorrhizae.
- 39 GERMINATION AND GROWTH Germinates in 10-14 days.  
Plantable size in 9-12 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported. Resists Gonipterus beetle.

PRINCIPAL REFERENCES:

57 82 83 91 130 152

SPECIES: Eucalyptus fastigata Deane & Maiden

TAXONOMY:

- 1 FAMILY ..... Myrtaceae
- 2 SYNONYMS ..... -
- 3 LOCAL OR TRADE NAMES . Brown barrel.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 37-30°S
- 5 AREAS ..... Australia: Highlands of Eastern New South Wales.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 200-2,000 m
- 7 MEAN ANNUAL RAINFALL . 750-1,100 mm
- 8 RAINFALL REGIME ..... Winter/summer/uniform
- 9 DRY SEASON ..... 1-2 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 22-26°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-4°C
- 12 MEAN ANNUAL TEMP. .... 13-18°C

SOILS:

- 13 TEXTURE ..... Medium
- 14 REACTION ..... Acid
- 15 DRAINAGE ..... Free draining; moist.
- 16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m
- 18 DESCRIPTION ..... Evergreen
- 19 FORM ..... Exceptional/acceptable
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Weak coppice; moderately resistant to frost.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 21-28

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.67-0.86
- 25 NATURAL DURABILITY ... Non-durable
- 26 PRESERVATION ..... Easy
- 27 SAWING ..... Easy
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... Wood contains resin pockets.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes.
- 31 ROUNDWOOD ..... Shortfibre pulp; veneer/plywood.
- 32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia; S. Africa; New Zealand.
- 34 SEEDS PER KILOGRAMME . 100,000-200,000 (viable).
- 35 STORAGE ..... Dry, cold and airtight for several years.
- 36 PRE-TREATMENT ..... Stratify in damp sand for thirty days.
- 37 PLANTING STOCK ..... Potted
- 38 SPECIAL REQUIREMENTS . Very susceptible to damping off.
- 39 GERMINATION AND GROWTH Plantable size in 7-9 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported. Resists attack by Gonipterus beetle.

PRINCIPAL REFERENCES:

4 82 83 91 130 133 152 166

SPECIES: Eucalyptus globulus Labill.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Tasmanian blue-gum; Blue gum.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 43-38°S  
5 AREAS ..... Southern Victoria and Tasmania.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,500-3,000 m  
7 MEAN ANNUAL RAINFALL . 550-1,500 mm  
8 RAINFALL REGIME ..... Winter/summer  
9 DRY SEASON ..... 2-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-12°C  
12 MEAN ANNUAL TEMP. .... 12-18°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Better growth on deep soils; tolerates poor soils.

SILVICULTURE:

- 17 SIZE ..... h = 40-60 m; d = 90-150 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; frost tender.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-40

ROLE IN LAND USE:

23 ..... Anti-erosion.

TIMBER:

- 24 DENSITY ..... S.G. 0.55-0.78 (plantation), 0.80-1.00 (natural).  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel (c.v. = 20,719 kJ/kg) and charcoal; short-fibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... Oils; honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia; Spain; Portugal; E. and S. Africa.  
34 SEEDS PER KILOGRAMME , 70,000-100,000(viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; direct sown; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH 80% germination in 8-14 days.  
Plantable size in 4-6 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Particularly susceptible to defoliating beetle Gonipterus scutellus.

PRINCIPAL REFERENCES:

16 51 91 93 109 121 128 130 133 152

SPECIES: Eucalyptus gomphocephala DC.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Tuart

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 33-31°S  
5 AREAS ..... Very restricted, in S.W. coast of W. Australia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 500-2,000 m  
7 MEAN ANNUAL RAINFALL , 500-1,000 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP,  
HOTTEST MONTH ..... 27-32°C  
11 MEAN MIN. TEMP,  
COLDEST MONTH ..... 6-12°C  
12 MEAN ANNUAL TEMP. .... 16-22°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates slightly saline soils, and low fertility, but not waterlogging.

SILVICULTURE:

- 17 SIZE ..... h = 20-30 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; resists termites; tolerates salt winds; frost tender; fire tender when young.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 8-15

ROLE IN LAND USE:

23 ..... Dune fixation.

TIMBER:

- 24 DENSITY ..... S.G. 0.76-1.05  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Tough; interlocked grain.

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fence posts; fuel and charcoal.  
32 OTHER PRODUCTS ..... Tannins

NURSERY:

- 33 SEED SOURCES ..... Australia; Morocco; Cyprus.  
34 SEEDS PER KILOGRAMME , 70,000-200,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 4-10 days.  
Plantable size in 6 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Susceptible to attack by borer, Phoracantha semipunctata when grown under moisture stress.  
Resists attack by Gonipterus beetle.

PRINCIPAL REFERENCES:

4 71 82 83 91 95 121 130 152

SPECIES: Eucalyptus grandis Hill ex Maiden

<b>TAXONOMY:</b>	
1 FAMILY .....	Myrtaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES	, Flooded gum; Rose gum.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	32-17°S
5 AREAS .....	Australia: Coastal Queensland and New South Wales.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-2,100 m
7 MEAN ANNUAL RAINFALL .	1,000-4,000 mm
8 RAINFALL REGIME .....	Summer/uniform
9 DRY SEASON .....	0-2 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	28-35°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	10-18°C
12 MEAN ANNUAL TEMP. ....	17-26°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Free draining; moist.
16 OTHER CHARACTERISTICS	Richer soils of lowlands best.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 40-55 m; d = 100-200 cm
18 DESCRIPTION .....	Evergreen
19 FORM .....	Exceptional
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Coppices; tolerates salt winds; moderately frost resistant; substantial provenance variation; fire sensitive; 6-15 year coppice rotations; 20 year timber rotation; coppice rotations generally out-yield seedling rotations.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	24-70
<b>ROLE IN LAND USE:</b>	
23 .....	-
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.48-0.64
25 NATURAL DURABILITY ...	Moderately durable
26 PRESERVATION .....	Easy
27 SAWING .....	Difficult
28 SEASONING .....	Difficult
29 OTHER FEATURES .....	Tendency to split on felling.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Heavy construction; light construction; furniture; boxes.
31 ROUNDWOOD .....	Building poles; transmission poles; fence posts; fuel and charcoal; shortfibre pulp; veneer/plywood.
32 OTHER PRODUCTS .....	-
<b>NURSERY:</b>	
33 SEED SOURCES .....	Australia; South and East Africa; Brazil.
34 SEEDS PER KILOGRAMME .	600,000-650,000 (viable); or 150,000 plants/kg of seed.
35 STORAGE .....	Dry, cold and airtight for several years.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS .	-
39 GERMINATION AND GROWTH	Germinates in 7-10 days. Plantable size in 2-6 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	Very susceptible to attack by termites when young. Attacked by the fungus <u>Diaporthe cubensis</u> in Brazil.
<b>PRINCIPAL REFERENCES:</b>	
	4 82 83 85 91 101 121 130 133 152

SPECIES: Eucalyptus intertexta R.T. Bak.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Gum-barked Coolibah.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 34-21°S  
5 AREAS ..... Central and S.E. Australia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,250 m  
7 MEAN ANNUAL RAINFALL , 250-400 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 6-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 32-38°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 8-13°C  
12 MEAN ANNUAL TEMP. .... 18-25°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates moderately saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 15-20 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 4-5

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 0.75-0.85  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Tough, interlocked grain. Only used in round.

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fence posts; fuel and charcoal.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia.  
34 SEEDS PER KILOGRAMME , 120,000-150,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 7-14 days.  
Plantable size in 6-8 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

81 84 95 130

SPECIES: Eucalyptus largiflorens F. Muell.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... E. bicolor A. Cunn. ex Hook.  
3 LOCAL OR TRADE NAMES , Black box

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 35-28°S  
5 AREAS ..... Semi-arid areas of Central Australia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,200 m  
7 MEAN ANNUAL RAINFALL . 250-500 mm  
8 RAINFALL REGIME ..... Winter/summer/uniform  
9 DRY SEASON ..... 4-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 30-36°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 5-12°C  
12 MEAN ANNUAL TEMP. .... 19-25°C

SOILS:

- 13 TEXTURE ..... Heavy  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Seasonally waterlogged  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 10-18 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; frost resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 7-9

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 0.90-1.00  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Building poles; fence posts; fuel and charcoal.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia.  
34 SEEDS PER KILOGRAMME . 400,000-700,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 12-21 days.  
Plantable size in 4-6 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

4 83 84 95

SPECIES: Eucalyptus maculata Hook.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Spotted gum.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 37-23°S  
5 AREAS ..... Australia: non-tropical Queensland and New South Wales.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,000-2,000 m  
7 MEAN ANNUAL RAINFALL . 620-1,250 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 2-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-6°C  
12 MEAN ANNUAL TEMP, .... 15-20°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 30-45 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; moderately fire resistant; windfirm; tolerates salt winds; drought hardy.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 21-35

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 1.00-1.10  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Fair  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Interlocked grain

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.  
31 ROUNDWOOD ..... Transmission poles; fence posts; fuel (c.v. = 19,036 kJ/kg) and charcoal; veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia; S. Africa; Kenya.  
34 SEEDS PER KILOGRAMME . 120,000-180,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Germinates in 6-7 days.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Susceptible to termite attack when young.

PRINCIPAL REFERENCES:

4 57 82 83 91 128 130 133 152

SPECIES: Eucalyptus maidenii F.Muell.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Maiden's gum.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 38-35°S  
5 AREAS ..... Australia: S.E. New South Wales and Victoria.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 600-2,100 m  
7 MEAN ANNUAL RAINFALL . 760-2,000 mm  
8 RAINFALL REGIME ..... Winter/uniform  
9 DRY SEASON ..... 2-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 22-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 8-12°C  
12 MEAN ANNUAL TEMP. .... 18-22°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 50-70 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; moderately frost resistant; 6-9 year coppice rotation.

PRODUCTION:

- 22 VOLUME (M<sup>3</sup>/HA/AN) .... 20-35

ROLE IN LAND USE:

- 23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.60-0.80  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... Normally used in round.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel and charcoal; shortfibre pulp.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia; E. Africa.  
34 SEEDS PER KILOGRAMME . 150,000-300,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Germinates in 7-8 days.  
Plantable size in 4-6 months.

PRINCIPAL PESTS AND

- DISEASES:  
40 ..... Very susceptible to termite attack when young.  
One of the Eucalyptus species most liable to Goniapterus attack.

PRINCIPAL REFERENCES:

- 4 82 83 85 91 128 130 152

SPECIES: Eucalyptus melliodora A. Cunn. ex Schau.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Yellow box; Honey-scented gum.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 37-26°S  
5 AREAS ..... Inland New South Wales and Victoria.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,000-2,000 m  
7 MEAN ANNUAL RAINFALL , 625-900 mm  
8 RAINFALL REGIME ..... Winter/summer  
9 DRY SEASON ..... 2-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 27-33°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-7°C  
12 MEAN ANNUAL TEMP. .... 16-21°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 20-25 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppies; termite resistant; frost resistant; drought hardy.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 2-6

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 0.75-0.85  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Rarely sawn; interlocked grain.

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fence posts; fuel and charcoal.  
32 OTHER PRODUCTS ..... Honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia.  
34 SEEDS PER KILOGRAMME , 300,000-330,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 5-7 days.  
Plantable size in 9 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... None of importance reported. Resists attack by Gonipterus beetle.

PRINCIPAL REFERENCES:

4 71 82 88 84 91 95 130 152

SPECIES: Eucalyptus microcorys F.Muell.

<b>TAXONOMY:</b>	
1 FAMILY .....	Myrtaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES ,	Tallow wood
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	32-25°S
5 AREAS .....	Australia: N.E. New South Wales and S.E. Queensland.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	500-2,000 m
7 MEAN ANNUAL RAINFALL .	900-1,500 mm
8 RAINFALL REGIME .....	Summer/uniform
9 DRY SEASON .....	0-2 months
10 MEAN MAX. TEMP.,	
HOTTEST MONTH .....	25-35°C
11 MEAN MIN. TEMP.,	
COLDEST MONTH .....	5-14°C
12 MEAN ANNUAL TEMP. ....	17-23°C
<b>SOILS:</b>	
13 TEXTURE .....	Medium
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Free draining
16 OTHER CHARACTERISTICS	Growth better on fertile soils.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 25-50 m
18 DESCRIPTION .....	Evergreen
19 FORM .....	Exceptional
20 LIGHT REQUIREMENTS ...	Moderately tolerant of shade.
21 OTHER CHARACTERISTICS	Coppices; frost tender; 7-10 year pole rotation; 15-20 year timber rotation.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	8-30
<b>ROLE IN LAND USE:</b>	
23 .....	Windbreaks; shade and shelter.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.90-0.99
25 NATURAL DURABILITY ...	Durable
26 PRESERVATION .....	Easy
27 SAWING .....	Easy
28 SEASONING .....	Easy
29 OTHER FEATURES .....	Tough
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Heavy construction; light construction; furniture; flooring.
31 ROUNDWOOD .....	Building poles; transmission poles; fence posts; fuel (c.v. = 19,538 kJ/kg).
32 OTHER PRODUCTS .....	Honeyflora.
<b>NURSERY:</b>	
33 SEED SOURCES .....	Australia; S. Africa.
34 SEEDS PER KILOGRAMME .	250,000-280,000 (viable)
35 STORAGE .....	Dry, cold and airtight for several years.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS .	-
39 GERMINATION AND GROWTH	Germinates in 12-15 days. Plantable size in 4-6 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	None of importance reported. Resists attack by <u>Gonipterus</u> beetle.
<b>PRINCIPAL REFERENCES:</b>	
	4 82 83 85 91 109 130 133 134 152

SPECIES: Eucalyptus microtheca F.Muell.

TAXONOMY:	
1 FAMILY .....	Myrtaceae
2 SYNONYMS .....	<u>E. coolabah</u> Blakely & Jacobs
3 LOCAL OR TRADE NAMES	Coolibah
NATURAL OCCURRENCE:	
4 LATITUDES .....	30-14°S
5 AREAS .....	Arid and semi-arid zones of N. Australia.
CLIMATE:	
6 ALTITUDINAL RANGE ....	0-1,000 m
7 MEAN ANNUAL RAINFALL .	250-1,000 mm
8 RAINFALL REGIME .....	Winter/summer
9 DRY SEASON .....	5-7 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	27-40°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	4-14°C
12 MEAN ANNUAL TEMP. ....	21-27°C
SOILS:	
13 TEXTURE .....	Heavy
14 REACTION .....	Alkaline/neutral
15 DRAINAGE .....	Seasonally waterlogged
16 OTHER CHARACTERISTICS	-
SILVICULTURE:	
17 SIZE .....	h = 10-15 m; d = 120-250 cm
18 DESCRIPTION .....	Evergreen
19 FORM .....	Poor
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Coppices; fire tender; substantial provenance variation.

PRODUCTION:	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	3-5
ROLE IN LAND USE:	
23 .....	Shade and shelter; anti-erosion.
TIMBER:	
24 DENSITY .....	S.G. 0.75-1.10
25 NATURAL DURABILITY ...	Very durable
26 PRESERVATION .....	-
27 SAWING .....	Difficult
28 SEASONING .....	Difficult
29 OTHER FEATURES .....	Resistant to termites; interlocked grain.
UTILIZATION:	
30 SAW TIMBER .....	-
31 ROUNDWOOD .....	Fence posts; fuel and charcoal; wharf piles.
32 OTHER PRODUCTS .....	-
NURSERY:	
33 SEED SOURCES .....	Australia; Sudan.
34 SEEDS PER KILOGRAMME .	400,000-450,000 (viable).
35 STORAGE .....	Dry, cold and airtight for several years.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS .	-
39 GERMINATION AND GROWTH	Germinates in 5-14 days. Plantable size in 5-6 months.
PRINCIPAL PESTS AND DISEASES:	
40 .....	Less liable to termite attack than <u>E. camaldulensis</u> .
PRINCIPAL REFERENCES:	
	4 84 91 95 107 121 130 152

SPECIES: Eucalyptus nitens (Deane & Maid.) Maid.

<b>TAXONOMY:</b>	
1	FAMILY ..... Myrtaceae
2	SYNONYMS ..... -
3	LOCAL OR TRADE NAMES . Shining gum.
<b>NATURAL OCCURRENCE:</b>	
4	LATITUDES ..... 38-35°C
5	AREAS ..... S.E. New South Wales and Victoria.
<b>CLIMATE:</b>	
6	ALTITUDINAL RANGE .... 2,000-3,500 m
7	MEAN ANNUAL RAINFALL . 750-1,500 mm
8	RAINFALL REGIME ..... Winter/uniform
9	DRY SEASON ..... 0-2 months
10	MEAN MAX. TEMP. HOTTEST MONTH ..... 20-22°C
11	MEAN MIN. TEMP. COLDEST MONTH ..... -1-+4°C
12	MEAN ANNUAL TEMP. .... 9-15°C
<b>SOILS:</b>	
13	TEXTURE ..... Medium/heavy
14	REACTION ..... Acid
15	DRAINAGE ..... Free draining
16	OTHER CHARACTERISTICS -
<b>SILVICULTURE:</b>	
17	SIZE ..... h = 40-50 m
18	DESCRIPTION ..... Evergreen
19	FORM ..... Exceptional
20	LIGHT REQUIREMENTS ... Strongly demanding
21	OTHER CHARACTERISTICS Coppices; frost resistant.

<b>PRODUCTION:</b>	
22	VOLUME (M <sup>3</sup> /HA/AN) .... 12-28
<b>ROLE IN LAND USE:</b>	
23	..... -
<b>TIMBER:</b>	
24	DENSITY ..... S.G. 0.60-0.65
25	NATURAL DURABILITY ... Non-durable
26	PRESERVATION ..... Easy
27	SAWING ..... Easy
28	SEASONING ..... Fair
29	OTHER FEATURES ..... Fissile
<b>UTILIZATION:</b>	
30	SAW TIMBER ..... Light construction; boxes.
31	ROUNDWOOD ..... Building poles; transmission poles; shortfibre pulp.
32	OTHER PRODUCTS ..... -
<b>NURSERY:</b>	
33	SEED SOURCES ..... Australia.
34	SEEDS PER KILOGRAMME . 200,000-250,000 (viable).
35	STORAGE ..... Dry and airtight for several years.
36	PRE-TREATMENT ..... Stratify in damp sand for thirty days.
37	PLANTING STOCK ..... Potted
38	SPECIAL REQUIREMENTS . -
39	GERMINATION AND GROWTH Germinates in 10 days. Plantable size in 4-6 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40	..... None of importance reported. Resists attack by <u>Gonipterus</u> beetle.
<b>PRINCIPAL REFERENCES:</b> 4 82 130 152	

SPECIES: Eucalyptus obliqua L'Herit.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Messmate stringybark.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 43-37°C  
5 AREAS ..... Australia: New South Wales, Victoria and Tasmania.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 2,000-3,000 m  
7 MEAN ANNUAL RAINFALL . 700-1,500 mm  
8 RAINFALL REGIME ..... Winter/summer  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 27-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-5°C  
12 MEAN ANNUAL TEMP. .... 9-16°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Moderately free draining; moist.  
16 OTHER CHARACTERISTICS Adaptable

SILVICULTURE:

- 17 SIZE ..... h = 50-70 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; moderately fire resistant; frost resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 18-30

ROLE IN LAND USE:

23 ..... Shade and shelter.

TIMBER:

- 24 DENSITY ..... S.G. 0.64-0.90  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Fissile

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture; boxes.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel and charcoal; shortfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia; New Zealand; S. Africa.  
34 SEEDS PER KILOGRAMME . 100,000-130,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... Stratify in damp sand for thirty days.  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , Soil may require inoculation with mycorrhizae.  
39 GERMINATION AND GROWTH Germinates in 10-12 days.  
Plantable size in 6 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... None of importance reported. Resists attack by Gonipterus beetle.

PRINCIPAL REFERENCES:

4 57 82 83 91 120 152

SPECIES: Eucalyptus occidentalis Engl.

<b>TAXONOMY:</b>	
1 FAMILY .....	Myrtaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES ,	Flat-topped yate.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	33-30°S
5 AREAS .....	Semi-arid zone of S.W. Western Australia.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-1,400 m
7 MEAN ANNUAL RAINFALL .	350-750 mm
8 RAINFALL REGIME .....	Winter
9 DRY SEASON .....	5-6 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	36-38°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	0-2°C
12 MEAN ANNUAL TEMP. ....	20-25°C
<b>SOILS:</b>	
13 TEXTURE .....	Medium/heavy
14 REACTION .....	Alkaline/neutral
15 DRAINAGE .....	Seasonally waterlogged
16 OTHER CHARACTERISTICS	Tolerates saline soils
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 20-25 m
18 DESCRIPTION .....	Evergreen; open-crowned.
19 FORM .....	Poor
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Coppices; moderately frost resistant; drought hardy.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	3-5
<b>ROLE IN LAND USE:</b>	
23 .....	Shade and shelter; anti-erosion.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.85-0.90
25 NATURAL DURABILITY ...	Moderately durable
26 PRESERVATION .....	-
27 SAWING .....	-
28 SEASONING .....	-
29 OTHER FEATURES .....	Very strong; not sawn.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Heavy construction.
31 ROUNDWOOD .....	Building poles; fence posts; fuel and charcoal.
32 OTHER PRODUCTS .....	Tannins
<b>NURSERY:</b>	
33 SEED SOURCES .....	Australia; Morocco.
34 SEEDS PER KILOGRAMME .	330,000-400,000 (viable).
35 STORAGE .....	Dry, cold and airtight for several years.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS .	-
39 GERMINATION AND GROWTH	Germinates in 11-23 days. Plantable size in 5 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	None of importance reported.
<b>PRINCIPAL REFERENCES:</b>	
	4 59 84 91 95 121 130 152

SPECIES: Eucalyptus paniculata Sm.

TAXONOMY:	
1 FAMILY .....	Myrtaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES ,	Grey ironbark.
NATURAL OCCURRENCE:	
4 LATITUDES .....	37-28°S
5 AREAS .....	Australia: Central and Southern New South Wales.
CLIMATE:	
6 ALTITUDINAL RANGE ....	500-1,500 m
7 MEAN ANNUAL RAINFALL ,	750-1,300 mm
8 RAINFALL REGIME .....	Summer/uniform
9 DRY SEASON .....	2-3 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	24-31°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	2-5°C
12 MEAN ANNUAL TEMP. ....	18-23°C
SOILS:	
13 TEXTURE .....	Light/medium
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Free draining
16 OTHER CHARACTERISTICS	Tolerates shallow soils and lateritic soils.
SILVICULTURE:	
17 SIZE .....	h = 25-30 m
18 DESCRIPTION .....	Evergreen
19 FORM .....	Exceptional
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Coppices; moderately frost resistant; drought hardy; 8-15 year pole rotation.

PRODUCTION:	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	9-18
ROLE IN LAND USE:	
23 .....	-
TIMBER:	
24 DENSITY .....	S.G. 1.10-1.20
25 NATURAL DURABILITY ...	Durable
26 PRESERVATION .....	-
27 SAWING .....	Difficult
28 SEASONING .....	-
29 OTHER FEATURES .....	Tough, interlocked grain.
UTILIZATION:	
30 SAW TIMBER .....	Heavy construction; sleepers; ship building.
31 ROUNDWOOD .....	Building poles; transmission poles; fence posts; fuel and charcoal.
32 OTHER PRODUCTS .....	-
NURSERY:	
33 SEED SOURCES .....	Australia; S. Africa; Kenya.
34 SEEDS PER KILOGRAMME ,	440,000-460,000 (viable).
35 STORAGE .....	Dry, cold and airtight for several years.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS ,	-
39 GERMINATION AND GROWTH	Germinates in 5-10 days. Plantable size in 4-6 months.
PRINCIPAL PESTS AND DISEASES:	
40 .....	Young plants liable to attack by termites. Resists <u>Gonipterus</u> .
PRINCIPAL REFERENCES:	
	4 82 83 91 130 133 152

SPECIES: Eucalyptus pellita F.Muell.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Large-fruited red mahogany.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 12-18°S and 27-36°S  
5 AREAS ..... Cape York Peninsula, Queensland and Fraser Island, Queensland to New South Wales, Australia. Discontinuous distribution.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,000 m  
7 MEAN ANNUAL RAINFALL . 900-2,400 mm  
8 RAINFALL REGIME ..... Uniform/summer  
9 DRY SEASON ..... 2-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-33°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 12-16°C  
12 MEAN ANNUAL TEMP. .... 23-26°C

SOILS:

- 13 TEXTURE ..... Medium/light  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 47 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Moderately shade tolerant.  
21 OTHER CHARACTERISTICS Coppices; 4-8 year coppice rotation.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.90-1.00  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Red colour; resin pockets.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; flooring; boat building; furniture; railway sleepers.  
31 ROUNDWOOD ..... Fuelwood; veneer/plywood; fence posts; building poles.  
32 OTHER PRODUCTS ..... Oils from leaves.

NURSERY:

- 33 SEED SOURCES ..... Australia (tropical northern provenances).  
34 SEEDS PER KILOGRAMME . 25,000-160,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... -  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Germination in 3 weeks.

PRINCIPAL PESTS AND DISEASES:

40 ..... Prone to Gonipterus attack.

PRINCIPAL REFERENCES:

4 85 91

SPECIES: Eucalyptus propinqua Deane & Maid.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Grey gum.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 24-33°S  
5 AREAS ..... Australia: New South Wales, N. Queensland.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,500 m  
7 MEAN ANNUAL RAINFALL . 875-1,400 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 4 months  
10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 27-33°C  
11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 4-10°C  
12 MEAN ANNUAL TEMP. .... 16-21°C

SOILS:

- 13 TEXTURE ..... Medium  
14 REACTION ..... Neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates dry, shallow soils.

SILVICULTURE:

- 17 SIZE ..... h = 35-40 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Moderately light demanding.  
21 OTHER CHARACTERISTICS Coppices; frost tender.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 1.06  
25 NATURAL DURABILITY ... Very durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Red; hard.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction.  
31 ROUNDWOOD ..... Poles; fuelwood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Queensland, Australia.  
34 SEEDS PER KILOGRAMME . 203,000-683,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... -  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germination in 3 weeks.

PRINCIPAL PESTS AND DISEASES:

40 ..... -

PRINCIPAL REFERENCES:

91

SPECIES: Eucalyptus regnans F.Muell.

TAXONOMY:	
1 FAMILY .....	Myrtaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES .	Mountain ash
NATURAL OCCURRENCE:	
4 LATITUDES .....	43-37°S
5 AREAS .....	Australia: discontinuous distribution through Victoria and Tasmania.
CLIMATE:	
6 ALTITUDINAL RANGE ....	2,000-3,200 m
7 MEAN ANNUAL RAINFALL .	1,000-2,000 mm
8 RAINFALL REGIME .....	Winter
9 DRY SEASON .....	0-2 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	18-25°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	0-10°C
12 MEAN ANNUAL TEMP, ....	10-16°C
SOILS:	
13 TEXTURE .....	Medium/heavy
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Free draining; moist.
16 OTHER CHARACTERISTICS	Better growth on deep soils.
SILVICULTURE:	
17 SIZE .....	h = 60-100 m
18 DESCRIPTION .....	Evergreen
19 FORM .....	Exceptional
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Frost resistant; 15-20 year timber rotation.

PRODUCTION:	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	11-15
ROLE IN LAND USE:	
23 .....	-
TIMBER:	
24 DENSITY .....	S.G. 0.56-0.80
25 NATURAL DURABILITY ...	Moderately durable
26 PRESERVATION .....	Difficult
27 SAWING .....	Easy
28 SEASONING .....	Fair
29 OTHER FEATURES .....	White; odour-free.
UTILIZATION:	
30 SAW TIMBER .....	Light construction; furniture; boxes.
31 ROUNDWOOD .....	Transmission poles; shortfibre pulp; veneer/plywood.
32 OTHER PRODUCTS .....	-
NURSERY:	
33 SEED SOURCES .....	Australia.
34 SEEDS PER KILOGRAMME .	80,000-100,000 (viable).
35 STORAGE .....	Dry, cold and airtight for several years.
36 PRE-TREATMENT .....	Stratify in damp sand for thirty days.
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS .	Soil may require inoculation with mycorrhizae.
39 GERMINATION AND GROWTH	Germinates in 10-14 days. Plantable size in 8-9 months.
PRINCIPAL PESTS AND DISEASES:	
40 .....	Very susceptible to <u>Gonipterus</u> attack.
PRINCIPAL REFERENCES:           4 57 82 83 85 88 91 130 152	

SPECIES: Eucalyptus resinifera F. Muell.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae
- 2 SYNONYMS ..... E. hemilampra F. Muell.
- 3 LOCAL OR TRADE NAMES . Red mahogany

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 34-17°S
- 5 AREAS ..... Australia: Coastal Queensland and New South Wales.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 900-2,000 m
- 7 MEAN ANNUAL RAINFALL . 1,000-3,000 mm
- 8 RAINFALL REGIME ..... Summer/uniform
- 9 DRY SEASON ..... 2-4 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 25-32°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-5°C
- 12 MEAN ANNUAL TEMP. .... 15-21°C

SOILS:

- 13 TEXTURE ..... Light/medium
- 14 REACTION ..... Neutral/acid
- 15 DRAINAGE ..... Free draining
- 16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m
- 18 DESCRIPTION ..... Evergreen
- 19 FORM ..... Acceptable
- 20 LIGHT REQUIREMENTS ... Shade tolerant in youth.
- 21 OTHER CHARACTERISTICS Coppices; frost tender.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 5-11

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.85-1.00
- 25 NATURAL DURABILITY ... Moderately durable
- 26 PRESERVATION ..... Difficult
- 27 SAWING ..... Easy
- 28 SEASONING ..... Fair
- 29 OTHER FEATURES ..... Tough, interlocked grain.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; boat-building.
- 31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel and charcoal.
- 32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia.
- 34 SEEDS PER KILOGRAMME . 120,000-160,000 (viable).
- 35 STORAGE ..... Dry, cold and airtight for several years.
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Potted
- 38 SPECIAL REQUIREMENTS , -
- 39 GERMINATION AND GROWTH Germinates in 7 days.  
Plantable size in 4-5 months.

PRINCIPAL PESTS AND

- DISEASES:
- 40 ..... Severely attacked by termites when young.  
Resists Gonipterus beetle attack.

PRINCIPAL REFERENCES:

4 82 83 91 130 134 152

SPECIES: Eucalyptus robusta Sm.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... E. multiflora Poir.  
3 LOCAL OR TRADE NAMES , Swamp mahogany

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 36-23°C  
5 AREAS ..... Australia: coasts of S. Queensland and New South Wales.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,600 m  
7 MEAN ANNUAL RAINFALL , 1,000-1,500 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 1-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 30-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 3-5°C  
12 MEAN ANNUAL TEMP. .... 18-28°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Seasonally waterlogged  
16 OTHER CHARACTERISTICS Better growth on deep soils; tolerates slight salinity.

SILVICULTURE:

- 17 SIZE ..... h = 25-30 m; d = 60-100 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable to poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; regenerates fast after fire; tolerates salt winds; frost tender; sawn-wood rotation of 35-50 years.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 14-28

ROLE IN LAND USE:

23 ..... Shade and shelter.

TIMBER:

- 24 DENSITY ..... S.G. 0.70-0.80  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... Red; coarse grained; Lyctus susceptible; moderately termite resistant.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.  
31 ROUNDWOOD ..... Building poles; fence posts; fuel (c.v. = 20,448 kJ/kg) and charcoal; shortfibre pulp.  
32 OTHER PRODUCTS ..... Honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia; S. Africa; Hawaii; Madagascar.  
34 SEEDS PER KILOGRAMME . 500,000-600,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH 80-85% germination in 7-10 days. Plantable size in 4-6 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Susceptible to attack by Coniapterus beetle and by termites when young.

PRINCIPAL REFERENCES:

4 82 83 88 91 96 109 128 130 134 152

SPECIES: Eucalyptus saligna Sm.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Sydney blue gum.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 35-28°S  
5 AREAS ..... Australia: New South Wales and extreme S.E. Queensland.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 500-2,100 m  
7 MEAN ANNUAL RAINFALL . 800-1,500 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 0-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 3-4°C  
12 MEAN ANNUAL TEMP. .... 15-23°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 35-45 m; d = 120-200 cm  
18 DESCRIPTION ..... Evergreen. Often confused with E. grandis in Africa.  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; moderately frost resistant; 12 year rotation for fuel.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 15-25(-35)

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.48-0.77  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Difficult  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... Tendency to split after sawing.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; furniture; boxes.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel and charcoal; shortfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... Oil from leaves.

NURSERY:

- 33 SEED SOURCES ..... Australia; S. Africa; Brazil (avoid confusion with E. grandis).  
34 SEEDS PER KILOGRAMME . 600,000-650,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Germinates in 10-20 days.  
Plantable size in 4-6 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Similar to E. grandis.

PRINCIPAL REFERENCES:

4 57 82 83 85 88 91 107 109 128 130  
133 134 152

SPECIES: Eucalyptus salmonophloia F. Muell.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Salmon gum

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 33.5-29.5°S  
5 AREAS ..... Inland, South West of W. Australia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,800 m  
7 MEAN ANNUAL RAINFALL , 250-500 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 4-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 32-35°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-12°C  
12 MEAN ANNUAL TEMP, .... 17-25°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 18-25 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; frost tender.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 1.00-1.10  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Strong

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction.  
31 ROUNDWOOD ..... Building poles; fence posts; fuel (c.v. = 20,230 kJ/kg) and charcoal.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia.  
34 SEEDS PER KILOGRAMME , 230,000-900,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 15-19 days.  
Plantable size in 6-8 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

4 49 82 83 84 91 95 130 152 166

SPECIES: Eucalyptus sargentii Maiden

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Salt River mallett.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 34-32.50°C  
5 AREAS ..... South West W. Australia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,500 m  
7 MEAN ANNUAL RAINFALL , 330-450 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 6-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 34-36°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-10°C  
12 MEAN ANNUAL TEMP. .... 18-25°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 8-10 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks.

TIMBER:

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... -  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Never sawn.

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fuel and charcoal.  
32 OTHER PRODUCTS ..... Tannins

NURSERY:

- 33 SEED SOURCES ..... Australia.  
34 SEEDS PER KILOGRAMME , 250,000-500,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 5-10 days.  
Plantable size in 8 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

84 95 130 166

SPECIES: Eucalyptus sideroxylon A. Cunn. ex Woolls

TAXONOMY:

- 1 FAMILY ..... Myrtaceae
- 2 SYNONYMS ..... -
- 3 LOCAL OR TRADE NAMES , Red ironbark.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 39-25°s
- 5 AREAS ..... Australia: Inland Victoria.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,000 m
- 7 MEAN ANNUAL RAINFALL . 420-750 mm
- 8 RAINFALL REGIME ..... Winter/summer/uniform
- 9 DRY SEASON ..... 4-7 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 27-34°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 3-8°C
- 12 MEAN ANNUAL TEMP. .... 19-24°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy
- 14 REACTION ..... Alkaline/neutral
- 15 DRAINAGE ..... Seasonally waterlogged
- 16 OTHER CHARACTERISTICS Tolerates shallow and moderately saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-30 m
- 18 DESCRIPTION ..... Evergreen
- 19 FORM ..... Acceptable
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Coppices; frost resistant; drought hardy.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 4-9

ROLE IN LAND USE:

23 ..... Ornamental; shade and shelter.

TIMBER:

- 24 DENSITY ..... S.G. 0.90-1.06
- 25 NATURAL DURABILITY ... Durable
- 26 PRESERVATION ..... -
- 27 SAWING ..... -
- 28 SEASONING ..... -
- 29 OTHER FEATURES ..... Rarely sawn; interlocked grain.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction.
- 31 ROUNDWOOD ..... Fence posts; fuel and charcoal.
- 32 OTHER PRODUCTS ..... Tannins; honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Australia; S. Africa.
- 34 SEEDS PER KILOGRAMME , 100,000-20,000 (viable).
- 35 STORAGE ..... Dry, cold and airtight for several years.
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Potted
- 38 SPECIAL REQUIREMENTS . -
- 39 GERMINATION AND GROWTH Germinates in 14-18 days; low germination percentage. Plantable size in 7-8 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Susceptible to Gonipterus and termites.

PRINCIPAL REFERENCES:

4 82 83 84 88 95 115 130 134 152

SPECIES: Eucalyptus st.-johnii (R.T. Bak.) R.T. Bak.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... E. bicostata Blakely & Simmonds  
3 LOCAL OR TRADE NAMES . Eurabbie

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 40-31°S  
5 AREAS ..... Australia: Victoria and S.E. New South Wales.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 2,000-3,500 m  
7 MEAN ANNUAL RAINFALL . 750-2,000 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 21-27°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-7°C  
12 MEAN ANNUAL TEMP. .... 9-16°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining but moist.  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable to exceptional.  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; windfirm; moderately frost resistant;  
6-10 year fuelwood rotation.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 8-14

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 0.73-0.82  
25 NATURAL DURABILITY ... Moderate  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... Interlocked grain.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction.  
31 ROUNDWOOD ..... Building poles; fence posts; fuel and charcoal;  
shortfibre pulp.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia.  
34 SEEDS PER KILOGRAMME . 100,000-140,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 12-14 days.  
Plantable size in 5-6 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Probably similar to E. globulus.

PRINCIPAL REFERENCES:

82 83 85 91 130 152

SPECIES: Eucalyptus tereticornis Sm.

TAXONOMY:	
1 FAMILY .....	Myrtaceae
2 SYNONYMS .....	<u>E. umbellata</u> (Gaertn.) Domin
3 LOCAL OR TRADE NAMES	Forest red gum; Mysore "hybrid" (India); "I2AEL" (Madagascar); Eucalyptus "C" (Zanzibar).
NATURAL OCCURRENCE:	
4 LATITUDES .....	38-5°S
5 AREAS .....	Queensland, Australia; Papua New Guinea.
CLIMATE:	
6 ALTITUDINAL RANGE ....	0-1,800 m
7 MEAN ANNUAL RAINFALL .	500-1,500 mm
8 RAINFALL REGIME .....	Summer
9 DRY SEASON .....	4-7 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	22-32°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	2-12°C
12 MEAN ANNUAL TEMP. ....	17-27°C
SOILS:	
13 TEXTURE .....	Light/medium/heavy
14 REACTION .....	Neutral
15 DRAINAGE .....	Free draining
16 OTHER CHARACTERISTICS	Tolerates slightly saline soils.
SILVICULTURE:	
17 SIZE .....	h = 35-45 m; d = 100-200 cm
18 DESCRIPTION .....	Evergreen
19 FORM .....	Acceptable to exceptional.
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Coppices; windfirm; frost resistant; substantial provenance variation; drought hardy; 6-10 year coppice rotation.

PRODUCTION:	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	12-25
ROLE IN LAND USE:	
23 .....	-
TIMBER:	
24 DENSITY .....	S.G. 0.70-0.85
25 NATURAL DURABILITY ...	Durable
26 PRESERVATION .....	Easy
27 SAWING .....	Easy
28 SEASONING .....	Fair
29 OTHER FEATURES .....	Interlocked grain; <u>Lyctus</u> susceptible.
UTILIZATION:	
30 SAW TIMBER .....	Heavy construction; light construction; boxes; boat building.
31 ROUNDWOOD .....	Building poles; transmission poles; fence posts; fuel (c.v. = 22,120 kJ/kg) and charcoal; shortfibre pulp.
32 OTHER PRODUCTS .....	Honeyflora; oils.
NURSERY:	
33 SEED SOURCES .....	Australia; Brazil; Sudan; India; Madagascar and many other tropical countries.
34 SEEDS PER KILOGRAMME .	300,000-800,000 (viable).
35 STORAGE .....	Dry, cold and airtight for several years.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS ,	-
39 GERMINATION AND GROWTH	Germinates in 5-15 days. Plantable size in 4-5 months.
PRINCIPAL PESTS AND DISEASES:	
40 .....	Susceptible to termite attack when young. Liable to attack by <u>Gonipterus</u> beetle.
PRINCIPAL REFERENCES:	
	4 71 82 83 85 88 91 95 101 130 152

SPECIES: Eucalyptus torelliana F. Muell.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Cadaga; Cadaghi.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 19-16°S  
5 AREAS ..... Australia: Coast and coastal ranges of N. Queensland (tropical rain forest margin).

CLIMATE:

- 6 ALTITUDINAL RANGE .... 100-1,800 m  
7 MEAN ANNUAL RAINFALL , 900-1,500 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 29-40°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 6-16°C  
12 MEAN ANNUAL TEMP. .... 14-26°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates some salinity.

SILVICULTURE:

- 17 SIZE ..... h = 25-30 m  
18 DESCRIPTION ..... Tall, dense-crowned tree.  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Adapts well to arid conditions; windfirm; moderately frost resistant; fire tender; very fast growing.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Windbreak. Soil improvement and land reclamation: may be useful for afforestation of degraded sites not suitable for rain-forest pioneers.

TIMBER:

- 24 DENSITY ..... S.G. 0.45(small wood)-0.91  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... Fair  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... Straight grain; gum veins present.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; wagon work.  
31 ROUNDWOOD ..... Shortfibre pulp; fuelwood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Queensland, Australia; India; USA.  
34 SEEDS PER KILOGRAMME , 260,000-800,000  
35 STORAGE ..... 6-12 months  
36 PRE-TREATMENT ..... -  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , Careful weeding.  
39 GERMINATION AND GROWTH Easy to raise; plantation performance erratic. Germination of 30-70%. Plantable size in 4-6 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Defoliation by coleoptera. Resists Diaporthe cubensis canker in latitudes below 20°S.

PRINCIPAL REFERENCES:

4 59 91 152

SPECIES: Eucalyptus urophylla S.T. Blake

<b>TAXONOMY:</b>	
1 FAMILY .....	Myrtaceae
2 SYNONYMS .....	Previously included in <u>E. alba</u> and <u>E. decaisneana</u> in Indonesia and Brazil.
3 LOCAL OR TRADE NAMES	Timor white gum.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	10-7°S
5 AREAS .....	Western Sunda Islands of Indonesia.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	200-3,000 m
7 MEAN ANNUAL RAINFALL .	1,100-1,950 mm
8 RAINFALL REGIME .....	Summer
9 DRY SEASON .....	2-6 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	20-26°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	8-12°C
12 MEAN ANNUAL TEMP, ....	18-28°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium/heavy
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Free draining
16 OTHER CHARACTERISTICS	-
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 35-45 m
18 DESCRIPTION .....	Evergreen
19 FORM .....	Acceptable
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Coppices; frost tender; substantial provenance variation.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	20-30
<b>ROLE IN LAND USE:</b>	
23 .....	-
<b>TIMBER:</b>	
24 DENSITY .....	-
25 NATURAL DURABILITY ...	Moderately durable
26 PRESERVATION .....	-
27 SAWING .....	Easy
28 SEASONING .....	-
29 OTHER FEATURES .....	-
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Heavy construction.
31 ROUNDWOOD .....	Building poles; fence posts; fuel and charcoal; shortfibre pulp.
32 OTHER PRODUCTS .....	-
<b>NURSERY:</b>	
33 SEED SOURCES .....	Australia; Indonesia; CTFT, France have made widespread collections.
34 SEEDS PER KILOGRAMME .	210,000-400,000 (viable).
35 STORAGE .....	Dry, cold and airtight.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted; cuttings.
38 SPECIAL REQUIREMENTS ,	-
39 GERMINATION AND GROWTH	Germinates in 7-12 days. Plantable size in 4 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	Susceptible to termite attack. Very resistant to canker <u>Diaporthe cubensis</u> .
<b>PRINCIPAL REFERENCES:</b> 59 113	

SPECIES: Eucalyptus viminalis Labill.

TAXONOMY:

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Manna gum; Ribbon gum.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 43-28°C  
5 AREAS ..... Australia: Upland areas of Victoria, Tasmania and New South Wales.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 2,000-3,000 m  
7 MEAN ANNUAL RAINFALL . 750-2,500 mm  
8 RAINFALL REGIME ..... Winter/summer/uniform  
9 DRY SEASON ..... 0-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-26°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-6°C  
12 MEAN ANNUAL TEMP. .... 10-16°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Neutral/acid/alkaline  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Better growth on deep soils; tolerates slightly saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 25-30 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; fire resistant; frost resistant; substantial provenance variation; 6-8 year coppice rotation for pulp.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-30

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.60-0.90  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Fair  
28 SEASONING ..... Fair (plantation-grown reputedly difficult).  
29 OTHER FEATURES ..... Second-quality timber.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes.  
31 ROUNDWOOD ..... Transmission poles; shortfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia.  
34 SEEDS PER KILOGRAMME . 300,000-400,000 (viable).  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Germinates in 5-6 days.  
Plantable size in 5-6 months.

PRINCIPAL PESTS AND DISEASES:

- 40 ..... Susceptible to Coniapterus beetle attack.  
Defoliation by chrysomelids severe in Australia and New Zealand.

PRINCIPAL REFERENCES:

4 82 83 88 91 128 130 134 152

SPECIES: Euphorbia tirucalli L.

<b>TAXONOMY:</b>	
1 FAMILY .....	Euphorbiaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES	Rubberhedge euphorbia; milk-bush; mgovu; manyara (E. Africa).
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	20°S-18°N
5 AREAS .....	Origins in S. Western Africa (probably Angola). Widely cultivated and naturalised in Americas and India.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-2,000 m
7 MEAN ANNUAL RAINFALL .	250-1,000 mm
8 RAINFALL REGIME .....	Summer
9 DRY SEASON .....	6-8 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	25-37°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	9-18°C
12 MEAN ANNUAL TEMP. ....	21-26°C
<b>SOILS:</b>	
13 TEXTURE .....	Light
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Good; but ground water must be available.
16 OTHER CHARACTERISTICS	-
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 3-10 m; d = 15 cm
18 DESCRIPTION .....	Succulent, many branched shrub.
19 FORM .....	Poor
20 LIGHT REQUIREMENTS ...	Light demanding
21 OTHER CHARACTERISTICS	Drought hardy; frost tender.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	-
<b>ROLE IN LAND USE:</b>	
23 .....	Windbreak (does not compete with crops); living hedge for habitations.
<b>TIMBER:</b>	
24 DENSITY .....	-
25 NATURAL DURABILITY ...	Poor
26 PRESERVATION .....	-
27 SAWING .....	-
28 SEASONING .....	-
29 OTHER FEATURES .....	Contains toxic latex; soft.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	-
31 ROUNDWOOD .....	Fuel from large trees; charcoal.
32 OTHER PRODUCTS .....	Toxic latex for insecticide and fish poison.
<b>NURSERY:</b>	
33 SEED SOURCES .....	-
34 SEEDS PER KILOGRAMME .	-
35 STORAGE .....	-
36 PRE-TREATMENT .....	-
37 PLANTING STOCK .....	Branch cuttings.
38 SPECIAL REQUIREMENTS .	-
39 GERMINATION AND GROWTH	Large (1 m long) branches planted at end of dry season, form 'instant' hedge.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	-
<b>PRINCIPAL REFERENCES:</b> 28 36 71 85 107	

SPECIES: Ficus benghalensis L.

TAXONOMY:

- 1 FAMILY ..... Moraceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Banyan

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 10°-30°N  
5 AREAS ..... India: sub-Himalayan tract and western peninsula.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 500-1,200 m  
7 MEAN ANNUAL RAINFALL , 500-4,000 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-36°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 6-13°C  
12 MEAN ANNUAL TEMP. .... 17-25°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid/alkaline  
15 DRAINAGE ..... Moist  
16 OTHER CHARACTERISTICS Better growth on fertile, deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-30 m  
18 DESCRIPTION ..... Evergreen (or semi deciduous) tree sacred to  
Hindus.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly light demanding  
21 OTHER CHARACTERISTICS Drought hardy; moderately frost resistant; fire  
sensitive; epiphytic in natural forest;  
adventitious prop roots; F. religiosa has  
similar characteristics and uses.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Shade

TIMBER:

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... -  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... Kiln dry at once after felling.  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Boxes.  
31 ROUNDWOOD ..... Posts; fuel (c.v. = 18,598 kJ/kg).  
32 OTHER PRODUCTS ..... Fodder (leaves); host to Laccifer spp. for  
shellac production.

NURSERY:

- 33 SEED SOURCES ..... India; Pakistan.  
34 SEEDS PER KILOGRAMME . 2,500,000 (cleaned, viable).  
35 STORAGE ..... For up to 2 years, dry, cool and sealed.  
36 PRE-TREATMENT ..... -  
37 PLANTING STOCK ..... Cuttings; bare-rooted or potted plants.  
38 SPECIAL REQUIREMENTS , Shade young plants.  
39 GERMINATION AND GROWTH Low germination percentage; germinates in 7-14  
days; plantable size in 16 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Various defoliating insects: especially  
Ocinara varians and Euploea core.

PRINCIPAL REFERENCES:

16

SPECIES: Gleditsia triacanthos L.

<b>TAXONOMY:</b>	
1	FAMILY ..... Caesalpiniaceae
2	SYNONYMS ..... -
3	LOCAL OR TRADE NAMES . Honey-locust; driedoring (S. Africa).
<b>NATURAL OCCURRENCE:</b>	
4	LATITUDES ..... 28-40°N
5	AREAS ..... East, Central and Southern USA.
<b>CLIMATE:</b>	
6	ALTITUDINAL RANGE .... 0-2,200 m
7	MEAN ANNUAL RAINFALL . 500-1,800 mm
8	RAINFALL REGIME ..... Winter/uniform/summer
9	DRY SEASON ..... 2-6 months
10	MEAN MAX. TEMP. HOTTEST MONTH ..... 32-40°C
11	MEAN MIN. TEMP. COLDEST MONTH ..... -5-+15°C
12	MEAN ANNUAL TEMP. .... 15-24°C
<b>SOILS:</b>	
13	TEXTURE ..... Light/medium/heavy
14	REACTION ..... Alkaline/neutral/acid
15	DRAINAGE ..... Moist; free draining.
16	OTHER CHARACTERISTICS High tolerance of alkalinity and salinity.
<b>SILVICULTURE:</b>	
17	SIZE ..... h = 20-45 m
18	DESCRIPTION ..... Thorny; deciduous; dioecious.
19	FORM ..... Acceptable (varied).
20	LIGHT REQUIREMENTS ... Light demanding.
21	OTHER CHARACTERISTICS Coppices; frost resistant; root suckers vigorously; drought hardy; thrives in irrigated plantations; <u>G. triacanthos</u> var. <u>inermis</u> is an aggressive coloniser.

<b>PRODUCTION:</b>	
22	VOLUME (M <sup>3</sup> /HA/AN) .... -
<b>ROLE IN LAND USE:</b>	
23	..... Erosion control; shade; hedges; agroforestry.
<b>TIMBER:</b>	
24	DENSITY ..... S.G. = 0.75-0.80
25	NATURAL DURABILITY ... Durable
26	PRESERVATION ..... -
27	SAWING ..... Difficult
28	SEASONING ..... -
29	OTHER FEATURES ..... Strong
<b>UTILIZATION:</b>	
30	SAW TIMBER ..... Heavy construction; light construction; furniture; railway sleepers.
31	ROUNDWOOD ..... Posts; firewood.
32	OTHER PRODUCTS ..... Fodder (450 kg dry pods/tree/year; choose varieties with pods of high nutritive value); honey flora.
<b>NURSERY:</b>	
33	SEED SOURCES ..... USA; Spain; Uruguay; France; Turkey.
34	SEEDS PER KILOGRAMME . 4,000-9,000
35	STORAGE ..... Fumigate seed; store up to 2 years.
36	PRE-TREATMENT ..... Boiling water till cool; soak 1 hr. in conc. H <sub>2</sub> SO <sub>4</sub>
37	PLANTING STOCK ..... Potted; root cuttings.
38	SPECIAL REQUIREMENTS . -
39	GERMINATION AND GROWTH 75% germination in 30-40 days. Rapid early growth.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40	..... <u>Mimosa</u> webworm <u>Homodaula albizziae</u> (defoliator). <u>Thyronectria austro-americana</u> (Canker).
<b>PRINCIPAL REFERENCES:</b> 62 71 120 134 150	

SPECIES: Gliricidia sepium (Jacq.) Walp.

TAXONOMY:

- 1 FAMILY ..... Papilionaceae  
2 SYNONYMS ..... G. maculata Kunth  
3 LOCAL OR TRADE NAMES , Madre de cacao (S. Am.); Kakawate (Philippines).

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 6-19°N  
5 AREAS ..... Tropical Americas. Naturalised in Philippines and W. Nigeria.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-900 m  
7 MEAN ANNUAL RAINFALL , 800-2,300 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 34-41°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 14-20°C  
12 MEAN ANNUAL TEMP. .... 22-28°C

SOILS:

- 13 TEXTURE ..... Medium  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Tolerates poor fertility soils.

SILVICULTURE:

- 17 SIZE ..... h = 5-15 m  
18 DESCRIPTION ..... Deciduous  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Coppices; fire resistant; fixes nitrogen; requires wide spacing; tolerates browsing and lopping; uses water economically during dry season; fast growing.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Land stabilisation prior to re-afforestation; live-fences; agricultural shade.

TIMBER:

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... Very durable  
26 PRESERVATION ..... -  
27 SAWING ..... Difficult  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Hard; tough; irregular grain; termite resistant.

UTILIZATION:

- 30 SAW TIMBER ..... Railway sleepers; heavy construction; locally for furniture.  
31 ROUNDWOOD ..... Posts; tools; fuelwood (c.v. 20,570 kJ/kg).  
32 OTHER PRODUCTS ..... Honeyflora; green manure; fodder (N.B. leaves toxic to horses; roots, bark and seed toxic to man); rat poison (seeds).

NURSERY:

- 33 SEED SOURCES ..... Nicaragua; Costa Rica.  
34 SEEDS PER KILOGRAMME , 6,500-7,000  
35 STORAGE ..... Up to 12 months.  
36 PRE-TREATMENT ..... Soak overnight in hot water, plant immediately.  
37 PLANTING STOCK ..... Potted; branch cuttings.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH 90-100% germination in 7 days.  
Plantable size in 3 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Termites; 'scale insects' in E. Africa.

PRINCIPAL REFERENCES:

16 48 121 131

SPECIES: Gmelina arborea Roxb.

TAXONOMY:

- 1 FAMILY ..... Verbenaceae
- 2 SYNONYMS ..... -
- 3 LOCAL OR TRADE NAMES . Yemane; Gmelina; Gamari; White Teak.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 5-30°N
- 5 AREAS ..... S.E. Asia, from Pakistan to Cambodia and S. China.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,200 m
- 7 MEAN ANNUAL RAINFALL , 1,000-4,500 mm
- 8 RAINFALL REGIME ..... Summer
- 9 DRY SEASON ..... 2-4 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-35°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 18-24°C
- 12 MEAN ANNUAL TEMP. .... 21-28°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy
- 14 REACTION ..... Neutral/acid
- 15 DRAINAGE ..... Free draining; moist.
- 16 OTHER CHARACTERISTICS Better growth on fertile soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-30m;d = 60-100 cm
- 18 DESCRIPTION ..... Deciduous; shortlived.
- 19 FORM ..... Poor to acceptable.
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Coppices; termite resistant; frost resistant; substantial provenance variation; plantations rapidly shade out competing species.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 18-32

ROLE IN LAND USE:

23 ..... Agroforestry

TIMBER:

- 24 DENSITY ..... S.G. 0.40-0.57
- 25 NATURAL DURABILITY ... Moderately durable
- 26 PRESERVATION ..... Fair
- 27 SAWING ..... Easy
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... White; odour-free.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes; furniture; tools.
- 31 ROUNDWOOD ..... Building poles; fuel (c.v. = 20,757 kJ/kg) and charcoal; shortfibre pulp; veneer/plywood; matches.
- 32 OTHER PRODUCTS ..... Honeyflora; cattle fodder (fruit and leaves).

NURSERY:

- 33 SEED SOURCES ..... Most tropical or sub-tropical countries.
- 34 SEEDS PER KILOGRAMME . 150 kernels, 700-1400 fresh seed or 2,500 dry seeds per kilogramme.
- 35 STORAGE ..... Short viability, up to 6 months.
- 36 PRE-TREATMENT ..... Soak in cold water for one to two days.
- 37 PLANTING STOCK ..... Stumps; potted; direct sown; cuttings.
- 38 SPECIAL REQUIREMENTS , -
- 39 GERMINATION AND GROWTH 65-80% germination in 14-28 days. Plantable size in 6 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... In Latin America Atta ants can cause serious defoliation but seldom death. Young trees damaged by cattle browsing.

PRINCIPAL REFERENCES:

4 5 16 23 61 69 85 102 107 109 121  
128 134 152

SPECIES: Grevillea robusta A. Cunn. ex R.Br.

TAXONOMY:

- 1 FAMILY ..... Proteaceae  
2 SYNONYMS ..... Grevillea umbricata A. Cunn.  
3 LOCAL OR TRADE NAMES . Silky oak.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 27-36°N  
5 AREAS ..... Australia: Queensland and New South Wales.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 800-2,100 m  
7 MEAN ANNUAL RAINFALL . 700-1,200 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 2-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-28°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 6-14°C  
12 MEAN ANNUAL TEMP. .... 13-21°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Better growth on deep soils, but adaptable.

SILVICULTURE:

- 17 SIZE ..... h = 25-35 m; d = 90-120 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Aggressive coloniser; poor coppice but can be pollarded; tolerates salt winds; drought hardy; frost tender; termite resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 5-15

ROLE IN LAND USE:

23 ..... Agricultural shade; ornamental; windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 0.54-0.66  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Fair  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Quarter sawn resembles oak. Lyctus susceptible.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture; joinery; boxes.  
31 ROUNDWOOD ..... Fuel (c.v. = 20,395 kJ/kg) and charcoal; veneer/plywood.  
32 OTHER PRODUCTS ..... Honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Most sub-tropical countries.  
34 SEEDS PER KILOGRAMME . 80,000-105,000  
35 STORAGE ..... Dry, cold and airtight for up to one year.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , Deep roots require pruning in nursery.  
39 GERMINATION AND GROWTH 60-70% germination in 20-28 days.  
Plantable size in 12 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... None of importance reported, but subject to dieback on excessively dry sites.

PRINCIPAL REFERENCES:

4 5 16 52 57 59 71 96 121 128 152

SPECIES: Haloxylon aphyllum (Minkw.) Iljin

TAXONOMY:

- 1 FAMILY ..... Chenopodiaceae  
2 SYNONYMS ..... H. ammondendron (C.A. Mey.) Bunge  
3 LOCAL OR TRADE NAMES , Black saxaul; Odzhar (Turkmeni).

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 30-45°N  
5 AREAS ..... Deserts of Central Asia from Mongolia to Asia Minor.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 200-2,500 m  
7 MEAN ANNUAL RAINFALL , 100-400 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 8-10 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 25-40°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-8°C  
12 MEAN ANNUAL TEMP. .... 10-25°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates high salinity and low nutrient levels; requires groundwater at less than 15 m depth.

SILVICULTURE:

- 17 SIZE ..... h = 5-8 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; frost resistant; drought hardy.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 1-3

ROLE IN LAND USE:

23 ..... Windbreaks; dune fixation (after initial stabilization); anti-erosion; pasture improvement.

TIMBER:

- 24 DENSITY ..... S.G. 1.02  
25 NATURAL DURABILITY ... -  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fuel and charcoal.  
32 OTHER PRODUCTS ..... Fodder (leaves); potash.

NURSERY:

- 33 SEED SOURCES ..... USSR; China; Iran.  
34 SEEDS PER KILOGRAMME , -  
35 STORAGE ..... Dry (4% moisture) and airtight for 1 year.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Direct sown; bare rooted plants.  
38 SPECIAL REQUIREMENTS , None  
39 GERMINATION AND GROWTH Easily established; good competitor with weeds.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Liable to attack by many insects and fungi, but none cause great damage.

PRINCIPAL REFERENCES: 121

SPECIES: Hieronyma chocoensis Cuatrec.

TAXONOMY:

- 1 FAMILY ..... Euphorbiaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Mascarey; pantano.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 4°N-4°S  
5 AREAS ..... From the Ecuador coast to the Amazon Basin.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-500 m  
7 MEAN ANNUAL RAINFALL . 3,000-5,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-26°C  
12 MEAN ANNUAL TEMP, .... 24-32°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Acid/very acid  
15 DRAINAGE ..... Moist; seasonally waterlogged.  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 25-35 m; d = 50-60 cm  
18 DESCRIPTION ..... Deciduous  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Moderately light demanding.  
21 OTHER CHARACTERISTICS Coppices; requires wide spacing.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-20

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.7-0.8  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Grain straight, to interlocked; medium texture.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; railway sleepers.  
31 ROUNDWOOD ..... Suitable for plywood/veneer.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Colombia; Costa Rica; Ecuador.  
34 SEEDS PER KILOGRAMME . 30,000-50,000  
35 STORAGE ..... Dry and cold for several months.  
36 PRE-TREATMENT ..... Soak for 12-24 hours in cold water.  
37 PLANTING STOCK ..... Potted; stumps; cuttings.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 15-30 days; plantable size in 3-5 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... -

PRINCIPAL REFERENCES:

SPECIES: Jacaranda copaia (Aubl.) D. Don

TAXONOMY:

- 1 FAMILY ..... Bignoniaceae  
2 SYNONYMS ..... Bignonia copaia Aubl.  
3 LOCAL OR TRADE NAMES , Futui; Para-para; Copaia.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 25°S-18°N  
5 AREAS ..... Tropical America: Belize to Brazil.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,000 m  
7 MEAN ANNUAL RAINFALL . 600-2,000 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 27-38°C  
11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 14-22°C  
12 MEAN ANNUAL TEMP. .... 20-28°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Moist; seasonally waterlogged  
16 OTHER CHARACTERISTICS Tolerates saline conditions and poor soils.

SILVICULTURE:

- 17 SIZE ..... h = 27 m; d = 40-90 cm  
18 DESCRIPTION ..... Trunk swollen at base.  
19 FORM ..... Good  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Coppices

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Ornamental

TIMBER:

- 24 DENSITY ..... S.G. 0.35-0.5  
25 NATURAL DURABILITY ... Perishable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Soft; prone to blue-stain.

UTILIZATION:

- 30 SAW TIMBER ..... Boxes; light construction.  
31 ROUNDWOOD ..... Matches; plywood/veneer; shortfibre pulp.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Cyprus; France; Kenya; Pakistan; Uruguay.  
34 SEEDS PER KILOGRAMME , -  
35 STORAGE ..... Dry, cold, sealed for 1-2 years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; cuttings.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Grows well through post-harvest slash and weed-growth.

PRINCIPAL PESTS AND

DISEASES:

40 ..... No serious pests reported.

PRINCIPAL REFERENCES:

SPECIES: Jacaranda mimosifolia D.Don

TAXONOMY:

- 1 FAMILY ..... Bignoniaceae  
2 SYNONYMS ..... -

3 LOCAL OR TRADE NAMES . Jacaranda (N.B. This is the local name; Dalbergia nigra is known commercially as jacaranda).

NATURAL OCCURRENCE:

- 4 LATITUDES ..... -  
5 AREAS ..... Western S. America; naturalised in Zimbabwe.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,500 m  
7 MEAN ANNUAL RAINFALL . 650-1,800 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 8-15°C  
12 MEAN ANNUAL TEMP. .... 19-26°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Sandy loams

SILVICULTURE:

- 17 SIZE ..... h = 8-15 m  
18 DESCRIPTION ..... Deciduous tree with spreading crown.  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Termite resistant; tolerates salt winds; drought hardy; frost tender when young; withstands pruning.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Shade in streets and gardens.

TIMBER:

- 24 DENSITY ..... S.G. 0.45-0.72  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... Slow  
29 OTHER FEATURES ..... Hard; fine texture.

UTILIZATION:

- 30 SAW TIMBER ..... Carpentry; boxes.  
31 ROUNDWOOD ..... Fuel; particle-board; veneer/plywood; shortfibre pulp.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Most tropical countries.  
34 SEEDS PER KILOGRAMME . 50,000-100,000  
35 STORAGE ..... Dry, cold, sealed for 1-2 years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Cuttings; potted; bare-rooted if conditions good.  
38 SPECIAL REQUIREMENTS . Pollard when young to produce dense crown.  
39 GERMINATION AND GROWTH 60-80% germination.  
Plantable size in 12 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... -

PRINCIPAL REFERENCES: 16

SPECIES: Khaya senegalensis (Desr.) A. Juss.

TAXONOMY:

- 1 FAMILY ..... Meliaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Acajou; Frimu; Ono; African mahogany; Khaya wood; Bisselon.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 8-15°N  
5 AREAS ..... West and Central Africa.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,800 m  
7 MEAN ANNUAL RAINFALL . 700-1,500 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 5-7 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 37-40°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 11-19°C  
12 MEAN ANNUAL TEMP. .... 19-29°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Moist  
16 OTHER CHARACTERISTICS Better growth on deep fertile soils; tolerates dry and lateritic soils.

SILVICULTURE:

- 17 SIZE ..... h = 15-40 m; d = 90-150 cm  
18 DESCRIPTION ..... Deciduous  
19 FORM ..... Acceptable above slight buttressing.  
20 LIGHT REQUIREMENTS ... Shade bearing when young; light demanding later.  
21 OTHER CHARACTERISTICS Drought hardy; fire tender when young; good natural regeneration.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Shade; agroforestry.

TIMBER:

- 24 DENSITY ..... S.G. 0.60-0.85  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Fair  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Interlocking grain; gum and crystal deposits common; slightly aromatic; variable with locality; termite resistant.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture; railway sleepers; flooring.  
31 ROUNDWOOD ..... Pulp; fuelwood (c.v. = 19,988 kJ/kg); plywood/ veneer.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Indonesia; Ghana; Nigeria; Sudan.  
34 SEEDS PER KILOGRAMME . 3,000-7,000  
35 STORAGE ..... For up to 3 months.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Bare-rooted plants; potted seedlings; stumps.  
38 SPECIAL REQUIREMENTS . Careful weeding.  
39 GERMINATION AND GROWTH 90% germination of fresh seed in 18 days.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Hypsipyla robusta shoot borer.

PRINCIPAL REFERENCES:

6

SPECIES: Leucaena leucocephala (Lam.) de Wit (Hawaiian type)

TAXONOMY:

- 1 FAMILY ..... Mimosaceae
- 2 SYNONYMS ..... Leucaena glauca Benth.
- 3 LOCAL OR TRADE NAMES , Leucaena; Ipil-Ipil.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 13-27°N
- 5 AREAS ..... Central America, from Mexico to Salvador. Naturalized in Philippines, Hawaii and parts of Asia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-800 m
- 7 MEAN ANNUAL RAINFALL , 600-1,000 mm
- 8 RAINFALL REGIME ..... Winter/summer
- 9 DRY SEASON ..... 2-6 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-32°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 16-24°C
- 12 MEAN ANNUAL TEMP. .... 20-26°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy
- 14 REACTION ..... Alkaline/neutral
- 15 DRAINAGE ..... Moderately free draining.
- 16 OTHER CHARACTERISTICS Tolerates shallow soils.

SILVICULTURE:

- 17 SIZE ..... h = 3-5 m
- 18 DESCRIPTION ..... Evergreen; deciduous; open-crowned shrub.
- 19 FORM ..... Poor
- 20 LIGHT REQUIREMENTS ... Strongly demanding; shade tolerant in youth.
- 21 OTHER CHARACTERISTICS Aggressive coloniser; coppices; tolerates salt winds; fixes nitrogen; frost tender.

PRODUCTION:

- 22 VOLUME (M<sup>3</sup>/HA/AN) .... 20-25

ROLE IN LAND USE:

- 23 ..... Windbreaks; anti-erosion; soil improvement; agricultural shade; green manure.

TIMBER:

- 24 DENSITY ..... S.G. 0.50-0.59
- 25 NATURAL DURABILITY ... Perishable
- 26 PRESERVATION ..... -
- 27 SAWING ..... -
- 28 SEASONING ..... -
- 29 OTHER FEATURES ..... Only produces fuel and fence posts.

UTILIZATION:

- 30 SAW TIMBER ..... -
- 31 ROUNDWOOD ..... Fence posts; fuel (c.v. = 19,492 kJ/kg) and charcoal.
- 32 OTHER PRODUCTS ..... Fodder (toxic to ruminants if not mixed with other feeds), 12-20 dry tonnes/ha/an.

NURSERY:

- 33 SEED SOURCES ..... Hawaii; Philippines.
- 34 SEEDS PER KILOGRAMME , 27,000-30,000
- 35 STORAGE ..... Ambient temperature for several years.
- 36 PRE-TREATMENT ..... Soak in water heated to 80°C, for two minutes.
- 37 PLANTING STOCK ..... Potted; cuttings.
- 38 SPECIAL REQUIREMENTS . Soil may require inoculation with a Rhizobium strain, for nitrogen fixation.
- 39 GERMINATION AND GROWTH Germinates in 8-10 days.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... High resistance to pests and disease.

PRINCIPAL REFERENCES:

79 109 119 120 121

SPECIES: Leucaena leucocephala (Lam) de Wit (Salvador type)

<b>TAXONOMY:</b>	
1	FAMILY ..... Mimosaceae
2	SYNONYMS ..... <u>Leucaena glauca</u> Benth.
3	LOCAL OR TRADE NAMES . Leucaena
<b>NATURAL OCCURRENCE:</b>	
4	LATITUDES ..... 15-17°N
5	AREAS ..... S.W. Mexico and Central Guatemala.
<b>CLIMATE:</b>	
6	ALTITUDINAL RANGE .... 0-800 m
7	MEAN ANNUAL RAINFALL . 600-1,000 mm
8	RAINFALL REGIME ..... Winter/summer
9	DRY SEASON ..... 2-6 months
10	MEAN MAX. TEMP. HOTTEST MONTH ..... 24-32°C
11	MEAN MIN. TEMP. COLDEST MONTH ..... 16-24°C
12	MEAN ANNUAL TEMP. .... 20-28°C
<b>SOILS:</b>	
13	TEXTURE ..... Light/medium/heavy
14	REACTION ..... Alkaline/neutral
15	DRAINAGE ..... Moderately free draining
16	OTHER CHARACTERISTICS -
<b>SILVICULTURE:</b>	
17	SIZE ..... h = 15-20 m
18	DESCRIPTION ..... Evergreen/deciduous
19	FORM ..... Acceptable
20	LIGHT REQUIREMENTS ... Strongly demanding; shade tolerant in youth.
21	OTHER CHARACTERISTICS Aggressive coloniser; coppices; fixes nitrogen; frost tender.

<b>PRODUCTION:</b>	
22	VOLUME (M <sup>3</sup> /HA/AN) .... 30-40
<b>ROLE IN LAND USE:</b>	
23	..... Soil improvement; agricultural shade; agroforestry.
<b>TIMBER:</b>	
24	DENSITY ..... S.G. 0.50-0.59
25	NATURAL DURABILITY ... -
26	PRESERVATION ..... Easy
27	SAWING ..... Easy
28	SEASONING ..... -
29	OTHER FEATURES ..... -
<b>UTILIZATION:</b>	
30	SAW TIMBER ..... Light construction; boxes.
31	ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel (c.v. = 19,492 kJ/kg) and charcoal; shortfibre pulp.
32	OTHER PRODUCTS ..... Fodder (toxic to ruminants if not mixed with other feeds).
<b>NURSERY:</b>	
33	SEED SOURCES ..... Philippines; Hawaii; Australia; Costa Rica; Mexico.
34	SEEDS PER KILOGRAMME . 26,000-30,000
35	STORAGE ..... Ambient temperature for several years.
36	PRE-TREATMENT ..... Soak in water heated to 80°C, for two minutes.
37	PLANTING STOCK ..... Potted
38	SPECIAL REQUIREMENTS . Soil may require inoculation with a <u>Rhizobium</u> strain for nitrogen fixation.
39	GERMINATION AND GROWTH Germinates in 8-10 days.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40	..... The high resistance of the Hawaiian type has yet to be confirmed for this type. <u>Camptomeris leucaenae</u> : potentially serious leaf-spot disease in Latin America.
<b>PRINCIPAL REFERENCES:</b> 79 109 119 120 121 329	

SPECIES: Liquidambar styraciflua L.

TAXONOMY:

- 1 FAMILY ..... Hamamelidaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Bilsted; Sweetgum; Redgum; Alligator tree; Ocozotl (Mex).

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 11-40°N  
5 AREAS ..... Connecticut to E. Texas (Southern USA); Mexico to Nicaragua.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,000-2,000 m  
7 MEAN ANNUAL RAINFALL , 1,000-1,500 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 5-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 25-36°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... -11+5°C  
12 MEAN ANNUAL TEMP. .... 8-20°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/alkaline  
15 DRAINAGE ..... Moist  
16 OTHER CHARACTERISTICS Often in river bottoms; tolerates some salinity.

SILVICULTURE:

- 17 SIZE ..... h = 17-50 m  
18 DESCRIPTION ..... Deciduous  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Coppices; windfirm on drier soils; tolerates salt winds; frost resistant; strong tap root; fire sensitive; longlived.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 21

ROLE IN LAND USE:

23 ..... Shade

TIMBER:

- 24 DENSITY ..... S.G. 0.50-0.65  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Irregular grain; sometimes figured.

UTILIZATION:

- 30 SAW TIMBER ..... Furniture; crates; doors; panels.  
31 ROUNDWOOD ..... Veneer/plywood; matches; pulp.  
32 OTHER PRODUCTS ..... 'Storax' gum for medicines and perfumes.

NURSERY:

- 33 SEED SOURCES ..... USA; Central America; France.  
34 SEEDS PER KILOGRAMME , 130,000-200,000  
35 STORAGE ..... Up to 4 years at 2-4°C and 5-15% moisture.  
36 PRE-TREATMENT ..... Stratify in damp sand at 4°C for 30-60 days.  
37 PLANTING STOCK ..... Potted; bare rooted plants.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH 30-70% germination.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Rodents in American plantations. Generally very resistant to disease and insect attack.

PRINCIPAL REFERENCES:

SPECIES: Maesopsis eminii Engl.

TAXONOMY:

- 1 FAMILY ..... Rhamnaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Musizi

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 2°S-8°N  
5 AREAS ..... Tropical Central Africa from Liberia to Uganda.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 100-700 m  
7 MEAN ANNUAL RAINFALL , 1,200-3,000 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 26-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 16-24°C  
12 MEAN ANNUAL TEMP. .... 22-27°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on fertile and deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m; d = 120-180 cm  
18 DESCRIPTION ..... Deciduous; wide crowned.  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; shortlived; self-pruning; prolific natural regeneration.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 8-20

ROLE IN LAND USE:

23 ..... Agricultural shade.

TIMBER:

- 24 DENSITY ..... S.G. 0.38-0.48  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Interlocked grain; knotty near core.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture; boxes.  
31 ROUNDWOOD ..... Building poles; shortfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... Bark for roofing material.

NURSERY:

- 33 SEED SOURCES ..... Uganda; Tanzania.  
34 SEEDS PER KILOGRAMME , 550-1,100  
35 STORAGE ..... -  
36 PRE-TREATMENT ..... Soak in cold water for one-two days.  
37 PLANTING STOCK ..... Potted; striplings; stumps; direct sown.  
38 SPECIAL REQUIREMENTS , Care of strong taproot.  
39 GERMINATION AND GROWTH Germinates in 14-28 days.  
Plantable size in 12-24 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Stem canker caused by Fusarium solani in E. Africa. Cerambicid beetle, Monoctonus scabiosus attacks plantations in Zaire.

PRINCIPAL REFERENCES:

43 45 57 59 128 149 152 155

SPECIES: Melaleuca leucadendron (L.) L.

**TAXONOMY:**

- 1 FAMILY ..... Myrtaceae  
2 SYNONYMS ..... M. leucadendra Linn., M. quinquenervia (Cav.)  
S.T. Blake.  
3 LOCAL OR TRADE NAMES . Paperbark; Cajeput oil tree; Broad-leaved  
tea-tree.

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 25°S-20°N  
5 AREAS ..... S.E. Asia from Burma to Indonesia, Philippines  
and tropical Australia.

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 0-800 m  
7 MEAN ANNUAL RAINFALL . 800-1,600 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 0-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 18-22°C  
12 MEAN ANNUAL TEMP. .... 22-28°C

**SOILS:**

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Seasonally waterlogged.  
16 OTHER CHARACTERISTICS Tolerates saline soils.

**SILVICULTURE:**

- 17 SIZE ..... h = 10-20 m; d = 30-60 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; fire resistant; tolerates salt winds;  
drought hardy; termite resistant.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-16

**ROLE IN LAND USE:**

23 ..... Shade and shelter; windbreaks; anti-erosion.

**TIMBER:**

- 24 DENSITY ..... S.G. 0.60-0.80  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Non-fissile; thick corky bark; resists attack  
by termites and marine borers.

**UTILIZATION:**

- 30 SAW TIMBER ..... Heavy construction; railway sleepers.  
31 ROUNDWOOD ..... Building poles; transmission poles; fuel and  
charcoal; shortfibre pulp; mining timber.  
32 OTHER PRODUCTS ..... Oils (cajeput oil: medicinal); honeyflora.

**NURSERY:**

- 33 SEED SOURCES ..... Australia; Malaya; Hawaii; Fiji; Indonesia.  
34 SEEDS PER KILOGRAMME . 250,000-350,000  
35 STORAGE ..... Ambient temperature for several years.  
36 PRE-TREATMENT ..... Soak in cold water for one to two days.  
37 PLANTING STOCK ..... Potted; cuttings.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Plantable size in 6 months.

**PRINCIPAL PESTS AND**

**DISEASES:**

40 ..... None of importance reported.

**PRINCIPAL REFERENCES:**

49 59 69 96 134 152

SPECIES: Musanga cecropioides R. Br.

<b>TAXONOMY:</b>	
1 FAMILY .....	Moraceae
2 SYNONYMS .....	<u>M. smithii</u> R. Br.
3 LOCAL OR TRADE NAMES	Umbrella tree; Parasolier; African corkwood.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	6°S-8°N
5 AREAS .....	West and Central tropical Africa.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-200 m
7 MEAN ANNUAL RAINFALL .	2,000-5,000 mm
8 RAINFALL REGIME .....	Uniform
9 DRY SEASON .....	0-2 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	28-36°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	20-26°C
12 MEAN ANNUAL TEMP. ....	25-30°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium
14 REACTION .....	Acid
15 DRAINAGE .....	Seasonally waterlogged
16 OTHER CHARACTERISTICS	-
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 12-15 m
18 DESCRIPTION .....	Prop roots.
19 FORM .....	Acceptable
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Coppices; can spread by aerial runners; short-lived.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	30-35
<b>ROLE IN LAND USE:</b>	
23 .....	Soil improvement.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.20-0.35
25 NATURAL DURABILITY ...	Perishable
26 PRESERVATION .....	Easy; heartwood difficult.
27 SAWING .....	Easy
28 SEASONING .....	-
29 OTHER FEATURES .....	Mainly used for pulp.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Insulation.
31 ROUNDWOOD .....	Shortfibre pulp; fishing floats; carving; fuelwood.
32 OTHER PRODUCTS .....	-
<b>NURSERY:</b>	
33 SEED SOURCES .....	Ivory Coast; Nigeria; Uganda.
34 SEEDS PER KILOGRAMME .	850,000-100,000
35 STORAGE .....	Ambient temperature for up to one year.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS ,	-
39 GERMINATION AND GROWTH	Germinates in 14-21 days. Plantable size in 3-4 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	None of importance reported.
<b>PRINCIPAL REFERENCES:</b> 23 39 49 155	

SPECIES: Nauclea diderrichii (De Wild. and Th. Dur.) Merrill

TAXONOMY:

- 1 FAMILY ..... Rubiaceae  
2 SYNONYMS ..... Sarcocephalus trillesii A. Chev.  
3 LOCAL OR TRADE NAMES . Opepe; Bilinga.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 5°S-10°N  
5 AREAS ..... West and Central tropical Africa.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-500 m  
7 MEAN ANNUAL RAINFALL . 2,000-4,500 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 22-26°C  
12 MEAN ANNUAL TEMP. .... 24-30°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Moderately free draining.  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 30-50 m; d = 90-150 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS -

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 3-10

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.C. 0.63-0.78  
25 NATURAL DURABILITY ... Very durable  
26 PRESERVATION ..... Fair  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Decorative; interlocked grain; contains an alkaloid potentially toxic to woodworkers; moderately termite resistant.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; boat building; marine timbers; flooring; furniture.  
31 ROUNDWOOD ..... Transmission poles; fuel (c.v. = 20,867 kg/kg) and charcoal; veneer/plywood.  
32 OTHER PRODUCTS ..... Bark used medicinally.

NURSERY:

- 33 SEED SOURCES ..... Most West African countries, especially Nigeria.  
34 SEEDS PER KILOGRAMME . 60,000-100,000  
35 STORAGE ..... -  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; striplings; stumps.  
38 SPECIAL REQUIREMENTS , Some shade required in first weeks.  
39 GERMINATION AND GROWTH Germinates in 14-18 days.  
Plantable size in 12 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Several different borers attack timber.

PRINCIPAL REFERENCES:

21 25 57 100 128 152 155

SPECIES: Ochroma pyramidale (Cav. ex Lam.) Urban

TAXONOMY:

- 1 FAMILY ..... Bombacaceae  
2 SYNONYMS ..... O. lagopus Sw.  
3 LOCAL OR TRADE NAMES , Balsa

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 20°S-19°N  
5 AREAS ..... Central America, West Indies and South America to Bolivia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,000 m  
7 MEAN ANNUAL RAINFALL , 1,500-3,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-25°C  
12 MEAN ANNUAL TEMP. .... 22-28°C

SOILS:

- 13 TEXTURE ..... Medium  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Better growth on fertile and deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 15-25 m; d = 60-70 cm  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Frost tender; shortlived.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 17-30

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.10-0.30  
25 NATURAL DURABILITY ... Perishable  
26 PRESERVATION ..... Fair  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Optimum growth rates essential to meet commercial density requirements of S.G. 0.10-0.17; most of commercial timber is sapwood.

UTILIZATION:

- 30 SAW TIMBER ..... Insulation and special.  
31 ROUNDWOOD ..... Shortfibre pulp.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Central America; Ecuador; Peru.  
34 SEEDS PER KILOGRAMME . 70,000-100,000  
35 STORAGE ..... Dry, cold and airtight for one-two years.  
36 PRE-TREATMENT ..... Boiling water till cool.  
37 PLANTING STOCK ..... Potted or direct sown.  
38 SPECIAL REQUIREMENTS . Requires 50% shade.  
39 GERMINATION AND GROWTH Germinates in 5-18 days.  
Plantable size in 3-4 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Very liable to fungal and insect attack via any damage to bark. Susceptible to damping off in the nursery.

PRINCIPAL REFERENCES:

4 5 25 52 57 100 109 152 169

SPECIES: Octomeles sumatrana Miq.

TAXONOMY:

- 1 FAMILY ..... Datisceaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Binuang; Erima.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 10°S-10°N  
5 AREAS ..... Indonesia, Philippines, New Guinea and Solomon Islands.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-500 m  
7 MEAN ANNUAL RAINFALL . 2,000-5,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-1 month  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 30-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-26°C  
12 MEAN ANNUAL TEMP. .... 24-30°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Better growth on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 40-50 m; d = 150-180 cm  
18 DESCRIPTION ..... Evergreen; buttressed.  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Moderately fire resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 25-40

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.27-0.47  
25 NATURAL DURABILITY ... Perishable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Difficult  
29 OTHER FEATURES ..... Very liable to stain and borers.

UTILIZATION:

- 30 SAW TIMBER ..... Boxes  
31 ROUNDWOOD ..... Plywood; fuelwood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Sabah; Solomon Islands; Papua New Guinea.  
34 SEEDS PER KILOGRAMME . 4,000,000  
35 STORAGE ..... Short viability.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH No information available on germination.  
Plantable size in 4 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Liable to severe attack by defoliators.

PRINCIPAL REFERENCES:

49 59

SPECIES: Parkia biglobosa (Jacq.) Benth.

TAXONOMY:

- 1 FAMILY ..... Mimosaceae
- 2 SYNONYMS ..... P. africana R.Br.
- 3 LOCAL OR TRADE NAMES , Locust bean tree; Nété.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 5-15°N
- 5 AREAS ..... Africa: Senegal to Ghana.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-300 m
- 7 MEAN ANNUAL RAINFALL , 400-1,500 mm
- 8 RAINFALL REGIME ..... Summer
- 9 DRY SEASON ..... 3-7 months
- 10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 28-40°C
- 11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 8-20°C
- 12 MEAN ANNUAL TEMP. .... 24-28°C

SOILS:

- 13 TEXTURE ..... -
- 14 REACTION ..... Acid
- 15 DRAINAGE ..... -
- 16 OTHER CHARACTERISTICS Latosols

SILVICULTURE:

- 17 SIZE ..... h = 15-20 m
- 18 DESCRIPTION ..... Deciduous; gnarled bole; dense crown.
- 19 FORM ..... Poor
- 20 LIGHT REQUIREMENTS ... -
- 21 OTHER CHARACTERISTICS Thick bark; bat pollinated.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.58-0.64
- 25 NATURAL DURABILITY ... Moderately durable
- 26 PRESERVATION ..... Easy
- 27 SAWING ..... Easy
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... Tough; liable to blue-stain.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes; furniture; tools.
- 31 ROUNDWOOD ..... Plywood; shortfibre pulp; matches; poles; fuelwood.
- 32 OTHER PRODUCTS ..... Crushed seeds are a valuable food; fodder (pods); tannin.

NURSERY:

- 33 SEED SOURCES ..... West Africa.
- 34 SEEDS PER KILOGRAMME , 5,000
- 35 STORAGE ..... -
- 36 PRE-TREATMENT ..... -
- 37 PLANTING STOCK ..... Budded onto rootstock; potted stock.
- 38 SPECIAL REQUIREMENTS , -
- 39 GERMINATION AND GROWTH 75% germination in 15 days. Slow growth.

PRINCIPAL PESTS AND DISEASES:

40 ..... -

PRINCIPAL REFERENCES:

SPECIES: Parkinsonia aculeata L.

TAXONOMY:

- 1 FAMILY ..... Caesalpinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES : Horsebean; Jerusalem thorn.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 10°S-30°N  
5 AREAS ..... Central and South America, from Texas to Peru.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,400 m  
7 MEAN ANNUAL RAINFALL . 250-800 mm  
8 RAINFALL REGIME ..... Winter/summer/uniform  
9 DRY SEASON ..... 6-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 22-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 18-24°C  
12 MEAN ANNUAL TEMP. .... 20-28°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates moderately saline soils but not waterlogging.

SILVICULTURE:

- 17 SIZE ..... h = 4-5 m  
18 DESCRIPTION ..... Deciduous/evergreen; spiny.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Aggressive coloniser; tolerates light frosts; drought hardy; short-lived; withstands heavy pruning or pollarding.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Windbreaks; anti-erosion; ornamental.

TIMBER:

- 24 DENSITY ..... S.G. 0.60  
25 NATURAL DURABILITY ... -  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fuel and charcoal.  
32 OTHER PRODUCTS ..... Fodder (pods and leaves).

NURSERY:

- 33 SEED SOURCES ..... Israel; Cyprus; Central and South America; USA.  
34 SEEDS PER KILOGRAMME , 12,000  
35 STORAGE ..... Ambient temperature for up to one year.  
36 PRE-TREATMENT ..... Soak in cold water for three-six days.  
37 PLANTING STOCK ..... Potted; root or shoot cuttings.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 10-14 days.  
Plantable size in 4-6 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... None of importance reported but young plants subject to termite damage.

PRINCIPAL REFERENCES:

69 71 94 95 121 134 152

SPECIES: Paulownia tomentosa Steud.

TAXONOMY:

- 1 FAMILY ..... Scrophulariaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Kiri; Royal Paulownia.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 32-40°N  
5 AREAS ..... Japan

CLIMATE:

- 6 ALTITUDINAL RANGE .... 500-1,200 m  
7 MEAN ANNUAL RAINFALL . 1,200-1,800 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 26-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 16-20°C  
12 MEAN ANNUAL TEMP, .... 20-24°C

SOILS:

- 13 TEXTURE ..... Medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Better growth on fertile and deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 12-16 m  
18 DESCRIPTION ..... Deciduous  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Windfirm; tolerates salt winds; frost resistant; drought hardy; requires wide spacing.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 25-35

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.45  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Tree requires pruning if timber is to meet high market specifications. Decorative.

UTILIZATION:

- 30 SAW TIMBER ..... Furniture  
31 ROUNDWOOD ..... -  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Root cuttings from Brazil and Japan. Seed from Argentina. Origin and species very important if timber is to be marketable.  
34 SEEDS PER KILOGRAMME . -  
35 STORAGE ..... -  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Cuttings  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 20-30 days. Plantable size in 4-5 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Reports of stem canker. Very liable to defoliator attacks including Atta ants.

PRINCIPAL REFERENCES:

115 127

SPECIES: Peltophorum pterocarpum (DC.) Heyne

TAXONOMY:

- 1 FAMILY ..... Caesalpinaceae  
2 SYNONYMS ..... P. ferrugineum (Decne.) Benth., P. inerme (Roxb.) Naves  
3 LOCAL OR TRADE NAMES , Jemerlang laut (Malaysia); Copper pod; Yellow flame.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 1-15°N  
5 AREAS ..... Sri Lanka; S. India; Malaysia.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,000 m  
7 MEAN ANNUAL RAINFALL . 1,000-1,800 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 32-36°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 9-16°C  
12 MEAN ANNUAL TEMP. .... 24-27°C

SOILS:

- 13 TEXTURE ..... Medium/light  
14 REACTION ..... -  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates poor soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-30 m  
18 DESCRIPTION ..... Spreading, ornamental tree. Deciduous.  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Coppices; windfirm; fast growing.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Shade in coffee and cacao plantations; reclamation of Imperata grasslands.

TIMBER:

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... -  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Hard

UTILIZATION:

- 30 SAW TIMBER ..... Boxes; furniture.  
31 ROUNDWOOD ..... Fuelwood  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Malaysia; Franca; Cambodia.  
34 SEEDS PER KILOGRAMME , 12,000-20,000  
35 STORAGE ..... -  
36 PRE-TREATMENT ..... Boiling water, soak till cool.  
37 PLANTING STOCK ..... Potted; stumps; large branch cuttings.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH 60-80% germination in 7 days.  
Plantable size in 5-6 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... -

PRINCIPAL REFERENCES:

SPECIES: Pericopsis elata (Harms) van Meeuwen

TAXONOMY:

- 1 FAMILY ..... Papilionaceae  
2 SYNONYMS ..... Afrormosia elata Harms  
3 LOCAL OR TRADE NAMES . Afrormosia; Kokrodua; Asamela.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 1-8°N  
5 AREAS ..... West and Central Africa: Ivory Coast, Ghana and Zaire.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 150-1,000 m  
7 MEAN ANNUAL RAINFALL . 750-1,500 mm  
8 RAINFALL REGIME ..... Bimodal (May/June and Sept./Oct.) to uniform.  
9 DRY SEASON ..... 2-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 30-35°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-23°C  
12 MEAN ANNUAL TEMP. .... 25-26°C

SOILS:

- 13 TEXTURE ..... Light  
14 REACTION ..... Neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates poor and eroded soils.

SILVICULTURE:

- 17 SIZE ..... h = 30-45 m; d = 90-180 cm  
18 DESCRIPTION ..... Deciduous; spreading crown; buttressed; fluted.  
19 FORM ..... Poor/acceptable  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Fixes nitrogen; substantial provenance variation; slow growing.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Taungya

TIMBER:

- 24 DENSITY ..... S.G. 0.62-0.85  
25 NATURAL DURABILITY ... Very durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy/fair  
28 SEASONING ..... Easy/fair  
29 OTHER FEATURES ..... Recognised teak-substitute; resists termites; sawdust irritates skin and eyes.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; boat-building; flooring; joinery; railway sleepers.  
31 ROUNDWOOD ..... Building poles; veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Ghana (viable seed difficult to obtain).  
34 SEEDS PER KILOGRAMME . 2,200-4,500  
35 STORAGE ..... Up to 3 months.  
36 PRE-TREATMENT ..... -  
37 PLANTING STOCK ..... Bare-rooted plants; direct sown; stem cuttings.  
38 SPECIAL REQUIREMENTS , Shade beneficial during germination.  
39 GERMINATION AND GROWTH Unreliable germination; up to 87% in 11-13 days.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Lamprosema lateritialis caterpillar defoliates nursery and plantation trees.

PRINCIPAL REFERENCES:

90 106

SPECIES: Pinus ayacahuite Ehrenb.

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Mexican white pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 14-21°N  
5 AREAS ..... Central America, from S. Mexico to Honduras.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,800-3,100 m  
7 MEAN ANNUAL RAINFALL , 1,200-2,500 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-24°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 6-12°C  
12 MEAN ANNUAL TEMP. .... 13-17°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on fertile and deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 30-35 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Moderately demanding  
21 OTHER CHARACTERISTICS Frost hardy

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 8-15

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.40-0.46  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Soft

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture; boxes.  
31 ROUNDWOOD ..... Longfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... Mexico; S. Africa.  
34 SEEDS PER KILOGRAMME , -  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH -

PRINCIPAL PESTS AND DISEASES:

40 ..... Generally very resistant.

PRINCIPAL REFERENCES:

4 30 34 52 53 110 114 152

SPECIES: Pinus brutia Ten.

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... P. halepensis var. brutia (Ten.) Elwes & Henry.  
3 LOCAL OR TRADE NAMES . -

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 33-45°N  
5 AREAS ..... N.E. Mediterranean, Cyprus, Turkey, Syria and Northern Iraq.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,500-2,500 m  
7 MEAN ANNUAL RAINFALL . 400-900 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 5-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-35°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-14°C  
12 MEAN ANNUAL TEMP, .... 15-20°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates shallow soils and is adaptable.

SILVICULTURE:

- 17 SIZE ..... h = 20-30 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Moderately fire resistant; termite resistant; very frost resistant. The closely related P. eldarica, originating from the Caucasus, is reported to be even more frost and drought resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 2-6

ROLE IN LAND USE:

23 ..... Windbreaks; anti-erosion.

TIMBER:

- 24 DENSITY ..... S.G. 0.50-0.60  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; furniture; boxes.  
31 ROUNDWOOD ..... Transmission poles; fence posts.  
32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... Cyprus; Israel; Turkey.  
34 SEEDS PER KILOGRAMME . 15,000-35,000  
35 STORAGE ..... Ambient temperature for one to two years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Germinates in 12-26 days.  
Plantable size in 18-24 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... The processionary caterpillar Thaumetopoea wilkinsoni is a major pest in the Mediterranean region.

PRINCIPAL REFERENCES:

30 34 71 84 95 152 154

SPECIES: Pinus canariensis C. Sm.

TAXONOMY:

- 1 FAMILY ..... Pinaceae
- 2 SYNONYMS ..... -
- 3 LOCAL OR TRADE NAMES . Canary Island pine

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 28-29°N
- 5 AREAS ..... Canary Islands.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,500-2,500 m
- 7 MEAN ANNUAL RAINFALL . 600-1,750 mm
- 8 RAINFALL REGIME ..... Winter/summer
- 9 DRY SEASON ..... 2-6 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 21-29°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 5-14°C
- 12 MEAN ANNUAL TEMP. .... 14-19°C

SOILS:

- 13 TEXTURE ..... Light/medium
- 14 REACTION ..... Neutral
- 15 DRAINAGE ..... Free draining
- 16 OTHER CHARACTERISTICS Growth better on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-30 m
- 18 DESCRIPTION ..... Evergreen
- 19 FORM ..... Acceptable
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Coppices; moderately fire resistant; tolerates salt winds; moderately frost resistant; drought hardy.

PRODUCTION:

- 22 VOLUME (M<sup>3</sup>/HA/AN) .... 8-18

ROLE IN LAND USE:

- 23 ..... Shade and shelter; windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 0.50-0.60
- 25 NATURAL DURABILITY ... Durable
- 26 PRESERVATION ..... Easy
- 27 SAWING ..... Easy
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... Ideal for transmission poles.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction.
- 31 ROUNDWOOD ..... Building poles; transmission poles; fuelwood.
- 32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... Spain; S. Africa; Australia; USA.
- 34 SEEDS PER KILOGRAMME . 8,000-9,000
- 35 STORAGE ..... Ambient temperature for several years.
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Potted; direct sown.
- 38 SPECIAL REQUIREMENTS . -
- 39 GERMINATION AND GROWTH Germinates in 18-21 days.  
Plantable size in 24 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Only major disease is attack by Dothistroma pini after hail damage. Liable to damping off.

PRINCIPAL REFERENCES:

- 30 34 71 84 128 133 152

SPECIES: Pinus caribaea Morelet var. bahamensis (Griseb.) Barr. & Golf.

TAXONOMY:

- 1 FAMILY ..... Pinaceae
- 2 SYNONYMS ..... -
- 3 LOCAL OR TRADE NAMES , Carribean pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 21-27°N
- 5 AREAS ..... Bahama Islands.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,000 m
- 7 MEAN ANNUAL RAINFALL , 1,000-1,500 mm
- 8 RAINFALL REGIME ..... Summer
- 9 DRY SEASON ..... 2-5 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 30-32°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 16-20°C
- 12 MEAN ANNUAL TEMP. .... 22-26°C

SOILS:

- 13 TEXTURE ..... Light
- 14 REACTION ..... Alkaline/neutral/acid
- 15 DRAINAGE ..... Free draining
- 16 OTHER CHARACTERISTICS Tolerates shallow soils.

SILVICULTURE:

- 17 SIZE ..... h = 15-20 m
- 18 DESCRIPTION ..... Evergreen
- 19 FORM ..... Exceptional
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Moderately windfirm; tolerates salt winds; frost tender.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-28

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.35-0.50
- 25 NATURAL DURABILITY ... Moderately durable
- 26 PRESERVATION ..... Easy
- 27 SAWING ..... Easy
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boat-building.
- 31 ROUNDWOOD ..... Transmission poles; fence posts; longfibre pulp; fuelwood (c.v. = 20,298 kJ/kg).
- 32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... Bahamas; Australia; Brazil.
- 34 SEEDS PER KILOGRAMME , 80,000-85,000
- 35 STORAGE ..... Dry, cold and airtight for several years.
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Potted
- 38 SPECIAL REQUIREMENTS , Mycorrhizae essential.
- 39 GERMINATION AND GROWTH Germinates in 8-20 days.  
Plantable size in 5-7 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... As for var. hondurensis. Damping off in nursery.

PRINCIPAL REFERENCES:

30 34 74 99 100 104 107 152

SPECIES: Pinus caribaea Morelet var. caribaea

TAXONOMY:	
1	FAMILY ..... Pinaceae
2	SYNONYMS ..... -
3	LOCAL OR TRADE NAMES , Carribean pine.
NATURAL OCCURRENCE:	
4	LATITUDES ..... 21-22.5°N
5	AREAS ..... Western Cuba and Isle of Pines.
CLIMATE:	
6	ALTITUDINAL RANGE .... 0-500 m
7	MEAN ANNUAL RAINFALL , 1,050-1,800 mm
8	RAINFALL REGIME ..... Summer
9	DRY SEASON ..... 2-4 months
10	MEAN MAX. TEMP. HOTTEST MONTH ..... 30-34°C
11	MEAN MIN. TEMP. COLDEST MONTH ..... 16-20°C
12	MEAN ANNUAL TEMP. .... 24-26°C
SOILS:	
13	TEXTURE ..... Light/medium
14	REACTION ..... Acid
15	DRAINAGE ..... Free draining
16	OTHER CHARACTERISTICS -
SILVICULTURE:	
17	SIZE ..... h = 20-27 m
18	DESCRIPTION ..... Evergreen
19	FORM ..... Exceptional
20	LIGHT REQUIREMENTS ... Strongly demanding
21	OTHER CHARACTERISTICS Tolerates salt winds; frost tender.

PRODUCTION:	
22	VOLUME (M <sup>3</sup> /HA/AN) .... 10-20
ROLE IN LAND USE:	
23	..... -
TIMBER:	
24	DENSITY ..... S.G. 0.35-0.50
25	NATURAL DURABILITY ... Moderately durable
26	PRESERVATION ..... Easy
27	SAWING ..... Easy
28	SEASONING ..... Easy
29	OTHER FEATURES ..... -
UTILIZATION:	
30	SAW TIMBER ..... Heavy construction; light construction; boat-building.
31	ROUNDWOOD ..... Transmission poles; fence posts; longfibre pulp; fuelwood (c.v. = 20,298 kJ/kg).
32	OTHER PRODUCTS ..... Resins
NURSERY:	
33	SEED SOURCES ..... Cuba; Australia.
34	SEEDS PER KILOGRAMME . 55,000-60,000
35	STORAGE ..... Dry, cold and airtight for several years.
36	PRE-TREATMENT ..... None
37	PLANTING STOCK ..... Potted
38	SPECIAL REQUIREMENTS , Mycorrhizae essential.
39	GERMINATION AND GROWTH Germinates in 8-21 days. Plantable size in 5-8 months.
PRINCIPAL PESTS AND DISEASES:	
40	..... As for var. <u>hondurensis</u> . Damping off in nursery.
PRINCIPAL REFERENCES: 30 34 52 74 99 100 104 107 114	

SPECIES: Pinus caribaea Morelet var. hondurensis (Sénécl.) Barr. & Golf.

TAXONOMY:	
1	FAMILY ..... Pinaceae
2	SYNONYMS ..... -
3	LOCAL OR TRADE NAMES , Carribean pine.
NATURAL OCCURRENCE:	
4	LATITUDES ..... 12-18°N
5	AREAS ..... Atlantic coast of Central America from Belize to N. Nicaragua.
CLIMATE:	
6	ALTITUDINAL RANGE .... 0-1,000 m
7	MEAN ANNUAL RAINFALL . 660-4,000 mm
8	RAINFALL REGIME ..... Summer
9	DRY SEASON ..... 0-6 months
10	MEAN MAX. TEMP. HOTTEST MONTH ..... 29-34°C
11	MEAN MIN. TEMP. COLDEST MONTH ..... 15-23°C
12	MEAN ANNUAL TEMP. .... 21-27°C
SOILS:	
13	TEXTURE ..... Light/medium
14	REACTION ..... Neutral/acid
15	DRAINAGE ..... Free draining; occasionally seasonally waterlogged
16	OTHER CHARACTERISTICS Better growth on moderately fertile soils.
SILVICULTURE:	
17	SIZE ..... h = 35-45 m
18	DESCRIPTION ..... Evergreen
19	FORM ..... Acceptable; variable between provenances.
20	LIGHT REQUIREMENTS ... Strongly demanding
21	OTHER CHARACTERISTICS Moderately fire resistant; tolerates salt winds; substantial provenance variation; frost tender.

PRODUCTION:	
22	VOLUME (M <sup>3</sup> /HA/AN) .... 10-40
ROLE IN LAND USE:	
23	..... -
TIMBER:	
24	DENSITY ..... S.G. 0.35-0.50
25	NATURAL DURABILITY ... Moderately durable
26	PRESERVATION ..... Easy
27	SAWING ..... Easy
28	SEASONING ..... Easy
29	OTHER FEATURES ..... -
UTILIZATION:	
30	SAW TIMBER ..... Heavy construction; light construction; boat-building.
31	ROUNDWOOD ..... Transmission poles; fence posts; longfibre pulp; fuelwood (c.v. = 20,290 kJ/kg).
32	OTHER PRODUCTS ..... Resins
NURSERY:	
33	SEED SOURCES ..... Honduras; Guatemala; Belize; S. Africa; Fiji; Australia.
34	SEEDS PER KILOGRAMME . 52,000-72,000
35	STORAGE ..... Dry, cold and airtight for several years.
36	PRE-TREATMENT ..... None
37	PLANTING STOCK ..... Potted
38	SPECIAL REQUIREMENTS , Mycorrhizae essential.
39	GERMINATION AND GROWTH Germinates in 8-21 days. Plantable size in 5-6 months.
PRINCIPAL PESTS AND DISEASES:	
40	..... Needle blight <u>Cercospora pini-densiflorae</u> can seriously attack exotic plantations. <u>Dendroctonus</u> beetles are major pests in Central America. Damping off in nursery.
PRINCIPAL REFERENCES:	
	4 30 34 52 74 99 100 104 107 109 110 128 133 152

SPECIES: Pinus chiapensis (Martínez) Andresen

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... Pinus strobus L. var. chiapensis (Martínez)  
3 LOCAL OR TRADE NAMES . -

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 15-20°N  
5 AREAS ..... Southern Mexico and Guatemala.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 600-1,800 m  
7 MEAN ANNUAL RAINFALL . 1,000-1,600 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 2-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-28°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 14-20°C  
12 MEAN ANNUAL TEMP, .... 17-23°C

SOILS:

- 13 TEXTURE ..... Light  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on fertile and deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 25-30 m  
18 DESCRIPTION ..... Evergreen; light, feathery crown.  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS -

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-30

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.40-0.45  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture; boxes.  
31 ROUNDWOOD ..... Longfibre pulp.  
32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... Mexico; Guatemala.  
34 SEEDS PER KILOGRAMME . 55,000-65,000  
35 STORAGE ..... Dry, cold and airtight for one to two years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS . Requires mycorrhizae.  
39 GERMINATION AND GROWTH Germinates in 12-30 days.  
Plantable size in 5-8 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported. Damping off in nursery.

PRINCIPAL REFERENCES:

4 30 34 52 53 100 152

SPECIES: Pinus eliottii Engelm. var. eliottii

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Slash pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 28-33°N  
5 AREAS ..... Coastal plains of South Eastern USA.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 500-2,500 m  
7 MEAN ANNUAL RAINFALL . 650-2,500 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 2-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 23-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-12°C  
12 MEAN ANNUAL TEMP. .... 15-24°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining; occasionally seasonally waterlogged  
16 OTHER CHARACTERISTICS Tolerates shallow soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-30 m; d = 60-100 cm  
18 DESCRIPTION ..... Evergreen; light crowned.  
19 FORM ..... Acceptable/exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Fire resistant; tolerates salt winds; frost resistant; drought hardy; termite resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-20

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.50-0.64  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes; boat-building.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; longfibre pulp; fuelwood.  
32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... USA; S. Africa; Australia.  
34 SEEDS PER KILOGRAMME . 27,000-34,000; or 14,500 plants/kg of seed.  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... Stratify in damp sand for thirty days.  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , Requires mycorrhizae.  
39 GERMINATION AND GROWTH Germinates in 15-20 days.  
Plantable size in 6-8 months.

PRINCIPAL PESTS AND

- DISEASES:  
40 ..... The most resistant pine to Diplodia pinea.  
Susceptible to damping off in nursery.

PRINCIPAL REFERENCES:

4 30 34 52 62 85 96 109 116 128 133  
142

SPECIES: Pinus greggii Engelm.

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... P. pseudopatula (Bois.) Hort.  
3 LOCAL OR TRADE NAMES . -

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 20-26°N  
5 AREAS ..... Mountains of Mexico.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,700-3,100 m  
7 MEAN ANNUAL RAINFALL . 650-800 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 3-5 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 16-24°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 5-10°C  
12 MEAN ANNUAL TEMP. .... 10-17°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on deep soils, but is adaptable.

SILVICULTURE:

- 17 SIZE ..... h = 15-18 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Frost resistant

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 5-13

ROLE IN LAND USE:

23 ..... Windbreaks

TIMBER:

- 24 DENSITY ..... S.G. 0.40-0.44  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Soft and weak timber.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes.  
31 ROUNDWOOD ..... Fence posts; longfibre pulp.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Mexico; S. Africa.  
34 SEEDS PER KILOGRAMME . 70,000-80,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH -

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

4 30 34 52 53 110 152

SPECIES: Pinus halepensis Mill.

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Aleppo pine

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 30-44°N  
5 AREAS ..... Throughout the Mediterranean, from Spain to Turkey.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,500-2,500 m  
7 MEAN ANNUAL RAINFALL , 400-800 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 5-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-10°C  
12 MEAN ANNUAL TEMP. .... 15-20°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Adaptable to most soil conditions including shallow soils and slightly saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 15-18 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Moderately fire resistant; termite resistant; tolerates salt winds; frost resistant; drought hardy; generally used for protection rather than production planting.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 5-11

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks; dune-fixation; anti-erosion.

TIMBER:

- 24 DENSITY ..... S.G. 0.50-0.53  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.  
31 ROUNDWOOD ..... Building poles; fence posts; fuelwood.  
32 OTHER PRODUCTS ..... Resins.

NURSERY:

- 33 SEED SOURCES ..... Most Mediterranean countries and Australia.  
34 SEEDS PER KILOGRAMME , 30,000-60,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted or direct sown.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 15-30 days.  
Plantable size in 12-18 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Susceptible to Diplodia pinea and heavily attacked by processionary caterpillar Thaumetopoea wilkinsoni in the Mediterranean.

PRINCIPAL REFERENCES:

4 30 34 52 71 84 95 121 128 134 152  
154

SPECIES: Pinus kesiya Royle ex Gordon

TAXONOMY:	
1 FAMILY .....	Pinaceae
2 SYNONYMS .....	<u>P. khasya</u> Royle; <u>P. insularis</u> Endl.
3 LOCAL OR TRADE NAMES	, Khasya pine; Khasi pine; Benguet pine.
NATURAL OCCURRENCE:	
4 LATITUDES .....	11-30°N
5 AREAS .....	Luzon Island, Philippines; India; Burma; Thailand, Vietnam.
CLIMATE:	
6 ALTITUDINAL RANGE ....	1,000-2,000 m
7 MEAN ANNUAL RAINFALL .	700-1,800 mm
8 RAINFALL REGIME .....	Summer
9 DRY SEASON .....	2-6 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	26-30°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	10-18°C
12 MEAN ANNUAL TEMP. ....	17-22°C
SOILS:	
13 TEXTURE .....	Light/medium/heavy
14 REACTION .....	Acid
15 DRAINAGE .....	Free draining
16 OTHER CHARACTERISTICS	-
SILVICULTURE:	
17 SIZE .....	h = 30-35 m; d = 80-120 cm
18 DESCRIPTION .....	Evergreen
19 FORM .....	Acceptable
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Termite resistant; substantial provenance variation; frost tender.

PRODUCTION:	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	10-30
ROLE IN LAND USE:	
23 .....	-
TIMBER:	
24 DENSITY .....	S.G. 0.50-0.72
25 NATURAL DURABILITY ...	Non-durable
26 PRESERVATION .....	Easy
27 SAWING .....	Easy
28 SEASONING .....	Easy
29 OTHER FEATURES .....	Good quality timber.
UTILIZATION:	
30 SAW TIMBER .....	Heavy construction; light construction; boxes.
31 ROUNDWOOD .....	Building poles; fuel (c.v. = 23,161 kJ/kg); veneer/plywood; longfibre pulp.
32 OTHER PRODUCTS .....	Resins
NURSERY:	
33 SEED SOURCES .....	India; Madagascar; Philippines; Thailand; Zambia.
34 SEEDS PER KILOGRAMME .	55,000-62,000; or 25,000 plants/kg of seed.
35 STORAGE .....	Dry, cold and airtight for several years.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS ,	Requires mycorrhizae.
39 GERMINATION AND GROWTH	Germinates in 8-10 days. Plantable size in 4-6 months.
PRINCIPAL PESTS AND DISEASES:	
40 .....	Liabile to <u>Dothistroma pini</u> attack in Africa and shoot borers in Asia. Damping off in nursery.
PRINCIPAL REFERENCES:	
	3 4 30 34 85 96 107 109 128 152

SPECIES: Pinus merkusii Jungh & de Vriese (continental provenances)

<b>TAXONOMY:</b>	
1 FAMILY .....	Pinaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES	Tenasserim pine; Merkus pine.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	11-21°N
5 AREAS .....	Mainland S.E. Asia from N.W. India to Cambodia.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-900 m
7 MEAN ANNUAL RAINFALL .	1,000-2,800 mm
8 RAINFALL REGIME .....	Summer
9 DRY SEASON .....	2-5 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	24-32°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	18-24°C
12 MEAN ANNUAL TEMP, ....	21-28°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium/heavy
14 REACTION .....	Acid
15 DRAINAGE .....	Free draining
16 OTHER CHARACTERISTICS	Adaptable to most soil conditions.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 30-40 m; d = 60-90 cm
18 DESCRIPTION .....	Evergreen
19 FORM .....	Exceptional
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Windfirm; fire resistant; termite resistant.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	8-18
<b>ROLE IN LAND USE:</b>	
23 .....	-
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.65-0.80
25 NATURAL DURABILITY ...	Moderately durable
26 PRESERVATION .....	Easy
27 SAWING .....	Easy
28 SEASONING .....	Easy
29 OTHER FEATURES .....	-
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Heavy construction; light construction; boxes.
31 ROUNDWOOD .....	Transmission poles; longfibre pulp; veneer/plywood; fuel (c.v. = 22,876 kJ/kg).
32 OTHER PRODUCTS .....	Resins
<b>NURSERY:</b>	
33 SEED SOURCES .....	Thailand.
34 SEEDS PER KILOGRAMME .	30,000-40,000
35 STORAGE .....	Short viability.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS .	Grass stage in seedling. Requires mycorrhizae.
39 GERMINATION AND GROWTH	Germinates in 10-12 days. Plantable size in 8-10 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	Less prone to shoot borer attack than <u>P. kesiya</u> . Susceptible to damping off in nursery.
<b>PRINCIPAL REFERENCES:</b>	
	29 30 34 107 152

SPECIES: Pinus merkusii Jungh & de Vriese (island provenances)

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Tenasserim pine; Merkus pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 3°S-5°N  
5 AREAS ..... Sumatra

CLIMATE:

- 6 ALTITUDINAL RANGE .... 800-1,600 m  
7 MEAN ANNUAL RAINFALL , 2,000-3,000 mm  
8 RAINFALL REGIME ..... Uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 16-22°C  
12 MEAN ANNUAL TEMP. .... 19-23°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Adaptable to most soil conditions.

SILVICULTURE:

- 17 SIZE ..... h = 50-60 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Termite resistant

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 12-27

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.58-0.80  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Frequent knots.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.  
31 ROUNDWOOD ..... Transmission poles; longfibre pulp; veneer/  
plywood; matches; fuelwood (c.v. = 22,876 kJ/kg).  
32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... Sumatra; Java.  
34 SEEDS PER KILOGRAMME , 60,000  
35 STORAGE ..... Dry for one to two years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , No grass stage. Requires mycorrhizae  
39 GERMINATION AND GROWTH Germinates in 10-12 days.  
Plantable size in 8 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Attacked by 'Looper' caterpillars in Indonesia.  
Damping off in nursery.

PRINCIPAL REFERENCES:

29 30 34 107 149 152

SPECIES: Pinus michoacana Martínez

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Michoacan pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 16-23°N  
5 AREAS ..... Central and Southern Mexico.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,000-2,300 m  
7 MEAN ANNUAL RAINFALL , 1,000-1,700 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 2-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-28°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 6-12°C  
12 MEAN ANNUAL TEMP, .... 14-21°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-25 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Moderately resistant to fire and frost.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 6-12

ROLE IN LAND USE:

23 ..... Windbreaks.

TIMBER:

- 24 DENSITY ..... S.G. 0.48-0.50  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.  
31 ROUNDWOOD ..... Transmission poles; longfibre pulp; veneer/  
plywood.  
32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... Mexico; S. Africa.  
34 SEEDS PER KILOGRAMME , 25,000-35,000  
35 STORAGE ..... Dry, cold and airtight for one to two years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH -

PRINCIPAL PESTS AND

DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

4 30 34 53 110 152

SPECIES: Pinus montezumae Lamb.

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Montezuma pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 14-23°N  
5 AREAS ..... Highlands of Mexico and Guatemala.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,400-3,000 m  
7 MEAN ANNUAL RAINFALL . 900-1,600 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 2-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 18-24°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-12°C  
12 MEAN ANNUAL TEMP. .... 11-18°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on fertile and deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 25-30 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding; moderately shade tolerant in youth.  
21 OTHER CHARACTERISTICS Moderately resistant to fire and frost.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 6-12

ROLE IN LAND USE:

23 ..... Windbreaks

TIMBER:

- 24 DENSITY ..... S.G. 0.40-0.50  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Knotty if not pruned.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.  
31 ROUNDWOOD ..... Fence posts; fuel and charcoal; longfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... Mexico; Guatemala; S. Africa.  
34 SEEDS PER KILOGRAMME . 35,000-50,000  
35 STORAGE ..... Dry, cold and airtight for one to two years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , Mycorrhizae required.  
39 GERMINATION AND GROWTH No information available on germination. Plantable size in 18-24 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

4 30 34 52 53 110 128 152

SPECIES: Pinus occidentalis Swartz

<b>TAXONOMY:</b>	
1 FAMILY .....	Pinaceae
2 SYNONYMS .....	<u>P. cubensis</u> Griseb.
3 LOCAL OR TRADE NAMES	West Indian pine.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	18-21°N
5 AREAS .....	Island of Hispaniola and Eastern Cuba.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-1,500 m
7 MEAN ANNUAL RAINFALL .	1,300-1,500 mm
8 RAINFALL REGIME .....	Summer
9 DRY SEASON .....	2-4 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	26-32°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	10-16°C
12 MEAN ANNUAL TEMP. ....	18-24°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium/heavy
14 REACTION .....	Acid
15 DRAINAGE .....	Free draining; moist.
16 OTHER CHARACTERISTICS	Adaptable to most soil conditions.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 25-35 m
18 DESCRIPTION .....	Evergreen; light crowned.
19 FORM .....	Exceptional
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Termite resistant

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	5-10
<b>ROLE IN LAND USE:</b>	
23 .....	-
<b>TIMBER:</b>	
24 DENSITY .....	-
25 NATURAL DURABILITY ...	Non-durable
26 PRESERVATION .....	Easy
27 SAWING .....	Easy
28 SEASONING .....	Easy
29 OTHER FEATURES .....	-
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Heavy construction; light construction; boxes.
31 ROUNDWOOD .....	Transmission poles; fence posts; longfibre pulp.
32 OTHER PRODUCTS .....	Resins
<b>NURSERY:</b>	
33 SEED SOURCES .....	Cuba; Dominican Republic; Haiti.
34 SEEDS PER KILOGRAMME .	35,000-40,000
35 STORAGE .....	-
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS .	Mycorrhizae required.
39 GERMINATION AND GROWTH	Plantable size in 10-12 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	None of importance reported. Susceptible to damping off in nursery.
<b>PRINCIPAL REFERENCES:</b>	
	30 34 52 152

SPECIES: Pinus oocarpa Schiede

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Ocoti pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 13-28°N  
5 AREAS ..... Central America, from North Mexico to Nicaragua.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,000-2,400 m  
7 MEAN ANNUAL RAINFALL , 750-1,500 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 2-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 8-16°C  
12 MEAN ANNUAL TEMP. .... 13-21°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates shallow soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-40 m  
18 DESCRIPTION ..... Evergreen; light crowned.  
19 FORM ..... Exceptional to poor (depending on provenance).  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Termite resistant; substantial provenance variation; slightly frost tender.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-40

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.45-0.60  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES..... -

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes.  
31 ROUNDWOOD ..... Transmission poles; fence posts; longfibre pulp.  
32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... B elize; Guatemala; Honduras; Nicaragua.  
34 SEEDS PER KILOGRAMME , 41,000-55,000  
35 STORAGE ..... Dry and cold for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , Mycorrhizae required.  
39 GERMINATION AND GROWTH Germinates in 14-21 days.  
Plantable size in 6-8 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Generally similar to P. caribaea var. hondurensis.

PRINCIPAL REFERENCES:

4 30 34 52 53 75 85 99 100 101 110 152

SPECIES: Pinus palustris Mill.

TAXONOMY:

- 1 FAMILY ..... Pinaceae
- 2 SYNONYMS ..... P. australis Michx.
- 3 LOCAL OR TRADE NAMES , Longleaf pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 27-36°N
- 5 AREAS ..... Atlantic and Gulf States of USA.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,500 m
- 7 MEAN ANNUAL RAINFALL , 1,000-2,000 mm
- 8 RAINFALL REGIME ..... Summer
- 9 DRY SEASON ..... 2-3 months
- 10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 27-31°C
- 11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 8-12°C
- 12 MEAN ANNUAL TEMP. .... 16-22°C

SOILS:

- 13 TEXTURE ..... Light/medium
- 14 REACTION ..... Acid
- 15 DRAINAGE ..... Free draining; moist.
- 16 OTHER CHARACTERISTICS Adaptable to most soil conditions.

SILVICULTURE:

- 17 SIZE ..... h = 25-30 m
- 18 DESCRIPTION ..... Evergreen; light crowned.
- 19 FORM ..... Acceptable
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Windfirm; moderately frost resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 6-12

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.54-0.58
- 25 NATURAL DURABILITY ... Moderately durable
- 26 PRESERVATION ..... Easy
- 27 SAWING ..... Easy
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... Suffers from resin checks.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes; boat building.
- 31 ROUNDWOOD ..... Transmission poles; fence posts; fuel and charcoal; longfibre pulp.
- 32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... USA; S. Africa.
- 34 SEEDS PER KILOGRAMME . 8,000-11,000
- 35 STORAGE ..... Dry, cold and airtight for several years.
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Potted
- 38 SPECIAL REQUIREMENTS . Seedlings with grass stage. Requires mycorrhizae.
- 39 GERMINATION AND GROWTH Germinates in 7-11 days. Plantable size in 12-18 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... None of importance reported. Susceptible to damping off in nursery.

PRINCIPAL REFERENCES:

4 30 34 62 116 133 152

SPECIES: Pinus patula Schiede and Deppe subsp. patula

TAXONOMY:

- 1 FAMILY ..... Pinaceae
- 2 SYNONYMS ..... -
- 3 LOCAL OR TRADE NAMES , Patula pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 18-20°N
- 5 AREAS ..... South Central Mexico.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,400-3,200 m
- 7 MEAN ANNUAL RAINFALL , 750-2,000 mm
- 8 RAINFALL REGIME ..... Summer
- 9 DRY SEASON ..... 0-3 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-29°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 6-12°C
- 12 MEAN ANNUAL TEMP. .... 12-18°C

SOILS:

- 13 TEXTURE ..... Light/medium
- 14 REACTION ..... Neutral/acid
- 15 DRAINAGE ..... Free draining; moist.
- 16 OTHER CHARACTERISTICS Better growth on deep soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-30 m
- 18 DESCRIPTION ..... Evergreen
- 19 FORM ..... Acceptable/exceptional
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Moderately frost resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 15-40

ROLE IN LAND USE:

23 ..... Windbreaks

TIMBER:

- 24 DENSITY ..... S.G. 0.38-0.50
- 25 NATURAL DURABILITY ... Non-durable
- 26 PRESERVATION ..... Easy
- 27 SAWING ..... Easy
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... Light and of only moderate strength.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes.
- 31 ROUNDWOOD ..... Transmission poles; fence posts; longfibre pulp.
- 32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Most Eastern and Southern African countries and Mexico
- 34 SEEDS PER KILOGRAMME , 100,000-140,000; or 69,000 plants/kg of seed.
- 35 STORAGE ..... Dry, cold and airtight for several years.
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Potted; bare-rooted plants.
- 38 SPECIAL REQUIREMENTS , Requires mycorrhizae.
- 39 GERMINATION AND GROWTH Germinates in 15-16 days.  
6-12 months in nursery.

PRINCIPAL PESTS AND DISEASES:

- 40 ..... Attack by Diplodia pinea causing cankers and dieback. Susceptible to damping off in nursery.

PRINCIPAL REFERENCES:

4 30 34 52 53 109 128 133 152 175

SPECIES: Pinus patula subsp. tecumanii (Schwerdt.) Mittak & Styles

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... Formerly thought to be some southern provenance of P. oocarpa.  
3 LOCAL OR TRADE NAMES .

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 12-19°N  
5 AREAS ..... Guatemala; Honduras; Nicaragua.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,000-2,500 m  
7 MEAN ANNUAL RAINFALL . 1,000-3,000 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 2-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 22-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 10-18°C  
12 MEAN ANNUAL TEMP. .... 15-23°C

SOILS:

- 13 TEXTURE ..... Medium/light  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Deep

SILVICULTURE:

- 17 SIZE ..... h = 40-55 m  
18 DESCRIPTION ..... Evergreen; light crowned.  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Drought susceptible on shallow soils; frost tender.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.41-0.57 (increases with age).  
25 NATURAL DURABILITY ... Poor; attacked by borers and termites.  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Frequent knots. Relatively low resin content for Pinus species.

UTILIZATION:

- 30 SAW TIMBER ..... Light structural uses; flooring; vehicles; food containers; furniture; boxes.  
31 ROUNDWOOD ..... Veneer/plywood; pulp; particleboard; poles; turnery.  
32 OTHER PRODUCTS .....

NURSERY:

- 33 SEED SOURCES ..... Honduras; Guatemala; Nicaragua.  
34 SEEDS PER KILOGRAMME . 90,000  
35 STORAGE ..... Dry, cold, sealed.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH -

PRINCIPAL PESTS AND

DISEASES:

40 ..... Similar to Pinus patula subsp. patula.

PRINCIPAL REFERENCES:

SPECIES: Pinus pinaster Aiton (Portuguese provenances)

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... P. maritima Poir.  
3 LOCAL OR TRADE NAMES , Maritime pine; Cluster pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 38-42°N  
5 AREAS ..... Portugal

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,400-2,500 m  
7 MEAN ANNUAL RAINFALL , 625-1,300 mm  
8 RAINFALL REGIME ..... Winter/uniform  
9 DRY SEASON ..... 1-3 months  
10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 21-30°C  
11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 3-13°C  
12 MEAN ANNUAL TEMP. .... 12-18°C

SOILS:

- 13 TEXTURE ..... Light  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates shallow soil and is adaptable to most soil conditions.

SILVICULTURE:

- 17 SIZE ..... h = 20-30 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Windfirm; moderately tolerant of salt winds and frost.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 12-24

ROLE IN LAND USE:

23 ..... Windbreaks; dune fixation.

TIMBER:

- 24 DENSITY ..... S.G. 0.45-0.48  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; longfibre pulp; fuel (c.v. = 20,176 kJ/kg).  
32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... Portugal; Australia.  
34 SEEDS PER KILOGRAMME , 14,000-26,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; direct sown; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , Requires mycorrhizae.  
39 GERMINATION AND GROWTH Germinates in 24-30 days.  
Plantable size in 12-18 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... None of importance reported. Susceptible to damping off in nursery.

PRINCIPAL REFERENCES:

4 30 34 52 71 84 128 133 152

SPECIES: Pinus pinea L.

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Umbrella or Stone pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 33-44°N  
5 AREAS ..... Iberian peninsula; N. and E. Mediterranean.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,500-2,500 m  
7 MEAN ANNUAL RAINFALL . 400-800 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 4-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 25-35°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-14°C  
12 MEAN ANNUAL TEMP. .... 14-18°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates shallow soils.

SILVICULTURE:

- 17 SIZE ..... h = 15-25 m  
18 DESCRIPTION ..... Evergreen; open-crowned.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Fire resistant; termite resistant; tolerates salt winds; moderately frost resistant; drought hardy; requires wide spacing.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 3-5

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks; dune fixation; anti-erosion.

TIMBER:

- 24 DENSITY ..... S.G. 0.50  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes.  
31 ROUNDWOOD ..... Fence posts; fuel and charcoal.  
32 OTHER PRODUCTS ..... Edible seeds.

NURSERY:

- 33 SEED SOURCES ..... Most Mediterranean countries.  
34 SEEDS PER KILOGRAMME . 1,200-1,400  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... Soak in cold water for one to two days.  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Germinates in 13-23 days.  
Plantable size in 18-24 months.

PRINCIPAL PESTS AND

DISEASES:

- 40 ..... Heavily attacked by processionary caterpillar Thaumetopoea wilkinsoni in Mediterranean region.  
Susceptible to damping off in nursery.

PRINCIPAL REFERENCES:

4 30 34 71 84 95 152

SPECIES: Pinus ponderosa Dougl. var. arizonica (Engelm.) Shaw

TAXONOMY:

- 1 FAMILY ..... Pinaceae
- 2 SYNONYMS ..... P. arizonica Engelm.
- 3 LOCAL OR TRADE NAMES . Ponderosa pine

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 23-35°N
- 5 AREAS ..... New Mexico, Arizona and Northern Mexico.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 2,000-3,000 m
- 7 MEAN ANNUAL RAINFALL . 650-900 mm
- 8 RAINFALL REGIME ..... Summer
- 9 DRY SEASON ..... 1-4 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 16-24 °C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-4 °C
- 12 MEAN ANNUAL TEMP. .... 8-15 °C

SOILS:

- 13 TEXTURE ..... Light/medium
- 14 REACTION ..... Alkaline/neutral/acid
- 15 DRAINAGE ..... Free draining
- 16 OTHER CHARACTERISTICS Tolerates shallow soils.

SILVICULTURE:

- 17 SIZE ..... h = 25-30 m
- 18 DESCRIPTION ..... Evergreen
- 19 FORM ..... Acceptable
- 20 LIGHT REQUIREMENTS .. Strongly demanding; shade tolerant in youth.
- 21 OTHER CHARACTERISTICS Fire resistant; windfirm; frost resistant.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 5-20

ROLE IN LAND USE:

23 ..... Windbreaks; anti-erosion.

TIMBER:

- 24 DENSITY ..... S.G. 0.48-0.54
- 25 NATURAL DURABILITY ... Non-durable
- 26 PRESERVATION ..... Easy
- 27 SAWING ..... Easy
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.
- 31 ROUNDWOOD ..... Transmission poles; fence posts; fuel and charcoal; longfibre pulp; veneer/plywood.
- 32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... USA; Mexico; Argentina.
- 34 SEEDS PER KILOGRAMME . 22,000-25,000
- 35 STORAGE ..... Dry, cold and airtight for several years.
- 36 PRE-TREATMENT ..... Stratify in damp sand for thirty days.
- 37 PLANTING STOCK ..... Potted; bare-rooted plants.
- 38 SPECIAL REQUIREMENTS . Mycorrhizae sometimes important.
- 39 GERMINATION AND GROWTH Germinates in 11-20 days.  
Plantable size in 24 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

4 30 34 49 52 71 107 152

SPECIES: Pinus pseudostrobus Lindl.

<b>TAXONOMY:</b>	
1	FAMILY ..... Pinaceae
2	SYNONYMS ..... -
3	LOCAL OR TRADE NAMES . Pino blanco
<b>NATURAL OCCURRENCE:</b>	
4	LATITUDES ..... 14-26°N
5	AREAS ..... Highlands of Mexico, Guatemala and Honduras.
<b>CLIMATE:</b>	
6	ALTITUDINAL RANGE .... 1,300-2,800 m
7	MEAN ANNUAL RAINFALL . 1,000-1,500 mm
8	RAINFALL REGIME ..... Summer/uniform
9	DRY SEASON ..... 0-3 months
10	MEAN MAX. TEMP. HOTTEST MONTH ..... 20-26°C
11	MEAN MIN. TEMP. COLDEST MONTH ..... 6-12°C
12	MEAN ANNUAL TEMP. .... 13-18°C
<b>SOILS:</b>	
13	TEXTURE ..... Medium/heavy
14	REACTION ..... Neutral/acid
15	DRAINAGE ..... Free draining
16	OTHER CHARACTERISTICS -
<b>SILVICULTURE:</b>	
17	SIZE ..... h = 25-35 m
18	DESCRIPTION ..... Evergreen
19	FORM ..... Exceptional
20	LIGHT REQUIREMENTS ... Moderately demanding
21	OTHER CHARACTERISTICS Moderately frost hardy; substantial provenance variation.

<b>PRODUCTION:</b>	
22	VOLUME (M <sup>3</sup> /HA/AN) .... 15-30
<b>ROLE IN LAND USE:</b>	
23	..... -
<b>TIMBER:</b>	
24	DENSITY ..... S.G. 0.40-0.50
25	NATURAL DURABILITY ... Non-durable
26	PRESERVATION ..... Easy
27	SAWING ..... Easy
28	SEASONING ..... Easy
29	OTHER FEATURES ..... Knotty unless pruned.
<b>UTILIZATION:</b>	
30	SAW TIMBER ..... Light construction; boxes.
31	ROUNDWOOD ..... Fence posts; fuel and charcoal; longfibre pulp.
32	OTHER PRODUCTS ..... Resins
<b>NURSERY:</b>	
33	SEED SOURCES ..... Mexico; Guatemala; Honduras; S. Africa.
34	SEEDS PER KILOGRAMME . 50,000-60,000
35	STORAGE ..... Dry, cold and airtight for several years.
36	PRE-TREATMENT ..... None
37	PLANTING STOCK ..... Potted
38	SPECIAL REQUIREMENTS . Protect from frost in nursery.
39	GERMINATION AND GROWTH High germination percentage in 14-21 days. Plantable size in 15-18 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40	..... Probably as susceptible as <u>P. patula</u> to attack by <u>Diplodia pinea</u> . Susceptible to damping off in nursery.
<b>PRINCIPAL REFERENCES:</b> 30 34 52 53 85 110 128 133 152	

SPECIES: Pinus radiata D. Don

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... P. insignis Dougl.  
3 LOCAL OR TRADE NAMES , Radiata; Monterey pine.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 35-37°N  
5 AREAS ..... Isolated localities on the Californian coast.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,500-3,000 m  
7 MEAN ANNUAL RAINFALL , 650-1,600 mm  
8 RAINFALL REGIME ..... Winter/uniform  
9 DRY SEASON ..... 2-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 2-12°C  
12 MEAN ANNUAL TEMP. .... 11-18°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 25-35 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Moderately demanding  
21 OTHER CHARACTERISTICS Tolerates salt winds; drought hardy; frost tender.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 12-30 or more

ROLE IN LAND USE:

23 ..... Windbreaks

TIMBER:

- 24 DENSITY ..... S.G. 0.38-0.50  
25 NATURAL DURABILITY ... -  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; longfibre pulp; veneer/plywood; fuelwood (c.v. = 20,469 kJ/kg).  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Australia; Chile; New Zealand; Spain; S. Africa; USA.  
34 SEEDS PER KILOGRAMME . 33,000-50,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , Requires mycorrhizae.  
39 GERMINATION AND GROWTH Germination is rapid and uniform. Plantable size in 12 months or less.

PRINCIPAL PESTS AND DISEASES:

- 40 ..... Attack by Diplodia pinea can be very serious causing death of tree. Susceptible to damping off in nursery.

PRINCIPAL REFERENCES:

4 30 34 51 52 62 71 128 134 148 152 160

SPECIES: Pinus roxburghii Sarg.

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... P. longifolia Roxb.  
3 LOCAL OR TRADE NAMES , Chir pine

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 26-35°N  
5 AREAS ..... The Himalayas, from Afghanistan to Bhutan.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,200-2,500 m  
7 MEAN ANNUAL RAINFALL , 750-1,100 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 2-4 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-12°C  
12 MEAN ANNUAL TEMP. .... 12-20°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates shallow soils.

SILVICULTURE:

- 17 SIZE ..... h = 30-35 m  
18 DESCRIPTION ..... Evergreen; open crowned.  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Fire resistant; frost resistant; drought hardy.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 7-14

ROLE IN LAND USE:

23 ..... Anti-erosion

TIMBER:

- 24 DENSITY ..... S.G. 0.45-0.55  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Spiral grain

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; boxes.  
31 ROUNDWOOD ..... Building poles; fence posts; longfibre pulp.  
32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... India; Pakistan; Nepal; S. Africa.  
34 SEEDS PER KILOGRAMME , 11,000-13,000  
35 STORAGE ..... Dry, cold and airtight for several years.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; direct sown; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 25-30 days.  
Plantable size in 24 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

30 34 128 133 152 154

SPECIES: Pinus taeda L.

TAXONOMY:

- 1 FAMILY ..... Pinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Loblolly pine

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 28-29°N  
5 AREAS ..... Eastern and South-Eastern USA.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,300-2,400 m  
7 MEAN ANNUAL RAINFALL , 900-2,200 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 0-2 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-25°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-18°C  
12 MEAN ANNUAL TEMP, .... 14-20°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Acid  
15 DRAINAGE ..... Moist; seasonally waterlogged.  
16 OTHER CHARACTERISTICS -

SILVICULTURE:

- 17 SIZE ..... h = 40-50 m  
18 DESCRIPTION ..... Evergreen  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Frost resistant; substantial provenance variation.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 12-30

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.47-0.51  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Easy  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; boxes.  
31 ROUNDWOOD ..... Transmission poles; longfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... Resins

NURSERY:

- 33 SEED SOURCES ..... USA; Australia; New Zealand; S. Africa.  
34 SEEDS PER KILOGRAMME . 35,000-40,000; or 20,000 plants/kg of seed.  
35 STORAGE ..... Dry, cold and airtight for several yeras.  
36 PRE-TREATMENT ..... Stratify in damp sand for sixty days.  
37 PLANTING STOCK ..... Potted; bare-rooted plants.  
38 SPECIAL REQUIREMENTS . Requires mycorrhizae.  
39 GERMINATION AND GROWTH Germinates in 18-22 days.  
Plantable size in 12 months.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Canker forming rust Cronartium fusiforme in USA.  
Resistant to Diplodia pinea.

PRINCIPAL REFERENCES:

4 30 34 62 116 128 133 152 165

SPECIES: Populus deltoides Bartr. var. deltoides

<b>TAXONOMY:</b>	
1 FAMILY .....	Salicaceae
2 SYNONYMS .....	<u>P. deltoides</u> Bartr. var. <u>missouriensis</u> (Henry) Henry.
3 LOCAL OR TRADE NAMES .	Carolina poplar; Eastern cottonwood.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	30-50°N
5 AREAS .....	The Missouri-Mississippi basin of USA.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	2,000-3,000 m
7 MEAN ANNUAL RAINFALL .	1,200-3,000 mm
8 RAINFALL REGIME .....	Uniform
9 DRY SEASON .....	0-1 month
10 MEAN MAX. TEMP. HOTTEST MONTH .....	22-30°C
11 MEAN MIN. TEMP. COLDEST MONTH .....	2-12°C
12 MEAN ANNUAL TEMP. ....	12-16°C
<b>SOILS:</b>	
13 TEXTURE .....	Medium
14 REACTION .....	Neutral/moderately acid
15 DRAINAGE .....	Free draining; moist; occasionally seasonally waterlogged.
16 OTHER CHARACTERISTICS	Better growth on fertile and deep soils; tolerates slightly saline soils.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 25-30 m
18 DESCRIPTION .....	Deciduous
19 FORM .....	Acceptable
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Frost resistant; root suckers vigorously; substantial provenance variation; requires wide spacing.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	20-40
<b>ROLE IN LAND USE:</b>	
23 .....	Shade and shelter; windbreaks; ornamental; erosion control.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.37-0.43
25 NATURAL DURABILITY ...	Non-durable
26 PRESERVATION .....	Difficult
27 SAWING .....	Easy
28 SEASONING .....	Fair
29 OTHER FEATURES .....	Soft, mainly used for matchmaking.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Boxes
31 ROUNDWOOD .....	Shortfibre pulp; veneer/plywood; matches; fuelwood (c.v. = 19,949 kJ/kg).
32 OTHER PRODUCTS .....	Fodder
<b>NURSERY:</b>	
33 SEED SOURCES .....	USA; Argentina.
34 SEEDS PER KILOGRAMME .	770,000
35 STORAGE .....	Short viability
36 PRE-TREATMENT .....	-
37 PLANTING STOCK .....	Cuttings; bare-rooted plants.
38 SPECIAL REQUIREMENTS .	Sow uncovered.
39 GERMINATION AND GROWTH	Germinates in 1-4 days. Rapid growth in nursery. Cuttings plantable size after 6 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	Susceptible to defoliators and leaf rusts. Borers cause degrade of timber. Susceptible to damping off in nursery.
<b>PRINCIPAL REFERENCES:</b>	
	4 16 50 62 128 133 134 152 160 162

SPECIES: Prosopis chilensis (Mol.) Stunz

TAXONOMY:

- 1 FAMILY ..... Mimosaceae
- 2 SYNONYMS ..... -
- 3 LOCAL OR TRADE NAMES , Algarrobo blanco; Algarrobo de Chile.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 25-15°C
- 5 AREAS ..... Pacific coast of South America from southern Peru to central Chile.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,500 m
- 7 MEAN ANNUAL RAINFALL . 200-600 mm
- 8 RAINFALL REGIME ..... Winter/summer
- 9 DRY SEASON ..... 8-10 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 22-30°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 10-20°C
- 12 MEAN ANNUAL TEMP. .... 15-25°C

SOILS:

- 13 TEXTURE ..... Light/medium
- 14 REACTION ..... Alkaline/neutral
- 15 DRAINAGE ..... Free draining
- 16 OTHER CHARACTERISTICS Poor soils

SILVICULTURE:

- 17 SIZE ..... h = 5-15 m
- 18 DESCRIPTION ..... Evergreen; spiny.
- 19 FORM ..... Poor
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Aggressive colonizer; drought hardy.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Shade and shelter; ornamental; erosion control.

TIMBER:

- 24 DENSITY ..... S.G. 0.80-0.92
- 25 NATURAL DURABILITY ... Durable
- 26 PRESERVATION ..... -
- 27 SAWING ..... Easy
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... -
- 31 ROUNDWOOD ..... Fuel and charcoal; fenceposts; turnery.
- 32 OTHER PRODUCTS ..... Fodder (pods).

NURSERY:

- 33 SEED SOURCES ..... Peru; Chile; Hawaii.
- 34 SEEDS PER KILOGRAMME . 35,000
- 35 STORAGE ..... Without difficulty at ambient temperature.
- 36 PRE-TREATMENT ..... Boiling water till cool.
- 37 PLANTING STOCK ..... Potted; direct sown.
- 38 SPECIAL REQUIREMENTS . -
- 39 GERMINATION AND GROWTH Germinates in 3-4 days.  
Plantable size in 4 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Seed crop often badly damaged by beetles.

PRINCIPAL REFERENCES:

52 69 71 121

SPECIES: Prosopis cineraria (L.) Druce

**TAXONOMY:**

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... P. spicigera L.  
3 LOCAL OR TRADE NAMES . Jand (Punjab); Ghaf (Arabia); Shumi; Khejri (India).

**NATURAL OCCURRENCE:**

- 4 LATITUDES ..... 10-30°N  
5 AREAS ..... India and the Near East.

**CLIMATE:**

- 6 ALTITUDINAL RANGE .... 0-600 m  
7 MEAN ANNUAL RAINFALL . 400-800 mm  
8 RAINFALL REGIME ..... Summer/winter  
9 DRY SEASON ..... 6-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 40-50°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... -4-6°C  
12 MEAN ANNUAL TEMP. .... 21-28°C

**SOILS:**

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Neutral/alkaline  
15 DRAINAGE ..... Free draining; seasonally waterlogged.  
16 OTHER CHARACTERISTICS Tolerates high alkalinity and some salinity.

**SILVICULTURE:**

- 17 SIZE ..... h = 8-10 m; d = 120-160 cm  
18 DESCRIPTION ..... Shortly deciduous; spiny; xerophilous.  
19 FORM ..... Poor unless pruned.  
20 LIGHT REQUIREMENTS ... Strongly light demanding.  
21 OTHER CHARACTERISTICS Aggressive coloniser; coppices; fixes nitrogen; drought hardy; pollards; casts little shade during growing season; frost resistant; root suckers vigorously.

**PRODUCTION:**

22 VOLUME (M<sup>3</sup>/HA/AN) .... 2.9-11.4

**ROLE IN LAND USE:**

23 ..... Agroforestry; soil improver; erosion control; dune fixation.

**TIMBER:**

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Hard

**UTILIZATION:**

- 30 SAW TIMBER ..... Construction; boat-building.  
31 ROUNDWOOD ..... Fence posts; fuel (c.v. = 16,800-20,400 kJ/kg) and charcoal; tools.  
32 OTHER PRODUCTS ..... Fodder (leaves lopped in winter); edible pods.

**NURSERY:**

- 33 SEED SOURCES ..... India; Pakistan; Netherlands.  
34 SEEDS PER KILOGRAMME . 10,000-28,000  
35 STORAGE ..... Dry for several years.  
36 PRE-TREATMENT ..... Mechanical scarification or soak in water 24 hrs.  
37 PLANTING STOCK ..... Direct sown; bare-rooted plants.  
38 SPECIAL REQUIREMENTS . Care of taproot. Irrigate.  
39 GERMINATION AND GROWTH 50-90% germination in two weeks. Plantable size in 2 months.

**PRINCIPAL PESTS AND DISEASES:**

40 ..... Locust attack reported.

**PRINCIPAL REFERENCES:**

SPECIES: Prosopis juliflora (Sw.) DC.

TAXONOMY:

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... Mimosa juliflora Swartz  
3 LOCAL OR TRADE NAMES , Mesquite; Algarrobo.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 4°S-35°N  
5 AREAS ..... Southern Western USA through Central America to Ecuador.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,000 m  
7 MEAN ANNUAL RAINFALL . 150-1,200 mm  
8 RAINFALL REGIME ..... Winter/summer  
9 DRY SEASON ..... 6-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 22-34°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 14-22°C  
12 MEAN ANNUAL TEMP. .... 16-28°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates moderately saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 5-10 m  
18 DESCRIPTION ..... Evergreen; spiny.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Aggressive coloniser; coppices; root suckers vigorously; drought hardy; competes strongly with ground flora; 10-15 year rotation for fuelwood.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 3-9

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks; dune fixation; anti-erosion.

TIMBER:

- 24 DENSITY ..... S.G. 0.70  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Tough

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fence posts; fuel (c.v. = 17,710 kJ/kg) and charcoal.  
32 OTHER PRODUCTS ..... Fodder (pods); 6-7 tonnes/ha/an; honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Available throughout its natural range.  
34 SEEDS PER KILOGRAMME . 20,000-26,000  
35 STORAGE ..... Without difficulty; ambient temperature.  
36 PRE-TREATMENT ..... Boiling water till cool.  
37 PLANTING STOCK ..... Potted; direct sown; stumps.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH 80-90% germination in 5-6 days.  
Plantable size in 3-4 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Seed crop often badly damaged by beetles.

PRINCIPAL REFERENCES:

52 71 95 107 109 120 121 152

SPECIES: Prosopis tamarugo F. Phil.

TAXONOMY:

- 1 FAMILY ..... Mimosaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Tamarugo

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 21-18°S  
5 AREAS ..... Northern Chile

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,000-2,500 m  
7 MEAN ANNUAL RAINFALL . 100-300 mm  
8 RAINFALL REGIME ..... Winter/summer  
9 DRY SEASON ..... 8-10 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 24-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... -1-+5°C  
12 MEAN ANNUAL TEMP. .... 15-18°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Seasonally waterlogged  
16 OTHER CHARACTERISTICS Tolerates highly saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 8-12 m  
18 DESCRIPTION ..... Deciduous  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Aggressive coloniser in less harsh climates; coppices; drought hardy; root exudate acts as natural herbicide preventing growth of nearby plants.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 2-4

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks; erosion control.

TIMBER:

- 24 DENSITY ..... S.G. 0.80  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Tough

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fence posts; fuel and charcoal.  
32 OTHER PRODUCTS ..... Fodder

NURSERY:

- 33 SEED SOURCES ..... Chile  
34 SEEDS PER KILOGRAMME , 65,000-75,000  
35 STORAGE ..... Without difficulty; ambient temperature.  
36 PRE-TREATMENT ..... Boiling water till cool; or cold water soak for 48 hours; or conc. H<sub>2</sub>SO<sub>4</sub> for 7 minutes.  
37 PLANTING STOCK ..... Bare rooted plants; potted.  
38 SPECIAL REQUIREMENTS , Care of long taproot. In surface-saline soils, plant in 40 cm deep pits.  
39 GERMINATION AND GROWTH Germination 35-45%. Plantable size in 3-6 months. Requires regular irrigation in first year when planted at minimum rainfall level.

PRINCIPAL PESTS AND

DISEASES:

40 ..... Seed frequently attacked by beetles.

PRINCIPAL REFERENCES:

52 71 80 95 120 121

SPECIES: Robinia pseudoacacia L.

TAXONOMY:

- 1 FAMILY ..... Papilionaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES . Black locust; False Acacia.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 34-40°N  
5 AREAS ..... Appalachian and Ozark regions of USA.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,500-2,500 m  
7 MEAN ANNUAL RAINFALL . 500-700 mm  
8 RAINFALL REGIME ..... Winter/summer  
9 DRY SEASON ..... 2-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 25-35°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 0-5°C  
12 MEAN ANNUAL TEMP. .... 10-18°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining; moist.  
16 OTHER CHARACTERISTICS Tolerates slightly saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 20-25 m  
18 DESCRIPTION ..... Deciduous; spiny.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Aggressive coloniser; coppices; tolerates salt winds; fixes nitrogen; root suckers vigorously; drought hardy.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 4-10(-20)

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks; dune fixation; anti-erosion; ornamental.

TIMBER:

- 24 DENSITY ..... S.G. 0.70-0.80  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Fair  
29 OTHER FEATURES ..... Good bending properties; resists termites.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction  
31 ROUNDWOOD ..... Fence posts; fuel and charcoal; fibreboard; veneer/plywood.  
32 OTHER PRODUCTS ..... Fodder (pods and leaves); honeyflora.

NURSERY:

- 33 SEED SOURCES ..... USA; Isreal and many warm temperate areas.  
34 SEEDS PER KILOGRAMME . 35,000-70,000  
35 STORAGE ..... Dry, ambient temperature for several years. Boiling water till cool; or conc. sulphuric acid for 20 minutes.  
36 PRE-TREATMENT .....  
37 PLANTING STOCK ..... Potted; cuttings.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH 70-90% germination in 10-20 days. Plantable size in 6-12 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

16 52 57 62 71 84 95 134 152

SPECIES: Roseodendron donnell-smithii (Rose) Miranda

<b>TAXONOMY:</b>	
1 FAMILY .....	Bignoniaceae
2 SYNONYMS .....	<u>Tabebuia donnell-smithii</u> Rose; <u>Cybistax donnell-smithii</u> (Rose) Seibert
3 LOCAL OR TRADE NAMES	, Primavera
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	13-17°N
5 AREAS .....	Southern Mexico and Pacific coast of Guatemala.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-600 m
7 MEAN ANNUAL RAINFALL .	1,000-3,000 mm
8 RAINFALL REGIME .....	Summer
9 DRY SEASON .....	2-3 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	23-31°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	17-23°C
12 MEAN ANNUAL TEMP. ....	23-28°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Free draining
16 OTHER CHARACTERISTICS	Better growth on deep soils.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 25-33; d = 60-100 cm
18 DESCRIPTION .....	Deciduous
19 FORM .....	Exceptional
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Coppices.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	20-30
<b>ROLE IN LAND USE:</b>	
23 .....	Agricultural shade.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.35-0.50
25 NATURAL DURABILITY ...	Non-durable
26 PRESERVATION .....	Easy
27 SAWING .....	Easy
28 SEASONING .....	Easy
29 OTHER FEATURES .....	Interlocked grain.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Light construction; furniture; boxes.
31 ROUNDWOOD .....	Veneer/plywood; fuelwood.
32 OTHER PRODUCTS .....	-
<b>NURSERY:</b>	
33 SEED SOURCES .....	Mexico; Guatemala.
34 SEEDS PER KILOGRAMME .	-
35 STORAGE .....	Dry, airtight at ambient temperature for up to one year.
36 PRE-TREATMENT .....	-
37 PLANTING STOCK .....	Potted; stumps; bare-rooted plants.
38 SPECIAL REQUIREMENTS ,	-
39 GERMINATION AND GROWTH	Germinates in 12-18 days. Plantable size in 6 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	None of importance reported.
<b>PRINCIPAL REFERENCES:</b>	
	49 96 120

SPECIES: Salix babylonica L. var. sacramenta

TAXONOMY:

1 FAMILY ..... Salicaceae

2 SYNONYMS ..... -

3 LOCAL OR TRADE NAMES , Sauce americano

NATURAL OCCURRENCE:

4 LATITUDES ..... 25-35°N

5 AREAS ..... Far East. Naturalised in Europe and many warm-temperate to sub-tropical countries. This variety developed in Brazil.

CLIMATE:

6 ALTITUDINAL RANGE .... 0-500 m

7 MEAN ANNUAL RAINFALL , 800-1,500 mm

8 RAINFALL REGIME ..... Summer

9 DRY SEASON ..... 1-2 months

10 MEAN MAX. TEMP,

HOTTEST MONTH ..... 21-26°C

11 MEAN MIN. TEMP,

COLDEST MONTH ..... 8-12°C

12 MEAN ANNUAL TEMP, .... 15-22°C

SOILS:

13 TEXTURE ..... Medium/light

14 REACTION ..... Neutral

15 DRAINAGE ..... Moist; seasonally waterlogged.

16 OTHER CHARACTERISTICS -

SILVICULTURE:

17 SIZE ..... h = 8-15 m

18 DESCRIPTION ..... Dioecious; briefly deciduous.

19 FORM ..... Acceptable

20 LIGHT REQUIREMENTS ... -

21 OTHER CHARACTERISTICS -

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 16-17

ROLE IN LAND USE:

23 ..... Erosion control.

TIMBER:

24 DENSITY ..... S.G. 0.74

25 NATURAL DURABILITY ... Moderately durable.

26 PRESERVATION ..... -

27 SAWING ..... -

28 SEASONING ..... -

29 OTHER FEATURES ..... Soft

UTILIZATION:

30 SAW TIMBER ..... -

31 ROUNDWOOD ..... Shortfibre pulp; matches.

32 OTHER PRODUCTS ..... Fodder (leaves); baskets.

NURSERY:

33 SEED SOURCES ..... -

34 SEEDS PER KILOGRAMME , -

35 STORAGE ..... Seed viable for a few days only.

36 PRE-TREATMENT ..... -

37 PLANTING STOCK ..... Cuttings

38 SPECIAL REQUIREMENTS , -

39 GERMINATION AND GROWTH -

PRINCIPAL PESTS AND

DISEASES:

40 ..... Good resistance to anthracnosis.

PRINCIPAL REFERENCES:

SPECIES: Samanea saman Merrill

<b>TAXONOMY:</b>	
1	FAMILY ..... Mimosaceae
2	SYNONYMS ..... <u>Pithecolobium saman</u> (Jacq.) Benth.
3	LOCAL OR TRADE NAMES . Raintree; Saman.
<b>NATURAL OCCURRENCE:</b>	
4	LATITUDES ..... 5°S-11°N
5	AREAS ..... Ecuador; Guatemala; Venezuela; S. Mexico.
<b>CLIMATE:</b>	
6	ALTITUDINAL RANGE .... 0-700 m
7	MEAN ANNUAL RAINFALL , 760-3,000 mm
8	RAINFALL REGIME ..... Summer/uniform
9	DRY SEASON ..... 2-4 months
10	MEAN MAX. TEMP. HOTTEST MONTH ..... 24-30°C
11	MEAN MIN. TEMP. COLDEST MONTH ..... 18-22°C
12	MEAN ANNUAL TEMP. .... 22-28°C
<b>SOILS:</b>	
13	TEXTURE ..... Light/medium/heavy
14	REACTION ..... Neutral/acid
15	DRAINAGE ..... Free draining; seasonally waterlogged.
16	OTHER CHARACTERISTICS -
<b>SILVICULTURE:</b>	
17	SIZE ..... h = 15-30 m; d = 100-200 m
18	DESCRIPTION ..... Open crowned
19	FORM ..... Acceptable/poor
20	LIGHT REQUIREMENTS ... Strongly demanding
21	OTHER CHARACTERISTICS -

<b>PRODUCTION:</b>	
22	VOLUME (M <sup>3</sup> /HA/AN) .... 25-35
<b>ROLE IN LAND USE:</b>	
23	..... Shade and shelter; agricultural shade.
<b>TIMBER:</b>	
24	DENSITY ..... S.G. 0.42-0.64
25	NATURAL DURABILITY ... Moderately durable
26	PRESERVATION ..... Easy
27	SAWING ..... Easy
28	SEASONING ..... Difficult
29	OTHER FEATURES ..... Interlocked grain.
<b>UTILIZATION:</b>	
30	SAW TIMBER ..... Heavy construction; light construction; furniture; boxes.
31	ROUNDWOOD ..... Fence posts; veneer/plywood; fuelwood.
32	OTHER PRODUCTS ..... Fodder (pods).
<b>NURSERY:</b>	
33	SEED SOURCES ..... Philippines; Hawaii; Fiji; Colombia.
34	SEEDS PER KILOGRAMME . 4,400-7,000
35	STORAGE ..... Dry, cold and airtight for several years.
36	PRE-TREATMENT ..... None
37	PLANTING STOCK ..... Potted
38	SPECIAL REQUIREMENTS . -
39	GERMINATION AND GROWTH Germinates in 14-20 days. Plantable size in 4-6 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40	..... None of importance reported.
<b>PRINCIPAL REFERENCES:</b> 49 52 100 106	

SPECIES: Schinus molle L.

TAXONOMY:

- 1 FAMILY ..... Anacardiaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Pepper tree; Molle.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 25-23°S  
5 AREAS ..... Highlands of Pacific coast of South America.  
Naturalised in South USA and Mexico.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 1,000-3,500 m  
7 MEAN ANNUAL RAINFALL , 300-620 mm  
8 RAINFALL REGIME ..... Winter/summer/uniform  
9 DRY SEASON ..... 4-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-28°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 5-15°C  
12 MEAN ANNUAL TEMP, .... 12-20°C

SOILS:

- 13 TEXTURE ..... Light  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates moderately saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 10-15 m  
18 DESCRIPTION ..... Evergreen; open crowned.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; termite resistant; tolerates salt winds; drought hardy; requires wide spacing; moderately frost tender; shallow root system; shortlived.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 3-5

ROLE IN LAND USE:

23 ..... Shade and shelter; windbreaks; ornamental.

TIMBER:

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... Moderately durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... -  
31 ROUNDWOOD ..... Fence posts; fuel and charcoal.  
32 OTHER PRODUCTS ..... Not usable for culinary pepper; honeyflora.

NURSERY:

- 33 SEED SOURCES ..... Western South America; Mexico.  
34 SEEDS PER KILOGRAMME , 35,000-65,000  
35 STORAGE ..... Ambient temperature for 3 months.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted  
38 SPECIAL REQUIREMENTS , Sow seed shallowly.  
39 GERMINATION AND GROWTH Low germination capacity. Seed 50% viable.

PRINCIPAL PESTS AND DISEASES:

40 ..... Termites attack young plants.

PRINCIPAL REFERENCES:

52 71 84 95 128 134 152

SPECIES: Schizolobium parahybum (Vell.) Blake

TAXONOMY:

- 1 FAMILY ..... Caesalpinaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Brazilian fire tree; Faveira; Guapuruvá (Brazil); Judío (Mexico).

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 35-23°S  
5 AREAS ..... South Brazil Coast between Rio de Janeiro and Rio Grande do Sul. Naturalised S. Mexico to S.E. Brazil.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,200 m  
7 MEAN ANNUAL RAINFALL , 1,000-1,800 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 0-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 20-26°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 5-9°C  
12 MEAN ANNUAL TEMP. .... 14-22°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on rich soils; but very adaptable.

SILVICULTURE:

- 17 SIZE ..... h = 20-35 m; d = 80-100 cm  
18 DESCRIPTION ..... Deciduous; may buttress.  
19 FORM ..... Acceptable to exceptional above buttresses.  
20 LIGHT REQUIREMENTS ... -  
21 OTHER CHARACTERISTICS Fixes nitrogen; drought hardy; 6-8 year pulp-wood rotation; self-pruning.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 20

ROLE IN LAND USE:

23 ..... Ornamental

TIMBER:

- 24 DENSITY ..... S.G. 0.30-0.40  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy/fair  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Variable density and workability; weak.

UTILIZATION:

- 30 SAW TIMBER ..... Boxes.  
31 ROUNDWOOD ..... Fuelwood; shortfibre pulp.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... France; Central America.  
34 SEEDS PER KILOGRAMME , 5,500-6,000  
35 STORAGE ..... -  
36 PRE-TREATMENT ..... -  
37 PLANTING STOCK ..... -  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Good germination and rapid early growth.

PRINCIPAL PESTS AND DISEASES:

40 ..... -

PRINCIPAL REFERENCES:

140

SPECIES: Sesbania grandiflora (L.) Poir.

<b>TAXONOMY:</b>	
1 FAMILY .....	Papilionaceae
2 SYNONYMS .....	<u>Agati grandiflora</u> (L.) Desv.
3 LOCAL OR TRADE NAMES	Agati; Gallito.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	10°S-20°N
5 AREAS .....	South East Asia from India, through Malaysia, Indonesia to the Philippines.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-800 m
7 MEAN ANNUAL RAINFALL .	1,000-2,000 mm
8 RAINFALL REGIME .....	Uniform
9 DRY SEASON .....	0-3 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	26-36°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	18-24°C
12 MEAN ANNUAL TEMP, ....	22-30°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium/heavy
14 REACTION .....	Acid
15 DRAINAGE .....	Tolerates seasonal waterlogging.
16 OTHER CHARACTERISTICS	Very adaptable
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 8-10 m
18 DESCRIPTION .....	Small tree
19 FORM .....	Moderate
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Vigorous coppice; fixes nitrogen; frost tender; requires very close spacing in plantation.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	20-25
<b>ROLE IN LAND USE:</b>	
23 .....	Anti-erosion; windbreaks; soil improvement; agroforestry; ornamental.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.42
25 NATURAL DURABILITY ...	-
26 PRESERVATION .....	-
27 SAWING .....	-
28 SEASONING .....	-
29 OTHER FEATURES .....	Soft
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	-
31 ROUNDWOOD .....	Fuel and charcoal; shortfibre pulp.
32 OTHER PRODUCTS .....	Fodder and green manure; gum; tannins.
<b>NURSERY:</b>	
33 SEED SOURCES .....	Indonesia; Philippines; Taiwan; USA (Florida).
34 SEEDS PER KILOGRAMME .	17,000 (cleaned, viable seed)
35 STORAGE .....	1-2 years
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Direct sown; cuttings; bare-rooted plants.
38 SPECIAL REQUIREMENTS .	None
39 GERMINATION AND GROWTH	85-90% germination
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	Susceptible to nematodes.
<b>PRINCIPAL REFERENCES:</b>	
	16 121

SPECIES: Simmondsia chinensis (Link) Schneid.

TAXONOMY:

- 1 FAMILY ..... Simmondsiaceae
- 2 SYNONYMS ..... S. californica Nutt.
- 3 LOCAL OR TRADE NAMES , Jojoba; Buck nut.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 25-31°N
- 5 AREAS ..... Arizona desert; N. Mexico.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,500 m
- 7 MEAN ANNUAL RAINFALL , 250-500 mm
- 8 RAINFALL REGIME ..... Winter/spring
- 9 DRY SEASON ..... 4-6 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 35-45°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... -2-4°C
- 12 MEAN ANNUAL TEMP. .... 18-25°C

SOILS:

- 13 TEXTURE ..... Light/medium
- 14 REACTION ..... Neutral/alkaline
- 15 DRAINAGE ..... Free draining
- 16 OTHER CHARACTERISTICS Well aerated; high phosphate; dune sands and alluvia; tolerates saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 2-3 m
- 18 DESCRIPTION ..... Evergreen; dioecious, desert shrub.
- 19 FORM ..... Poor
- 20 LIGHT REQUIREMENTS ... Light demander
- 21 OTHER CHARACTERISTICS Drought hardy; frost tender when young; longlived.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... -
- 25 NATURAL DURABILITY ... -
- 26 PRESERVATION ..... -
- 27 SAWING ..... -
- 28 SEASONING ..... -
- 29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... -
- 31 ROUNDWOOD ..... -
- 32 OTHER PRODUCTS ..... Important seed crop (2,250 kg/ha/an) yields an industrial liquid wax; browse for livestock.

NURSERY:

- 33 SEED SOURCES ..... Central America.
- 34 SEEDS PER KILOGRAMME , -
- 35 STORAGE ..... 1-2 years
- 36 PRE-TREATMENT ..... -
- 37 PLANTING STOCK ..... Direct sown; potted (pots 40 cm deep); stem cuttings.
- 38 SPECIAL REQUIREMENTS , Irrigate for first two years.
- 39 GERMINATION AND GROWTH Ensure sufficient female (seed bearing) plants by planting several seeds at each spot, or by using cuttings.

PRINCIPAL PESTS AND DISEASES:

40 ..... -

PRINCIPAL REFERENCES: 117

SPECIES: Swietenia macrophylla King

<b>TAXONOMY:</b>	
1 FAMILY .....	Meliaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES	Honduras Mahogany; Acajou; Caoba.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	18°S-20°N
5 AREAS .....	From Yucatan, Mexico through Central America to Venezuela and Brazil.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	50-1,400 m
7 MEAN ANNUAL RAINFALL .	1,600-4,000 mm
8 RAINFALL REGIME .....	Summer/uniform
9 DRY SEASON .....	0-4 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	26-35°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	11-22°C
12 MEAN ANNUAL TEMP. ....	23-28°C
<b>SOILS:</b>	
13 TEXTURE .....	Medium/heavy
14 REACTION .....	Alkaline/neutral
15 DRAINAGE .....	Free draining
16 OTHER CHARACTERISTICS	-
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 30-40 m; d = 100-200 cm
18 DESCRIPTION .....	Deciduous; buttressed.
19 FORM .....	Exceptional
20 LIGHT REQUIREMENTS ...	Strongly demanding; shade tolerant in youth.
21 OTHER CHARACTERISTICS	Coppices; moderately windfirm.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	7-11
<b>ROLE IN LAND USE:</b>	
23 .....	-
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.51-0.57
25 NATURAL DURABILITY ...	Moderately durable
26 PRESERVATION .....	Difficult
27 SAWING .....	Easy
28 SEASONING .....	Easy
29 OTHER FEATURES .....	Decorative
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Light construction; furniture; boat-building.
31 ROUNDWOOD .....	Fuelwood (c.v. = 19,588 kJ/kg); veneer/plywood; turnery.
32 OTHER PRODUCTS .....	-
<b>NURSERY:</b>	
33 SEED SOURCES .....	Central America and Trinidad.
34 SEEDS PER KILOGRAMME .	2,000-2,500
35 STORAGE .....	Dry, cold and airtight for up to one year.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted; striplings.
38 SPECIAL REQUIREMENTS .	Requires full shade for two-three weeks then half shade for one month.
39 GERMINATION AND GROWTH	40% germination in 14-28 days. Plantable size in 6-24 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	<u>Hypsipyla</u> shoot borer is a major pest limiting use in plantation in Americas, Africa and Asia. Attack is deterred by growth in mixture with other fast growing light demanders.
<b>PRINCIPAL REFERENCES:</b>	
	4 5 52 100 109 152

SPECIES: Tabebuia rosea (Bertol.) DC.

TAXONOMY:

- 1 FAMILY ..... Bignoniaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Mayflower; Apamate; Roble.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 2°S-20°N  
5 AREAS ..... Southern Mexico to Venezuela and Ecuador including West Indies.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 100-1,000 m  
7 MEAN ANNUAL RAINFALL , 1,250-2,500 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 0-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 23-30°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 17-22°C  
12 MEAN ANNUAL TEMP, .... 22-27°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral/acid  
15 DRAINAGE ..... Free draining; seasonally waterlogged.  
16 OTHER CHARACTERISTICS Adaptable to most soil conditions.

SILVICULTURE:

- 17 SIZE ..... h = 25-30 m  
18 DESCRIPTION ..... Deciduous; open crowned; buttressed.  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-20

ROLE IN LAND USE:

23 ..... Agricultural shade; ornamental.

TIMBER:

- 24 DENSITY ..... S.G. 0.52-0.62  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Decorative

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture.  
31 ROUNDWOOD ..... Veneer/plywood  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Colombia; Guatemala; Belize.  
34 SEEDS PER KILOGRAMME , 40,000-72,000  
35 STORAGE ..... Dry, cold and airtight for one-two years.  
36 PRE-TREATMENT ..... Soak in cold water for one-two days.  
37 PLANTING STOCK ..... Potted; stumps; bare-rooted plants.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germinates in 12-14 days.  
Plantable size in 6 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

49 52 100 152 160

SPECIES: Tamarix aphylla (L.) Karst.

TAXONOMY:

- 1 FAMILY ..... Tamaricaceae  
2 SYNONYMS ..... Tamarix articulata Vahl; T. orientalis Forsk.  
3 LOCAL OR TRADE NAMES . Tamarisk; Athel tree; Saltcedar; Tarfa.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 25-40°N  
5 AREAS ..... Central Asia, from Arabia to Afghanistan.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,400 m  
7 MEAN ANNUAL RAINFALL . 200-500 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 6-8 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 27-40°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 3-8°C  
12 MEAN ANNUAL TEMP. .... 18-28°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Tolerates very saline soils.

SILVICULTURE:

- 17 SIZE ..... h = 10-15 m  
18 DESCRIPTION ..... Practically evergreen  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; moderately frost resistant. Commonly reduces growth of nearby plants and is considered a wasteful user of deep ground-water reserves.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 3-5

ROLE IN LAND USE:

23 ..... Windbreaks; dune fixation; anti-erosion; firebreaks.

TIMBER:

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... -

UTILIZATION:

- 30 SAW TIMBER ..... Furniture  
31 ROUNDWOOD ..... Fuel (c.v. = 18,890 kJ/kg) and charcoal.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Cuttings available from some parts of natural range.  
34 SEEDS PER KILOGRAMME . -  
35 STORAGE ..... Loses viability within a few days.  
36 PRE-TREATMENT ..... -  
37 PLANTING STOCK ..... Rooted cuttings.  
38 SPECIAL REQUIREMENTS . -  
39 GERMINATION AND GROWTH Plantable size in 12 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES: 52 71 84 95 121 152 154

SPECIES: Taxodium distichum (L.) Rich.

<b>TAXONOMY:</b>	
1 FAMILY .....	Pinaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES	Swamp cypress; Sabino; Ahuehuate.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	24-36°N
5 AREAS .....	South Eastern USA.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-1,500 m
7 MEAN ANNUAL RAINFALL .	1,000-1,600 mm
8 RAINFALL REGIME .....	Winter/summer/uniform
9 DRY SEASON .....	0-2 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	20-30°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	8-18°C
12 MEAN ANNUAL TEMP. ....	16-22°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium/heavy
14 REACTION .....	Alkaline/neutral/acid
15 DRAINAGE .....	Seasonally waterlogged
16 OTHER CHARACTERISTICS	Adaptable to most soil conditions including slight salinity.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 30-40 m
18 DESCRIPTION .....	Deciduous
19 FORM .....	Acceptable
20 LIGHT REQUIREMENTS ...	Shade tolerant in youth.
21 OTHER CHARACTERISTICS	Coppices; frost resistant; root suckers vigorously; longlived.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	4-8
<b>ROLE IN LAND USE:</b>	
23 .....	Ornamental
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.48-0.54
25 NATURAL DURABILITY ...	Durable
26 PRESERVATION .....	-
27 SAWING .....	Easy
28 SEASONING .....	Easy
29 OTHER FEATURES .....	Good bending properties; soft.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Light construction; furniture.
31 ROUNDWOOD .....	Fence posts; fuel and charcoal.
32 OTHER PRODUCTS .....	Bark (medicinal).
<b>NURSERY:</b>	
33 SEED SOURCES .....	USA; Argentina.
34 SEEDS PER KILOGRAMME .	20,000
35 STORAGE .....	Short viability; store in ambient conditions.
36 PRE-TREATMENT .....	Stratify in damp sand for thirty days; or 4 hrs. soak in conc. H <sub>2</sub> SO <sub>4</sub> .
37 PLANTING STOCK .....	Potted; stumps; bare-rooted plants.
38 SPECIAL REQUIREMENTS .	-
39 GERMINATION AND GROWTH	Germinates in 40-90 days. No information on growth in nursery.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	None of importance reported.
<b>PRINCIPAL REFERENCES:</b>	
	52 62 152

SPECIES: Tectona grandis L.f.

TAXONOMY:

- 1 FAMILY ..... Verbenaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Teak; Tec; Teca.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 12-25°N  
5 , AREAS ..... The Indian subcontinent, Burma, Cambodia and Thailand.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-900 m  
7 MEAN ANNUAL RAINFALL . 1,250-3,000 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 3-6 months  
10 MEAN MAX. TEMP.,  
HOTTEST MONTH ..... 25-32°C  
11 MEAN MIN. TEMP.,  
COLDEST MONTH ..... 18-24°C  
12 MEAN ANNUAL TEMP. .... 22-26°C

SOILS:

- 13 TEXTURE ..... Medium/heavy  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on fertile and deep soils. Often leads to soil erosion in pure stands.

SILVICULTURE:

- 17 SIZE ..... h = 30-40 m; d = 90-250 cm  
18 DESCRIPTION ..... Deciduous; older trees fluted.  
19 FORM ..... Acceptable/exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; moderately fire resistant; substantial provenance variation; drought sensitive; early flowering spoils form.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 6-18

ROLE IN LAND USE:

23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.58-0.82  
25 NATURAL DURABILITY ... Very durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Fair  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Premier fine hardwood. Decorative, tough and strong; silica in wood; dust may irritate skin.

UTILIZATION:

- 30 SAW TIMBER ..... Heavy construction; light construction; furniture; boxes; boat-building.  
31 ROUNDWOOD ..... Building poles; transmission poles; fence posts; fuel (c.v. = 21,353 kJ/kg) and charcoal; veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... India; Thailand; Trinidad and elsewhere where established as an exotic.  
34 SEEDS PER KILOGRAMME , 800-2,000  
35 STORAGE ..... Dry; without difficulty for several years.  
36 PRE-TREATMENT ..... Alternate soaking and drying frequently practised.  
37 PLANTING STOCK ..... Stumps; potted stock.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH Germination often protracted; up to 60 days. 70% viability. Several embryos per seed. Plantable size in 12 months.

PRINCIPAL PESTS AND

DISEASES:  
40 ..... Generally healthy. Atta ants may cause defoliation in first year. Root rots in Africa. Leaf skeletonizer in Asia.

PRINCIPAL REFERENCES:

4 5 16 51 52 57 69 100 107 109 128 152

SPECIES: Terminalia brassii Exell

<b>TAXONOMY:</b>	
1 FAMILY .....	Combretaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES	Dafo; Swamp oak.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	10-4°S
5 AREAS .....	Solomon Islands, Bougainville and New Ireland.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-500 m
7 MEAN ANNUAL RAINFALL .	2,000-5,000 mm
8 RAINFALL REGIME .....	Uniform
9 DRY SEASON .....	0-1 month
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	28-34°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	20-24°C
12 MEAN ANNUAL TEMP. ....	23-28°C
<b>SOILS:</b>	
13 TEXTURE .....	Heavy/medium
14 REACTION .....	Acid
15 DRAINAGE .....	Moist; seasonally waterlogged.
16 OTHER CHARACTERISTICS	Better growth on deep soils.
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 30-35 m; d = 100-150 cm
18 DESCRIPTION .....	Evergreen
19 FORM .....	Exceptional
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	-

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	25-35
<b>ROLE IN LAND USE:</b>	
23 .....	-
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.33-0.51
25 NATURAL DURABILITY ...	Non-durable
26 PRESERVATION .....	Difficult
27 SAWING .....	Easy
28 SEASONING .....	Easy
29 OTHER FEATURES .....	Very susceptible to stain and borers.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Light construction; boxes.
31 ROUNDWOOD .....	Shortfibre pulp; veneer/plywood.
32 OTHER PRODUCTS .....	-
<b>NURSERY:</b>	
33 SEED SOURCES .....	Solomon Islands; Papua New Guinea.
34 SEEDS PER KILOGRAMME .	60 000-70,000
35 STORAGE .....	Very short-lived.
36 PRE-TREATMENT .....	None
37 PLANTING STOCK .....	Potted
38 SPECIAL REQUIREMENTS .	Requires some shade in first few weeks.
39 GERMINATION AND GROWTH	Germinates in 10-20 days. Plantable size in 4 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	None of importance reported.
<b>PRINCIPAL REFERENCES:</b>	
	59 96 111 112 158

SPECIES: Terminalia calamansanai (Blanco) Rolfe

TAXONOMY:

- 1 FAMILY ..... Combretaceae
- 2 SYNONYMS ..... -
- 3 LOCAL OR TRADE NAMES . Kwako; Yellow Terminalia.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 10°N-10°S
- 5 AREAS ..... Philippines; Papua New Guinea; Solomon Islands.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-500 m
- 7 MEAN ANNUAL RAINFALL . 2,000-5,000 mm
- 8 RAINFALL REGIME ..... Uniform
- 9 DRY SEASON ..... 0-2 months
- 10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-34°C
- 11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 20-24°C
- 12 MEAN ANNUAL TEMP, .... 23-28°C

SOILS:

- 13 TEXTURE ..... Medium/heavy
- 14 REACTION ..... Neutral/acid
- 15 DRAINAGE ..... Free draining
- 16 OTHER CHARACTERISTICS Better growth on fertile soils.

SILVICULTURE:

- 17 SIZE ..... h = 30-40 cm; d = 80-120 cm
- 18 DESCRIPTION ..... Deciduous
- 19 FORM ..... Exceptional
- 20 LIGHT REQUIREMENTS ... Strongly demanding
- 21 OTHER CHARACTERISTICS Windfirm

PRODUCTION:

- 22 VOLUME (M<sup>3</sup>/HA/AN) .... 25-30

ROLE IN LAND USE:

- 23 ..... -

TIMBER:

- 24 DENSITY ..... S.G. 0.30-0.46
- 25 NATURAL DURABILITY ... Non-durable
- 26 PRESERVATION ..... Easy
- 27 SAWING ..... Easy
- 28 SEASONING ..... Easy
- 29 OTHER FEATURES ..... Susceptible to stain and borer attack. Weak.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; joinery; boxes.
- 31 ROUNDWOOD ..... Shortfibre pulp; veneer/plywood.
- 32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... Papua New Guinea; Solomon Islands.
- 34 SEEDS PER KILOGRAMME . 13,000-14,000
- 35 STORAGE ..... Shortlived: up to 1 month.
- 36 PRE-TREATMENT ..... None
- 37 PLANTING STOCK ..... Potted
- 38 SPECIAL REQUIREMENTS . -
- 39 GERMINATION AND GROWTH Germinates in 3-10 days (80% from fresh seed).  
Plantable size in 6 months.

PRINCIPAL PESTS AND DISEASES:

- 40 ..... Liable to unidentified dieback in nursery.

PRINCIPAL REFERENCES:

59 111 112 158

SPECIES: Terminalia ivorensis A. Chev.

<b>TAXONOMY:</b>	
1 FAMILY .....	Combretaceae
2 SYNONYMS .....	-
3 LOCAL OR TRADE NAMES	. Idigbo; Framiré.
<b>NATURAL OCCURRENCE:</b>	
4 LATITUDES .....	4-11°N
5 AREAS .....	West Africa, from Guinea to Cameroons.
<b>CLIMATE:</b>	
6 ALTITUDINAL RANGE ....	0-700 m
7 MEAN ANNUAL RAINFALL	, 1,300-3,000 mm
8 RAINFALL REGIME .....	Uniform
9 DRY SEASON .....	0-2 months
10 MEAN MAX. TEMP.	
HOTTEST MONTH .....	26-30°C
11 MEAN MIN. TEMP.	
COLDEST MONTH .....	22-24°C
12 MEAN ANNUAL TEMP. ....	24-26°C
<b>SOILS:</b>	
13 TEXTURE .....	Light/medium
14 REACTION .....	Neutral/acid
15 DRAINAGE .....	Free draining; occasionally seasonally waterlogged
16 OTHER CHARACTERISTICS	-
<b>SILVICULTURE:</b>	
17 SIZE .....	h = 35-45 m; d = 90-150 cm
18 DESCRIPTION .....	Deciduous; buttressed; open, wide crown.
19 FORM .....	Exceptional
20 LIGHT REQUIREMENTS ...	Strongly demanding
21 OTHER CHARACTERISTICS	Coppices; requires wide spacing.

<b>PRODUCTION:</b>	
22 VOLUME (M <sup>3</sup> /HA/AN) ....	8-17
<b>ROLE IN LAND USE:</b>	
23 .....	Agricultural shade.
<b>TIMBER:</b>	
24 DENSITY .....	S.G. 0.45-0.62
25 NATURAL DURABILITY ...	Moderately durable
26 PRESERVATION .....	Difficult
27 SAWING .....	Easy
28 SEASONING .....	Easy
29 OTHER FEATURES .....	Decorative; "brittleheart" common; dust may irritate skin.
<b>UTILIZATION:</b>	
30 SAW TIMBER .....	Heavy construction; light construction; furniture.
31 ROUNDWOOD .....	Shortfibre pulp; veneer/plywood.
32 OTHER PRODUCTS .....	-
<b>NURSERY:</b>	
33 SEED SOURCES .....	West Africa, especially Ivory Coast.
34 SEEDS PER KILOGRAMME	, 5,500-6,600
35 STORAGE .....	Dry, cold and airtight for up to one year.
36 PRE-TREATMENT .....	Alternate soaking and drying.
37 PLANTING STOCK .....	Potted; striplings; stumps.
38 SPECIAL REQUIREMENTS	. Requires light shade after germination.
39 GERMINATION AND GROWTH	Germinates in 14-50 days. Plantable size in 4 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40 .....	Termites attack young plants. Liable to attack by many defoliators but none very serious.
<b>PRINCIPAL REFERENCES:</b>	
	20 25 57 59 100 105 128 152 155

SPECIES: Terminalia superba Engl. & Diels

TAXONOMY:

- 1 FAMILY ..... Combretaceae  
2 SYNONYMS ..... -  
3 LOCAL OR TRADE NAMES , Afara; Limba; Korina.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 6°S-10°N  
5 AREAS ..... West Africa, from Sierra Leone to Zaire.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-500 m  
7 MEAN ANNUAL RAINFALL , 1,300-1,900 mm  
8 RAINFALL REGIME ..... Summer/uniform  
9 DRY SEASON ..... 1-3 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 26-32°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 22-26°C  
12 MEAN ANNUAL TEMP. .... 24-27°C

SOILS:

- 13 TEXTURE ..... Medium  
14 REACTION ..... Alkaline/neutral  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Better growth on deep soils but is adaptable to most soil conditions.

SILVICULTURE:

- 17 SIZE ..... h = 40-60 m; d = 120-240 cm  
18 DESCRIPTION ..... Practically evergreen; buttressed.  
19 FORM ..... Exceptional  
20 LIGHT REQUIREMENTS ... Strongly demanding  
21 OTHER CHARACTERISTICS Coppices; wide crowned requiring wide spacing.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 10-14

ROLE IN LAND USE:

23 ..... Agricultural shade.

TIMBER:

- 24 DENSITY ..... S.G. 0.48-0.64  
25 NATURAL DURABILITY ... Non-durable  
26 PRESERVATION ..... Difficult  
27 SAWING ..... Easy  
28 SEASONING ..... Easy  
29 OTHER FEATURES ..... Decorative

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture; boxes; boat-building.  
31 ROUNDWOOD ..... Shortfibre pulp; veneer/plywood.  
32 OTHER PRODUCTS ..... -

NURSERY:

- 33 SEED SOURCES ..... West Africa, especially Nigeria.  
34 SEEDS PER KILOGRAMME , 8,500-9,500  
35 STORAGE ..... Dry, cold and airtight for up to one year.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Potted; striplings; stumps.  
38 SPECIAL REQUIREMENTS , -  
39 GERMINATION AND GROWTH No information available on germination. Plantable size in 6 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... None of importance reported.

PRINCIPAL REFERENCES:

4 5 18 57 59 100 128 143 152 155

SPECIES: Toona ciliata M.J. Roem.

TAXONOMY:

- 1 FAMILY ..... Meliaceae  
2 SYNONYMS ..... Cedrela toona Roxb.  
3 LOCAL OR TRADE NAMES , Toon; Burma cedar.

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 15-25°N  
5 AREAS ..... S.E. Asia, from India to Thailand. (T. ciliata var. australis occurs in N. Queensland).

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-1,200 m  
7 MEAN ANNUAL RAINFALL . 850-4,000 mm  
8 RAINFALL REGIME ..... Summer  
9 DRY SEASON ..... 2-6 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 28-45°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 6-18°C  
12 MEAN ANNUAL TEMP. .... 22-28°C

SOILS:

- 13 TEXTURE ..... Light/medium  
14 REACTION ..... Neutral/acid  
15 DRAINAGE ..... Free draining  
16 OTHER CHARACTERISTICS Best growth on deep, rich soils.

SILVICULTURE:

- 17 SIZE ..... h = 30-35 m; d = 90-180 cm  
18 DESCRIPTION ..... Deciduous/evergreen; sometimes buttressed.  
19 FORM ..... Acceptable  
20 LIGHT REQUIREMENTS ... Strongly demanding; shade tolerant in youth.  
21 OTHER CHARACTERISTICS Coppices; resists termites; root suckers vigorously; fire sensitive.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... 7-18

ROLE IN LAND USE:

23 ..... Windbreaks

TIMBER:

- 24 DENSITY ..... S.G. 0.42-0.64  
25 NATURAL DURABILITY ... Moderately durable.  
26 PRESERVATION ..... Fair  
27 SAWING ..... Easy  
28 SEASONING ..... Easy in kilns.  
29 OTHER FEATURES ..... Decorative; scented.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture; boxes; flooring; boat-building; carts.  
31 ROUNDWOOD ..... Veneer/plywood.  
32 OTHER PRODUCTS ..... Fodder (lopped branches).

NURSERY:

- 33 SEED SOURCES ..... India  
34 SEEDS PER KILOGRAMME , 300,000-380,000  
35 STORAGE ..... Short viability: 6 months-1 year.  
36 PRE-TREATMENT ..... None  
37 PLANTING STOCK ..... Striplings; potted; direct sown; stumps.  
38 SPECIAL REQUIREMENTS , Heavy shade for two months after germination. Care of taproot.  
39 GERMINATION AND GROWTH 40-60% germination when fresh. Slow early growth. Potted stock plantable size at 18-24 months.

PRINCIPAL PESTS AND DISEASES:

40 ..... Hypsipyla, a shoot borer, causes severe damage. Plant Toona in mixtures on optimum sites, as vigorous growth reduces susceptibility. (N.B. Toona ciliata var. australis appears to resist Hypsipyla).

PRINCIPAL REFERENCES:

16 49 59 61 96 109 152

SPECIES: Triplochiton scleroxylon K. Schum.

<b>TAXONOMY:</b>	
1	FAMILY ..... Sterculiaceae
2	SYNONYMS ..... -
3	LOCAL OR TRADE NAMES , Obeche; Samba; Wawa; Ayous.
<b>NATURAL OCCURRENCE:</b>	
4	LATITUDES ..... 0-10°N
5	AREAS ..... West Africa, from Sierra Leone to Zaire.
<b>CLIMATE:</b>	
6	ALTITUDINAL RANGE .... 0-500 m
7	MEAN ANNUAL RAINFALL , 1,600-3,000 mm
8	RAINFALL REGIME ..... Uniform
9	DRY SEASON ..... 0-2 months
10	MEAN MAX. TEMP, HOTTEST MONTH ..... 26-32°C
11	MEAN MIN. TEMP, COLDEST MONTH ..... 20-26°C
12	MEAN ANNUAL TEMP. .... 24-29°C
<b>SOILS:</b>	
13	TEXTURE ..... Light/medium
14	REACTION ..... Neutral/acid
15	DRAINAGE ..... Free draining
16	OTHER CHARACTERISTICS -
<b>SILVICULTURE:</b>	
17	SIZE ..... h = 40-50 m; d = 100-150 cm
18	DESCRIPTION ..... Deciduous; buttressed.
19	FORM ..... Exceptional
20	LIGHT REQUIREMENTS ... Strongly demanding
21	OTHER CHARACTERISTICS -

<b>PRODUCTION:</b>	
22	VOLUME (M <sup>3</sup> /HA/AN) .... 6-18
<b>ROLE IN LAND USE:</b>	
23	..... -
<b>TIMBER:</b>	
24	DENSITY ..... S.G. 0.35-0.40
25	NATURAL DURABILITY ... Non-durable
26	PRESERVATION ..... Difficult
27	SAWING ..... Easy
28	SEASONING ..... Easy
29	OTHER FEATURES ..... Susceptible to borers and stain. Premier quality, white, odour-free hardwood..
<b>UTILIZATION:</b>	
30	SAW TIMBER ..... Light construction; boxes; furniture.
31	ROUNDWOOD ..... Shortfibre pulp; veneer/plywood; blockboard; fuelwood.
32	OTHER PRODUCTS ..... -
<b>NURSERY:</b>	
33	SEED SOURCES ..... West Africa (N.B. seed years are irregular).
34	SEEDS PER KILOGRAMME , 3,000
35	STORAGE ..... -
36	PRE-TREATMENT ..... None
37	PLANTING STOCK ..... Stumps; potted; cuttings.
38	SPECIAL REQUIREMENTS , -
39	GERMINATION AND GROWTH Germinates in 10-12 days. Plantable size in 15 months.
<b>PRINCIPAL PESTS AND DISEASES:</b>	
40	.....
<b>PRINCIPAL REFERENCES:</b> 22 57 100 128 155	

SPECIES: Zizyphus spina-christi (L.) Willd.

TAXONOMY:

- 1 FAMILY ..... Rhamnaceae  
2 SYNONYMS ..... Rhamnus spina-christi L.  
3 LOCAL OR TRADE NAMES . Christ-thorn; Kurna; Sidr (Arabic).

NATURAL OCCURRENCE:

- 4 LATITUDES ..... 25-38°N  
5 AREAS ..... N. Africa and Near East.

CLIMATE:

- 6 ALTITUDINAL RANGE .... 0-2,000 m  
7 MEAN ANNUAL RAINFALL . 100-500 mm  
8 RAINFALL REGIME ..... Winter  
9 DRY SEASON ..... 8-10 months  
10 MEAN MAX. TEMP.  
HOTTEST MONTH ..... 30-35°C  
11 MEAN MIN. TEMP.  
COLDEST MONTH ..... 4-15°C  
12 MEAN ANNUAL TEMP. .... 19-28°C

SOILS:

- 13 TEXTURE ..... Light/medium/heavy  
14 REACTION ..... Neutral/alkaline  
15 DRAINAGE ..... Moist  
16 OTHER CHARACTERISTICS Tolerates some salinity; better growth on deep alluvia.

SILVICULTURE:

- 17 SIZE ..... h = 5-10 m  
18 DESCRIPTION ..... Thorny; evergreen; pendulous branches.  
19 FORM ..... Poor  
20 LIGHT REQUIREMENTS ... Light demanding  
21 OTHER CHARACTERISTICS Aggressive coloniser; coppices; drought hardy; frost tender; deep rooting; long-lived.

PRODUCTION:

22 VOLUME (M<sup>3</sup>/HA/AN) .... -

ROLE IN LAND USE:

23 ..... Erosion control; windbreaks; shade; dune fixation.

TIMBER:

- 24 DENSITY ..... -  
25 NATURAL DURABILITY ... Durable  
26 PRESERVATION ..... -  
27 SAWING ..... -  
28 SEASONING ..... -  
29 OTHER FEATURES ..... Hard; heavy; termite resistant.

UTILIZATION:

- 30 SAW TIMBER ..... Light construction; furniture.  
31 ROUNDWOOD ..... Posts; tools; fuel (c.v. = 19,800-20,100 kJ/kg).  
32 OTHER PRODUCTS ..... Edible fruit; fodder (leaves).

NURSERY:

- 33 SEED SOURCES ..... Netherlands; Near East.  
34 SEEDS PER KILOGRAMME . 15,000  
35 STORAGE ..... Dry, cold, sealed.  
36 PRE-TREATMENT ..... Scarify mechanically or in conc. H<sub>2</sub>SO<sub>4</sub> for 2 hours, then cold stratify.  
37 PLANTING STOCK ..... Bare-rooted seedlings; cuttings.  
38 SPECIAL REQUIREMENTS . Care of taproot.  
39 GERMINATION AND GROWTH 60-80% germination; medium growth rate in nursery.

PRINCIPAL PESTS AND DISEASES:

40 ..... -

PRINCIPAL REFERENCES:



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