別添資料集

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資料1　締結したシニッツ

MINUTES OF DISCUSSIONS ON THE JAPAN AND AUSTRALIA AID CO-OPERATION (SUPPORT PROGRAM FOR SOCIAL FORESTRY TRAINING PROJECT OF JAPAN IN KENYA)

Based on the discussions between the Government of Japan and the Government of the Commonwealth of Australia on Aid Co-operation ~~reached~~ at the Annual Aid Consultations and subsequent discussions, the Japanese Consultation Team (hereinafter referred to as 'the Team'), headed by Mr Masahiro Obata and organized by the Japan International Co operation Agency (hereinafter referred to as 'JICA') visited the Commonwealth of Australia from May 22 to 31 May, 1988 for the purpose of formulating a support program for the Social Forestry Training Project of Japan in Kenya (hereinafter referred to as 'the Program').

During its stay in the Commonwealth of Australia, both Australian and Japanese sides had a series of discussions and exchanged views on the basic matters and detailed procedure for the Program.

As a result of the discussions, the authorities concerned of the Commonwealth of Australia and the Team recognized the importance and necessity of the Program and agreed to recommend the following items to their respective Governments:

1. Basic Policy

(1) The objective of the Program is to support Social Forestry Training Project in Kenya (hereinafter referred to as 'the Project')

(2) Japan will provide the Project with fund, skills and knowledge

(3) Australia will provide the Project with facilities, knowledge, and materials at costs to be determined on a case-by-case basis

2. Measures to be Taken by Both Governments

In accordance with the laws and regulations in force in the Commonwealth of Australia and in Japan, both sides will take necessary measures:

(1) to organize technical trainings for the Kenyan personnel connected with the Project under the Counterpart Training Program under the Tripartite Arrangement of JICA.

(2) to exchange knowledge, skills and information concerned with the Project.

(3) to supply seeds and other materials necessary for the Project.

For this purpose, the Centre for International Research Co-operation of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) has been appointed as the co-ordinating body for this Program.

Dr Barry FILSHIE
Officer-in-Charge
Centre for International
Research Co-operation
CSIRO
AUSTRALIA

Mr Masahiro OBATA
Leader
Consultation Team
JICA
JAPAN

資料2

AUSTRALIAN
INTERNATIONAL
DEVELOPMENT
ASSISTANCE
BUREAU
DEPARTMENT OF FOREIGN AFFAIRS AND TRADE

G.P.O. BOX 887
CANBERRA 2601
Telephone 49 5733, 61 9111
Telegrams AUST DE VAID
Telex 62631

ACTION OFFICER
REFERENCE

Dr Filshie,
Officer in Charge,
Centre for International
Research Cooperation,
CSIRO
Australia

27. May 1988

Dear Dr Filshie,

The purpose of this letter is to inform you that we have seen the proposed minutes of discussion between yourself and Mr Obata which record an understanding on cooperation for the Kenya Social Forestry Project.

While noting that AIDAB cannot accept any financial responsibility under the program we wish CIRC and JICA every success for the future implementation of the project.

Yours sincerely,

(P. Callan)
Acting Assistant Director General
Asia, Africa and Bilateral Coordination Branch

cc. Mr Kusama
Japanese Embassy

Publications of special interest

Available from the Australian Government Publishing Service, PO Box 84, Canberra ACT 2600, Australia: (write for brochures and order forms)

- 'The Use of Trees & Shrubs in the Dry Country of Australia'
- 'Eucalypts of the Western Australian *goldfields*'
- 'Trees for Darwin and Northern Australia'

Available from CSIRO Editorial and Publications Service, PO Box 89, East Melbourne, Vic. 3002, Australia: (write for brochures and order forms)

- 'Eucalypts for Wood Production'
- 'Eucalyptus Seed'
- 'Forest Trees of Australia'
- 'Casuarina Ecology, Management and Utilization': Proceedings of the International Casuarina Workshop Canberra, August 1981

Available from Distribution and Sales Section, FAO of the United Nations, Via delle Terme di Caracalla, 00100 Rome, Italy.

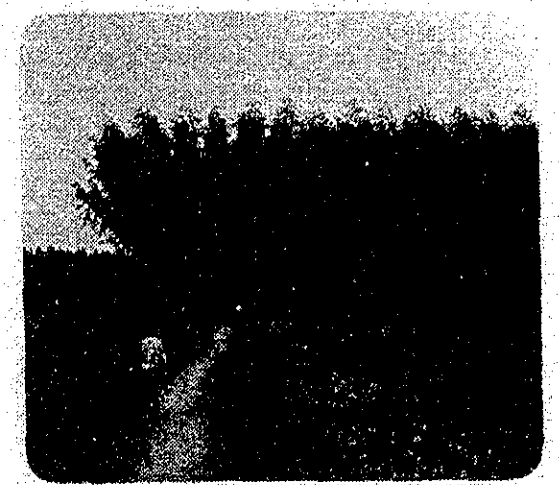
- 'Eucalypts for Planting'
- 'Handbook on Seeds of Dry-Zone Acacias'

Available from CSIRO Forest Research, PO Box 4008 Queen Victoria Terrace ACT 2600 Canberra, Australia

- 'Australian Acacias' Leaflet Series.

Seed collecting using rifle.

Viability testing.

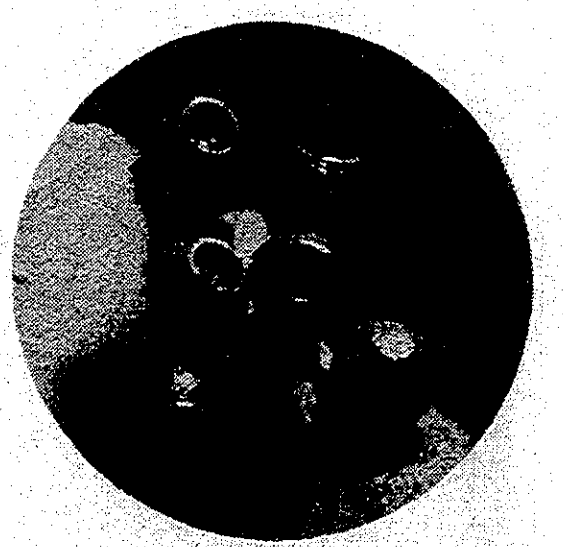


Cuttings of eucalypt hybrids, Brazil. Age 32 months.

Forest Research CSIRO

Tree Seed Centre

The collection, distribution and improved use of the genetic resources of Australia's trees



Australian trees are being planted on a very large scale throughout the warm temperate and tropical regions of the world. They provide raw materials for both industry and domestic use and often have great social significance.

A tree seed centre, now part of CSIRO's Division of Forest Research, has been collecting tree seed throughout Australia over the past 20 years.

The main aim has always been to provide authenticated and representative samples of seed of Australian trees for international and Australian research.

Seed collection

The seed collection program, reviewed every two years, is strongly influenced by priorities established by the FAO Panel of Experts on Forest Gene Resources and by the needs for research material in Australia. In the past, the program concentrated on the collection of Eucalyptus seeds but other genera such as Acacia and Casuarina are now receiving increased attention. Financial support by FAO and the Australian Development Assistance Bureau (ADAB) has helped expand seed collecting activities to include species of particular interest to developing countries.

Seed distribution

To provide small lots of authentic native tree seed to Australian and international forest researchers, seed samples are drawn from a stock of about 700 species including 400 eucalypts and 150 acacias. Some 300 kilograms of seed in 4000 seedlots are sent annually to organisations in more than 80 countries. A range of seed origins (provenances) is available for most eucalypts and for a growing number of acacias and casuarinas. For special purposes some provenances can be supplied with the identity of individual trees maintained. All seedlots are tested for germination capacity, fumigated and issued with seed certificates and phytosanitary certificates before despatch. A catalogue is not available but quotations are provided on request. Some seed is available for exchange with government research organisations.

Information

The centre advises growers on selection of the most appropriate species and provenances for establishing plantations. Although bulk quantities of seed are not available from the centre, a leaflet listing the major Australian commercial suppliers of tree seed is updated regularly and available on request.

It gathers, publishes and disseminates technical information on Australian species. Some publications of interest from the Australian Government Publishing Service, CSIRO and FAO are listed in this pamphlet.

Research

As part of the overall activities of the Genetic Resources and Breeding Strategy program at CSIRO Forest Research, the centre conducts research on seed germination and seed collection, extraction and storage methods. It also collaborates in studies of genetic variation in Australian tree species.

Cooperation with development assistance programs

The centre cooperates with international organisations assisting forestry development in the Third World. Both seed and advice are provided to programs sponsored by these organisations. Since 1979 the centre has collaborated closely with ADAB to distribute free research seed and literature and to undertake advisory visits to recipient countries.

For further information, write to:

Officer-in-Charge
Tree Seed Centre
CSIRO Division of Forest Research
PO Box 4008
Queen Victoria Terrace
ACT 2600
Canberra, Australia

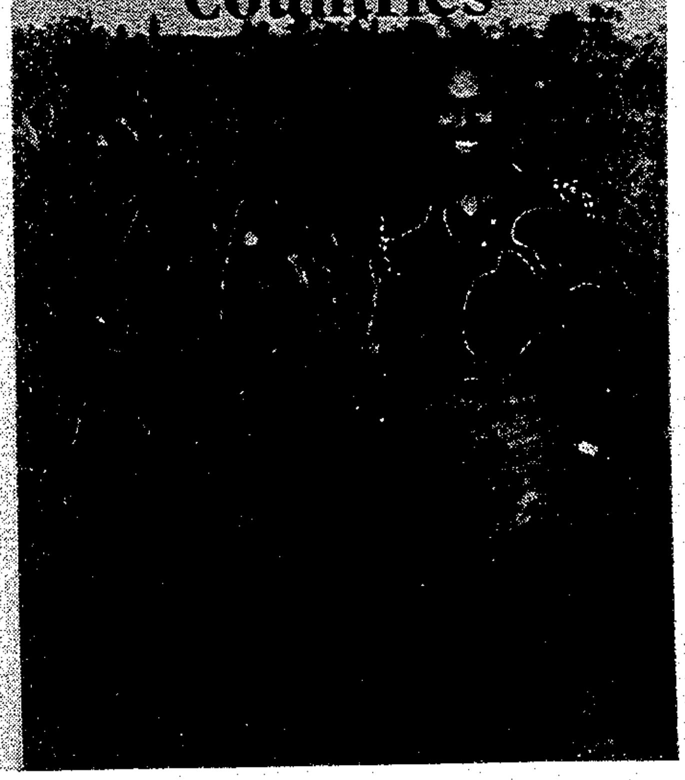
Design by Vlad Mosmondor
Typesetting by Hot Type
Printed by Pirie Printers Pty Ltd

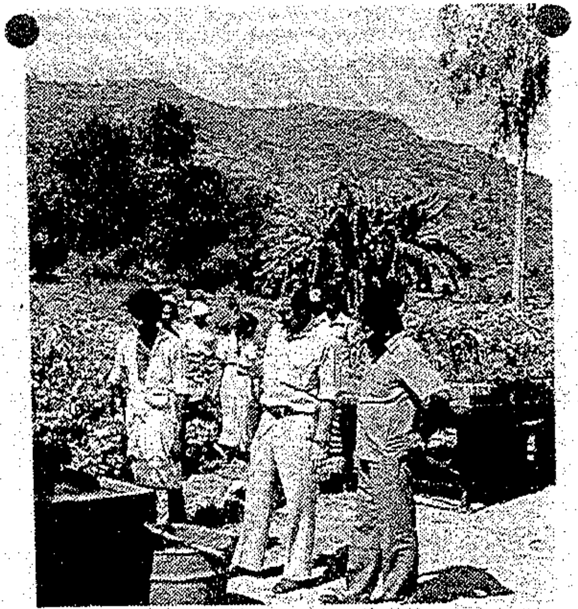
資料4

TREE SEED CENTRE

AUSTRALIAN DEVELOPMENT ASSISTANCE BUREAU (ADAB)

Seeds of Australian Trees for Developing Countries





Consultative visits to developing countries by Seed Centre staff.

Training in seed technology.

AUSTRALIAN DEVELOPMENT ASSISTANCE BUREAU

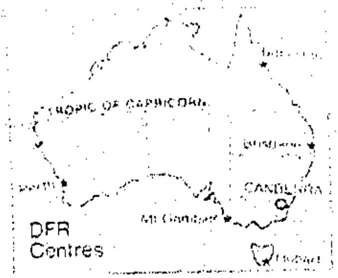
ADAB is an autonomous Bureau within the Department of Foreign Affairs, and is responsible for the management of Australia's program of development assistance.

CSIRO TREE SEED CENTRE

The Tree Seed Centre, part of CSIRO's Division of Forest Research, was established in 1961. It provides authenticated seed and expert advice on Australian trees for both international and Australian research.

The Centre works in close collaboration with Australian development and research agencies (ADAB, ACIAR) and cooperates with international agencies including FAO, IUFRO, IDRC, CTFT and DANIDA.

THE CSIRO Division of Forest Research has its headquarters in Canberra and regional research centres in Perth, Mt Gambier, Hobart, Brisbane, and Atherton. The Division's research programs are designed to provide a scientific basis for the balanced management of Australia's forests to meet the needs of a broad range of uses including wood production, water supply, recreation, ecosystem conservation and scientific reference.



For further information, write to:
Officer-in-Charge
Tree Seed Centre
CSIRO Division of Forest Research
PO Box 4008, Queen Victoria Terrace
Canberra, ACT 2600
AUSTRALIA
Telex: 62751
Facsimile: (062) 81 8312
Telephone: (062) 81 8211

SEEDS OF AUSTRALIAN TREES FOR DEVELOPING COUNTRIES (SATDC)

BACKGROUND

Eucalypts, acacias, casuarinas and other Australian trees are being planted on a large scale throughout the warm temperate and tropical regions of the world. They provide raw materials for both industry and domestic use and give environmental protection.

The Australian Development Assistance Bureau (ADAB) has recognized the important contribution of Australian trees to improving living standards in developing countries by funding the Tree Seed Centre's Seeds of Australian Trees for Developing Countries (SATDC) project. Since 1979 the Centre has, with the support of ADAB, distributed free research seed and literature and undertaken advisory visits to recipient countries.

Rapid growth of 5 year-old cuttings of eucalypt hybrids, Brazil.

SATDC SERVICES

Seed and information

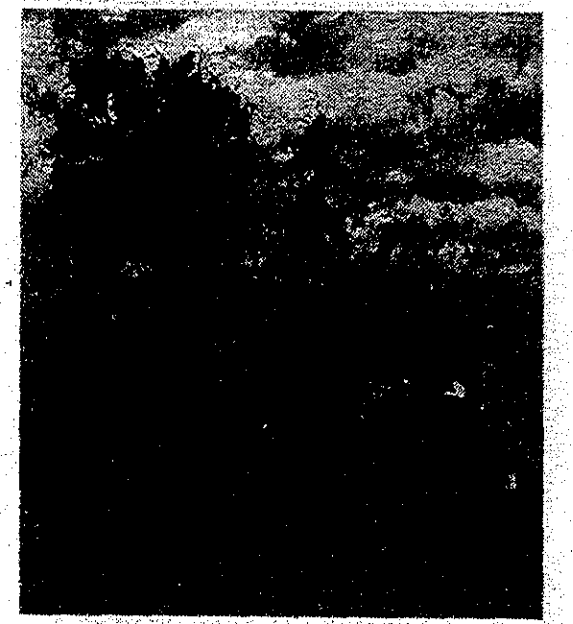
Under SATDC the Tree Seed Centre makes available high-quality, source-identified seeds of promising species, together with technical information, for **research projects** and **pilot plantations** in developing countries in Asia, Africa and the South Pacific.

Training

Short-term training in the fields of seed technology (collection, processing, testing and storage), establishment techniques and design of species and provenance (seed origin) trials is available to selected candidates.

Advisory visits

Suitably qualified experts on Australian trees undertake annual advisory visits to selected countries. During these visits, they discuss problems and provide information and advice on species/provenance selection, seedling propagation and establishment techniques and other relevant topics.



Collecting seed of a multipurpose shrub from Australia's arid zone *Acacia cowleana* (Tanami Desert, Western Australia).

BENEFITS

High-quality germplasm of Australian trees can be used in trials to identify healthy and productive species for agroforestry, village woodlots and plantations which provide for long-term development and improvement of living standards. Extensive and successful reforestation is now in progress using species and provenances identified with assistance provided by the Seed Centre.

An 8 year old provenance trial of *Eucalyptus camaldulensis* in Nigeria, showing the much greater growth of the Petford, Queensland, provenance (left) compared with the Lake Albacutya, Victoria, provenance (right). Similar results have been obtained in other trials in tropical, summer rainfall areas. In temperate winter rainfall areas the situation is reversed — the Lake Albacutya provenance is greatly superior to Petford.

資料5

THE AUSTRALIAN TREE SEED CENTRE

BACKGROUND

Australia is guardian to a unique and extensive resource of woody flora which has proven to be very valuable in afforestation programmes both in Australia and overseas. There are over 6 million hectares of Eucalyptus plantations in the world, about half a million of Acacia species, another half million of Casuarina and many other plantings of Hakea, Grevillea and Araucaria. These are playing an increasingly important role in the industrial and economic development of many countries. Within Australia there is an increasing establishment of industrial plantations of native species (E. grandis, E. regnans, E. globulus, Araucaria cunninghamii), wide use in community tree planting programmes and considerable use in rehabilitation of mining sites and salt affected areas. The foundation to making the best use of this useful, valuable, but variable tree flora is the supply of seed of authenticated botanical identity and representative geographic origin. Without this foundation of high quality seed, the genetic basis of planting programs will always be in question. It costs just as much to establish a plantation with seed of poor quality as it does with seed of the highest genetic potential, but the difference in long-term production, quality and profitability may be great.

The Australian Tree Seed Centre (ATSC), part of CSIRO's Division of Forestry and Forest Products, has acted for 25 years as a national tree seed bank. It supplies seeds of Australia's unique woody flora to researchers in Australia and over 100 other countries. It is a national focus for both the import and export of tree seed and a recognised source of knowledge of the practical use of the Australian flora. The Centre provides technical advice on species selection and silviculture and conducts research on seed collection, germination, extraction and storage methods. The Centre also collaborates in studies of genetic variation in Australian tree species. Staff of the Centre have, over the past 10 years, written over 175 papers, written or contributed to the production of 9 books, produced a series of eucalypt and acacia leaflets and provided on-site consultant services to over 20 countries. The Centre distributes a brochure of 'Suppliers of Australian Tree Seed' and, by acting as a 'shop window' to Australia's flora, assists a commercial seed export industry valued at over A$7 million annually.

National and international interest in the work of the Centre has resulted in many government and corporate bodies providing support and the Centre currently receives 75% of its funds from outside sources. Over 30% of the Centre's activities are directed towards Australian research. Past and current supporters of the Centre's work include such diverse groups as FAO, the Australian International Development Assistance Bureau (AIDAB), Australian Centre for International Agricultural Research (ACIAR), Brazil's Agricultural Research Corporation (EMBRAPA), France's Centre Technique Forestier Tropical (CTFT), ALCOA of Australia, the US Department of Agriculture, aid bodies from Denmark, Canada, the USA, and a number of large international forestry companies. Such support helps maintain the service of provision of high quality seed and advice from the Centre. Supplementary services include training programs, overseas advisory visits and supply of literature to selected countries. The Centre encourages overseas foresters to visit Australia to collect their own seed as this provides an opportunity for a better understanding of the resource.

The seed stock of over 10,000 accessions from more than 800 species is the most comprehensive, publicly-accessible collection of its type in the world, and represents a uniquely Australian contribution to world forestry.

資料6

AUSTRALIAN TREE SEED CENTRE
— Staff at a Glance

Stephen Midgley - Officer-in-Charge

Mr Midgley has had extensive field experience in Asia, spending over 10 years implementing community-based and commercial plantation programs in Laos, Nepal and Sri Lanka. He has provided consultant services on the use and silviculture of Australian tree species to other countries in Asia, Africa, the Middle East and South America.

Lex Thomson - Experimental Scientist

Extensive experience in propagation and establishment of Australian trees and shrubs. He has led seed collection expeditions to all regions of Australia and Papua New Guinea and undertaken forestry consultations in Saudi Arabia, India, Nepal, Pakistan, Seychelles and Rome (FAO). Special interest in tropical acacias. Recently completed PhD investigation of salt tolerance in *Eucalyptus*.

Tim Vercoe - Experimental Scientist

A graduate forester with considerable seed collecting experience in all regions of Australia. Special interest in salt-tolerant species, species with potential for fodder use, and computerised tree crops data base.

Craig Gardiner - Experimental Scientist

Forestry graduate from the Australian National University with wide experience in the collection of native tree seed, especially south-east Australian eucalypts. Special interest in native tree species for mine rehabilitation and horticultural purposes.

Brian Gunn - Technical Officer

Responsible for the running of the Australian Tree Seed Centre laboratory. Over 9 years experience in seed collection and handling of Australian tree species for research. Has developed special techniques for cleaning, germination and storage of seed.

Maurice McDonald - Technical Assistant

Applied science graduate. Experience includes seed collections of native flora throughout Australia, analysis of leaf oil composition of south-western Australian eucalypts and soil chemical analysis. Interests include the taxonomy of eucalypts and acacias and photographing Australian flora.

Debbie Crawford - Technical Assistant

Honours graduate in Science from the Australian National University. She has assisted with seed collections of *Eucalyptus* species in south-eastern Australia, notably *Eucalyptus globulus* from southern Victoria. Considerable experience in germination testing of *Eucalyptus* and *Acacia* species. Research interest in the physiological responses of eucalypts to stress conditions.

James Moriarty - Technical Assistant

10 years experience in seed collection of eastern Australia, especially Cape York, including 3 years with ACIAR-sponsored collections in Queensland. Special interest in tropical acacias.

Sohiel Ahadizad - Technical Assistant

A diploma in optical dispensing at Sydney technical college with 6 years of practice management and optical prescription dispensing experience. Laboratory experience in seed testing and germination techniques. Field experience in seed collecting *Acacia* species.

John Lamour - Technical Assistant

A geology diplomate with mineral exploration experience in remote parts of Australia. Main duties in the Centre are seed collection and processing.

Beryl Thompson - Office Manager

Many years experience in word processing and secretarial duties, especially scientific manuscripts. Has worked in the Australian Tree Seed Centre for 3 years, with major responsibility for seed records data base and seed despatch.

Sally Bleakley - Seed Tester

Geography graduate with 4 years experience in the Tree Breeding section of the Zimbabwe Forestry Commission. Experience includes design and implementation of field trials. Also involved in the organisation of international conferences and workshops held in Zimbabwe. Currently employed by the Centre in seed testing and germination techniques.

Chris Doran - Clerical Assistant

Assistant to Beryl Thompson in the areas of seed despatch, office duties. Involved in updating seed store computer records.

資料7　FUNDING AGENCIES FOR THE ACTIVITIES OF THE AUSTRALIAN TREE SEED CENTRE

AUSTRALIA

Australian International Development Assistance Bureau

Australian Centre for International Agricultural Research

Australian Pulp and Paper Manufacturers

ALCOA of Australia Ltd

Commonwealth Employment Program - National Seed Collection Program

National Biotechnology Program

WA Chip and Pulp

Australian Mining Industry Council

National Capital Development Commission

OVERSEAS

EMBRAPA	(Brazil)
ENCE	(Spain)
Wiggins Teape	(United Kingdom)
CELBI	(Portugal)
USAID	(United States)
USDA	(United States)
IDRC	(Canada)
GTZ	(West Germany)
FAO	(United Nations)
CTFT	(France)
DANIDA	(Denmark)

MISCELLANEOUS

Consulting

Seed Sales

ESTIMATED TOTAL OUTSIDE FUNDS 1987-88 - c. $A 700,000

T R E E S E E D
Version 1.0

WHAT IS IT ?

A database management system used principally by the Australian Tree Seed Centre for the storage of seed information and accounting options. Potentially it has a wide range of other uses and can easily be adapted to other inventory systems.

WHO CAN USE IT ?

This program is designed for use on microcomputers in the management of seed stores where provenance information and mother tree details are regularly used. The program is easy to use and has been designed particularly for those not familiar with computers. Clear instructions with examples are given in the user manual.

WHAT DOES IT DO ?

Seed data such as species name, locality of collection, weight of seed and its viability are stored, as are details of transactions with customers.

Names of customers, countries, species and sponsor for despatch are accessed by codes, which are determined by the user.

The storage and manipulation of records of multiple collections of seed from different sets of trees at the same locality are a feature of the program. Records from *single trees are also accepted.*

When interrogating the database, search criteria (based on the fields included in the database) are selected by the user; output is sent to the screen or printer.

The following databases are used by the program:

* accessions
* despatches
* customers
* countries
* plant genera
* plant species
* seed pre-treatments

Listings of their contents are easily obtained.

During the transaction procedure records are updated automatically. Despatch or consignment notes are prepared and printed during the transaction process. There is also an option to delay despatch note production.

Backup procedures are also a feature. All files are dumped on to floppy disks (1.2Mb or 360kb) using instructions presented by the program on the screen.

There is also the facility where all files may be restored from the backup floppy disks to the hard disk. Instructions for backup and restoration are easy to follow.

資料８　種子センターにおける種子情報管理手法

T R E E S E E D

Version 1.0

Program Name: "TREESEED" a management system for the maintenance of tree seed collections.

Programmer: Peter N. Martensz

Hardware and Software Requirements:

Computer Model: IBM-compatible PC/AT, XT or PS2 microcomputers

Operating System: DOS 2.0 or higher

Memory required: 320kb

Disk drives required: 1 hard drive and 1 floppy drive
(to accept either 1.2Mb or 360kb floppy disks)

Printer required: Yes (must be capable of printing 120 characters on one line)

Additional Information:

Developed at: CSIRO, Division of Forestry and Forest Products,
PO Box 4008, Queen Victoria Terrace,
Canberra ACT 2600 Australia

Program available from: Mr P.N. Martensz
CSIRO, Division of Forestry & Forest Products
PO Box 4008
Queen Victoria Terrace
Canberra ACT 2600 Australia

Media: 2 floppy disks and user's manual

Cost: AS450 (Discount may apply to approved purchasers)

資料9

SESSION NO.
Paper No.

THE AUSTRALIAN TREE SEED CENTRE
A window to the resource

S.J. MIDGLEY
Australian Tree Seed Centre
CSIRO Division of Forestry and Forest Products
Canberra

INTRODUCTION

The Australian flora is extensive, diverse and demonstrates considerable natural variation. The very foundation to making the best use of this useful, valuable, but variable tree flora is the supply of seed of authenticated botanical identity and representative geographic origin. Without this foundation of high quality seed, the genetic basis of planting programs will always be in question. It costs just as much to establish a plantation with seed of poor quality as it does with seed of the highest genetic potential, but the difference in long-term production, quality and profitability may be great.

The Australian Tree Seed Centre (ATSC), part of CSIRO's Division of Forestry and Forest Products, has acted for 25 years as a national tree seed bank. It supplies seeds of Australia's unique woody flora to researchers in Australia and over 100 other countries. It is a national focus for both the import and export of tree seed and a recognised source of considerable knowledge of the practical use of the Australian flora. The Centre provides technical advice on species selection and silviculture and conducts research on seed germination and seed collection, extraction and storage methods. Staff of the Centre have, over the past 10 years, written over 175 papers, written or contributed to the production of 9 books, produced a series of eucalypt and acacia leaflets and provided on-site consultant services to over 20 countries. The Centre also collaborates in studies of genetic variation in Australian tree species.

The purpose of this paper is to describe the historical development of the Centre including its national and international role, and to outline current programmes and policies, and future directions.

HISTORICAL DEVELOPMENT OF THE CENTRE

Seed of Australia's unusual tree flora was an early export soon after white contact was made with Australia. A small tree of Eucalyptus obliqua, grown from seed collected by the Royal Navy's Tobias Furneaux in 1773, was noted as growing in Kew Gardens in 1789. In 1788, the private English nurserymen Lee and Kennedy had found a ready market for "New

Holland" plants and in 1790 dispatched a seed collector of their own to Sydney. Within 40 years of European settlement in Australia eucalypts were growing in Britain, France, Italy, Spain, Portugal, South Africa, Mauritius and Brazil (Ref. 1).

The early French enthusiasm for the Australian flora saw eucalypts planted through the warmer parts of Europe and the French colonies. Ferdinand von Mueller and his enthusiastic French disciple Prosper Ramel (of E. rameliana fame) vigorously exported seed of Australian species, particularly eucalypts, in the mid 1800s. By the 1860s eucalypts, acacias and grevilleas were being used in many parts of Europe, Africa, Asia and the Americas. The State forest services of Australia exported seed of many species and large commercial quantities were exported in the early 1900s by suppliers such as A. Murphy of Woy Woy. Much of the early work on the Australian flora was based upon seed collected from single trees and of sometimes confused taxonomy.

The economic and social importance of the Australian trees was quickly established outside Australia, but there remained a need for a reliable supply of certified, authenticated seed for international use. In 1961 the Food and Agricultural Organisation (FAO) of the United Nations requested the Australian Government to set up a centre with three objectives:

- To assemble and disseminate technical information on Eucalyptus species, most suitable for maximum wood production and for sheltering field crops, for use in countries outside Australia.

- To assist in the procurement of seeds of Eucalyptus species suitable for use in countries outside Australia.

- To conduct research in genetics of Eucalyptus and in tree breeding for improved varieties.

In the late 1960s the economic importance of non-eucalypts was recognised, and with the encouragement of the FAO Panel of Experts on Forest Gene Resources, the charter of the centre was expanded to include all genera of useful Australian woody plants, from small shrubs to tall trees.

Jacobs (Ref. 2) envisaged the newly-formed Forest Research Institute of the Forestry and Timber Bureau as the logical base for the centre, and the desirability of a central seed source to reduce duplication of effort was agreed to by the autonomous State forest services. From that time, with a fledgling staff of one professional officer, the Australian Tree Seed Centre has now become a group of 4 professionals and 10 technical staff. Research functions of the Forestry

and Timber Bureau were transferred to the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in 1975 and formed the basis for the current Division of Forestry and Forest Products. The seed service, now referred to as the Australian Tree Seed Centre, has been maintained as part of this Division.

The Centre provided the high quality seed for provenance trials of E. camaldulensis established in the early 1960s under the auspices of the FAO Mediterranean Forestry Research Committee. These trials provided positive and definitive demonstrations of differences in growth rate between provenances and support for the high standards of collection the Centre follows. Intensive and systematic seed sampling has subsequently been carried out on many species including E. cloeziana, E. delegatensis, E. grandis, E. globulus ssp globulus, E. leucoxylon, E. microtheca, E. nitens, E. obliqua, E. saligna, E. tereticornis, E. viminalis, Acacia aneura, A. auriculiformis and A. mangium. In collaboration with local forest authorities, the Centre has participated in seed collections of eucalypts and acacias occurring naturally in Indonesia and Papua New Guinea. These collections complement those made in Australia and have been used mainly for international provenance trials.

National and international interest in the work of the Centre has resulted in many government and corporate bodies providing support and the Centre is currently 75% self-financed. However, as a result, the operational role has expanded greatly. Figure 1 shows the geographic origin of seed orders processed by the Centre in 1987.

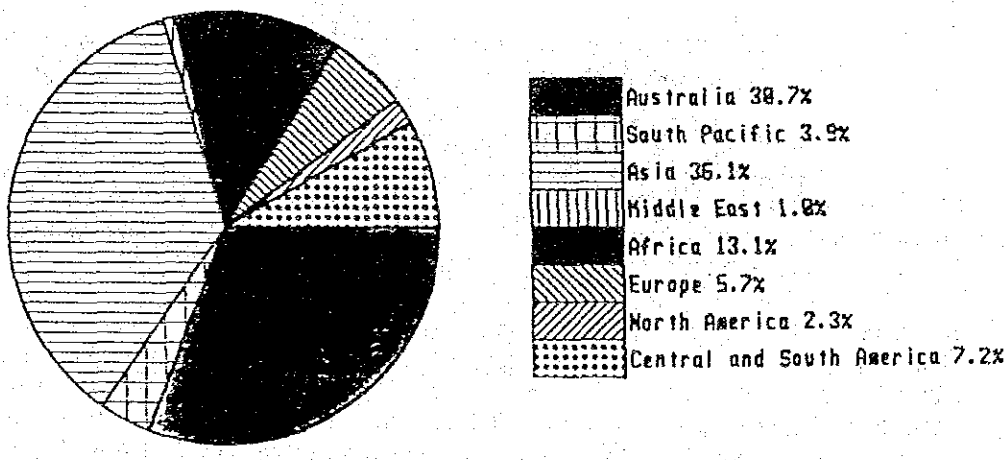


Figure 1. Seed orders processed 1987; by geographic origin

Past and current supporters of the Centre's work include such diverse groups as FAO, the Australian International Development Assistance Bureau (AIDAB), the Australian Centre for International Agricultural Research (ACIAR), the Brazilian Agricultural Research Corporation (EMBRAPA), the French Centre Technique Forestier Tropical (CTFT), ALCOA of Australia, the US Department of Agriculture, aid bodies from Denmark, Canada and the USA, and a number of large international forestry companies. Without such support the service of high quality seed and advice from the Centre could not be provided. The AIDAB support is especially valuable as it supports services in addition to seed collection and distribution, allowing for training programs, advisory visits and supply of literature. The Centre encourages overseas foresters to visit Australia to collect their own seed as this provides a better understanding of the resource with which they are dealing.

The primary aim of the Australian Tree Seed Centre is to provide authenticated and representative samples of seed to international and Australian researchers. Where research leads to greater quantities of seed being required, the seed may be secured through commercial seed suppliers or State forest services. The Centre distributes a brochure of "Suppliers of Australian Tree Seed" and, by acting as a "shop window" to Australia's flora, assists a commercial seed export industry valued at over A$7 million annually.

CSIRO's standards for seed collection are very strict. Parent trees are selected at a minimum distance apart to minimise the number of closely related individuals included in a seedlot. Precise records including parent tree description, botanical identity, collection location, habitat description, basic soil description, date of collection and number of parent trees are maintained. Appendix 1 is an example of the current field data sheet.

All seed distributed by the Centre is provided with a seed certificate which provides information on geographic origin and viability, and the number of trees sampled. This information is computerised to minimise transcription errors and improve handling efficiency. Researchers requiring additional seed origin information can request copies of the original provenance record sheets completed during the collection. Recipients of CSIRO seed are urged to use and record the unique 5-figure seedlot number which accompanies the seed. This number is the key to the record-keeping system of the Centre and is now commonly used for exchanging information in international eucalypt research.

Seed distributed by the Centre is priced according to a formula based on the cost of collection, processing and storage and is more expensive than seed from commercial suppliers. This reflects the cost of collection from widely spaced trees, the cost of collecting detailed site

information, the cost of record maintenance and the cost of dispatching seed in grams rather than kilograms. Prospective purchasers should be aware, however, that excessive economy in obtaining seed may jeopardise the results of much more costly research programs or the value of resulting plantations. There is a long-standing policy of exchanging seed whenever an appropriate arrangement can be made (Ref. 3).

To Australia's lasting credit the export of seed of Australian tree species has been mostly free of government restriction. From 1944 until 1953 the export of seed of Eucalyptus polybractea, a species rich in essential oils, was prohibited. There have been suggestions at different times since then that the export of seed of other species be prohibited. Examples include Melaleuca alternifolia which has a foliar oil of strong anti-bacterial quality, Castanospermum australe the seed of which contains an alkaloid reported to be of high potential for AIDS and cancer treatment and Duboisia spp. which produce atropine. Apart from the moral issues of laying proprietary claim to a wild species, the simple problem of adequately policing such regulations make prohibition impractical.

CURRENT PROGRAMS

Seed Collection and Distribution

The seed collection program of the ATSC is formulated every 2 years and is strongly influenced by the priorities of funding/sponsoring bodies, anticipated research needs within Australia and the FAO Panel of Experts in Forest Gene Resources. Appendix 2 shows the program for the 1988-89 biennium. This program reflects the increasing demand for a wider range of species and has meant the development of new techniques for the collection, handling and storage of those new species. It also reflects the current preference for collaborative, carefully focused seed collections. Over 70 person-months were spent in the field seed collecting in 1987.

Table 1 demonstrates the growth in seed collection and distribution in the 10 years, 1976-1986 and Table 2 reflects the current demand for species of different genera. The technical challenges of collecting, handling and testing such a range of species are great.

Table 1: Growth in seed collection and distribution 1976-1986.

Numbers of Seedlots	1976	1986
Accessions to store	700	2600
Dispatches from store	1500	6000

Table 2: Breakdown by genera of seedlots dispatched over 2 years, 1986-1987

Genera	Number of Species	Number of Seedlots
Eucalyptus	331	6526
Acacia	83	3893
Casuarina	9	758
Melaleuca	31	282
Allocasuarina	23	194
Sesbania	1	74
Grevillea	9	46
Other	84	320

Figure 2 shows the geographic origins of seedlots dispatched in 1987 and demonstrates the breadth of the stocks maintained by the Centre. Whilst there has been a strong increase in the demand for species suitable for agroforestry and arid and semi-arid land planting over the past 8 years, the most-requested species remain E. camaldulensis, E. tereticornis, E. grandis, E. globulus ssp. globulus, A. mangium and, more recently, A. auriculiformis. This is demonstrated by the steady demand for the popular E. camaldulensis, the most favoured provenance of which is Petford in north Queensland; in the 30 months after January 1985 the Centre sent over 72 kg of seed to 348 researchers in 79 countries - a total of 1700 seedlots, 30% of which went to India, Nepal and Zimbabwe (Ref. 4).

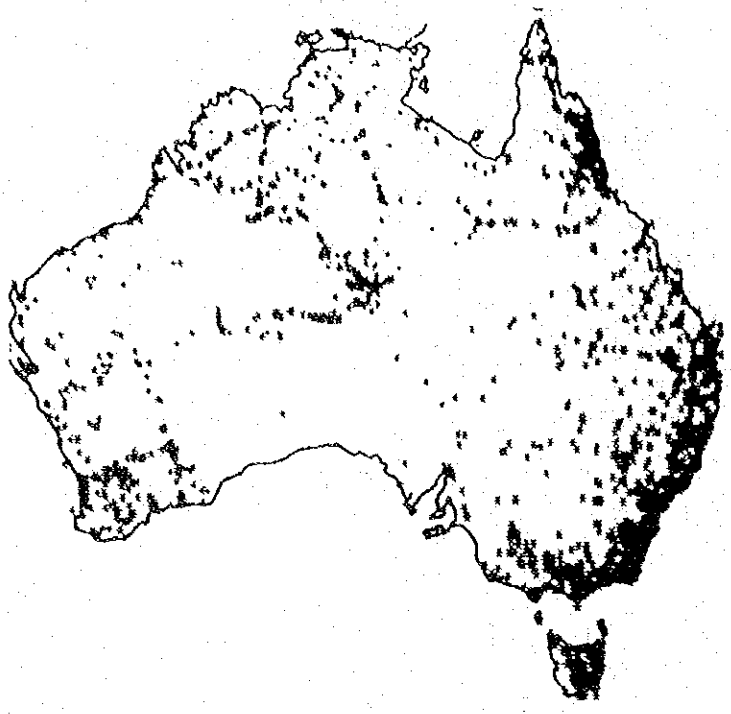


Figure 2. Geographic origins of seedlots dispatched, 1987.

Research

Research aimed at optimising methods for collecting, processing, storing and germinating Australian tree seed so as to obtain maximum longevity and germinative capacity is an essential function of the Centre and information from this work has been published.

The Centre contributes to research within the Division of Forestry and Forest Products on genetic variation and breeding systems on eucalypts, acacias and casuarinas. Complementary research within the Division includes eucalypt taxonomy, breeding strategies, quantitative genetics, isozyme studies, and advanced investigations of a range of physiological attributes such as frost resistance, salt tolerance, nutritional requirements and water relations. At many Universities and other research laboratories in Australia work is in progress on microbiological associates, nutritional value of foliage and wood properties, using seed and information from the Centre.

Support and coordination of international provenance trials of E. microtheca, E. urophylla, A. aneura and A. mangium have recently been provided under FAO auspices. The inability to make a larger input into international species and provenance trials has long been a source of frustration, but current collaborative work with ACIAR is partly addressing the problem.

Training, Extension and Consultancy Services

The Centre has provided in-service training in seed technology to foresters from fourteen countries over the past 10 years and this remains a significant part of the "Seeds of Australian Trees Project" sponsored by AIDAB. Apart from basic training in techniques of seed collection, handling and testing, this training provides a valuable opportunity for overseas foresters to become familiar with the ecology of Australian species in their native occurrence.

Staff of the Centre respond to about 1000 requests for seed or information a year. Advice is provided on an ad hoc basis to tree growers on the selection of appropriate tree species and provenances to meet stated objectives. To support this service, information on the ecology, propagation, silvicultural techniques, harvesting and utilisation of selected species is collated and disseminated.

The Centre regularly participates in international workshops to provide information and advice on the use of Australian trees and seed handling. As part of this activity the Centre played a major role in organising an international workshop on casuarina ecology, management and utilisation in 1981. The Centre will organise a IUFRO meeting on seed problems to be held in Australia in 1989.

Since 1980 Centre staff have undertaken on-site consultancies and advisory visits to 20 countries. As greater international use is made of the Australian flora, this activity will increase. Such visits are of value to Australia as they provide feedback on the overseas use and silviculture of Australian trees.

THE FUTURE

With the high national and international interest in planting and improving Australian tree species it is inevitable that demand for the services of the Australian Tree Seed Centre will continue. Natural populations will remain important sources of germplasm of Australian trees. Many widely planted species such as E. grandis and E. globulus remain inadequately sampled, partly due to an incomplete knowledge of their population structure and breeding systems. The recognition of superior provenances, the progressive identification of the potential of previously little-known species and wider recognition of inbreeding problems in many overseas plantations all point towards the need for continued intensive and systematic sampling of native populations of Australian tree species. There will be a continuing need for high quality seed for

research and development of commercially important species such as Eucalyptus grandis, E. globulus ssp. globulus, E. camaldulensis, E. tereticornis, Acacia mangium, A. auriculiformis and A. mearnsii. Research programs will undoubtedly identify a further suite of species useful for agroforestry and small-scale village afforestation. Two species which will receive increased attention are Grevillia robusta, a species widely used in the tropical highlands for high shade, agroforestry and lumber, and Macadamia integrifolia which has considerable potential as a high value tree crop for crowded village garden situations. There is evidence to suggest that the extensive international plantings of Grevillea robusta have a narrow genetic base.

Essential research to improve handling techniques for seed of high value species will continue. This will be of particular importance should afforestation using a broader range of high-value rainforest species become a reality.

Seed supply of important provenances of priority species such as A. auriculiformis and A. mangium will be assured through the establishment of seed orchards by State forest services and private organisations in Australia.

Service activities of the ATSC such as the advisory service, consultancies and training will continue under outside sponsorship. An exciting innovation will be the further development of a new tree crops data base, TREDAT, which will permit the results of field trials of species, provenances and other sub-specific taxa to be stored and selectively retrieved. The accumulated records will be used to assist in the choice of planting material for nominated localities and end uses.

Australia has an obligation to contribute to reforestation efforts in a world of shrinking forest resources. No other organisation maintains such a diverse and publicly-accessible collection of source-identified, authenticated tree seed. The Australian Tree Seed Centre represents a uniquely Australian contribution to international forestry.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the fine work of Mr Egon Larsen who died in an accident while collecting seed in Indonesia, Dr John Turnbull, Mr Doug Boland and Mr John Doran who established and developed the Centre. The dedication of all the past and current staff is acknowledged.

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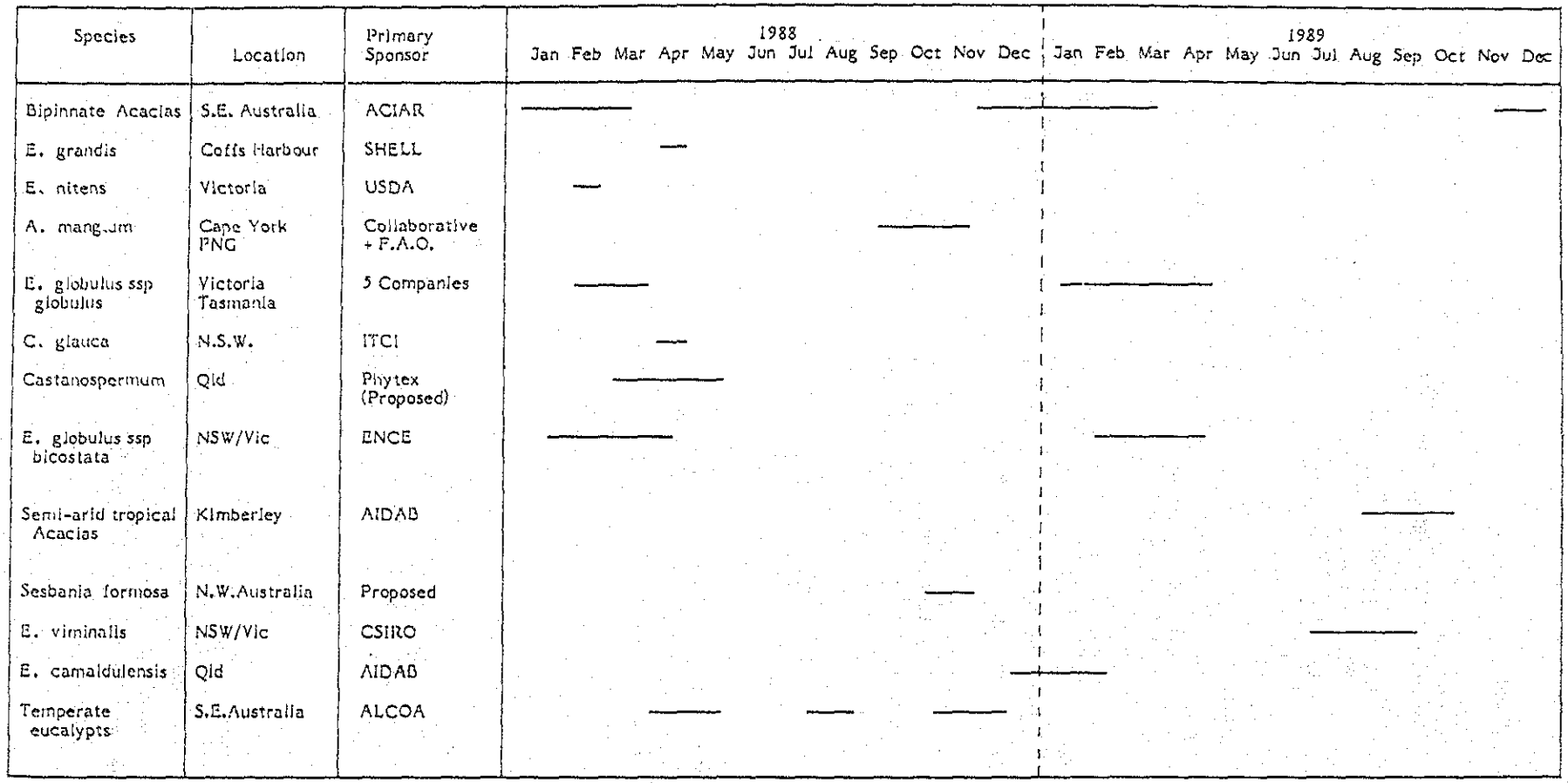
AUSTRALIAN TREE SEED CENTRE

PROPOSED SEED COLLECTION SCHEDULE *

Jan 1988 - Dec 1989



* Indicates field collection time only - does not reflect time for planning, cleaning and reporting.
Does not include other major Centre activities such as extension, advisory service, consulting or training.

Tree Seed Centre,
CSIRO, Division of Forest Research,
P.O. Box 4008, Queen Victoria Terrace,
Canberra, A.C.T. 2600, Australia.

SEED DATA SHEET

Species: _____ Seedlot No. _____

Collection Locality: _____

_____

Latitude: ___° ___'S Longitude: ___° ___'E Altitude: _____ (m) Aspect: _____ Slope: _____

Climatic Zone: _____ Met. Station: _____

Association includes: _____

Geology and Soil: _____ pH: _____

Collection No.	Bot. spec.	Photo No.	Ht (m)	dbh (cm)	Tree Description	Seed wt (g)	No. viable seed/10g

Work supervised by: _____ Date: _____ Total: grams

資料１０

WOODY PLANT SEED COLLECTIONS IN TROPICAL, ARID AND SEMI-ARID AUSTRALIA AND RECOMMENDATIONS FOR INTERNATIONAL SPECIES TRIALS 1/

by

L.A.J. Thomson and E.G. Cole
Tree Seed Centre, Division of Forest Research, C.S.I.R.O.,
P.O. Box 4008, Queen Victoria Terrace, A.C.T., 2600, Australia

SUMMARY

Between 12 September and 16 October 1984 a seed-collecting expedition was jointly undertaken by the Tree Seed Centre (CSIRO, Australia) and the Centre Technique Forestier Tropical (CTFT, France) to the arid and semi-arid parts of the Northern Territory and north-western Australia. Field assistance was provided by the Conservation Commission of the Northern Territory (CCNT). This expedition formed part of a continuing program by the Centre to investigate Australia's arid zone flora and to make available well-documented, representative seed collections of woody species from the region.

This article lists a selection of species and provenances of which seed, collected on the 1984 and previous expeditions, is available for field trials to evaluate the potential of these species for fuelwood production, fodder production, soil stabilization and other uses in tropical/sub-tropical, arid and semi-arid zones. The Centre proposes to co-ordinate the evaluation of selected species and provenances in these trials.

INTRODUCTION

There is an urgent need to re-establish and increase shrub and tree cover in the arid and semi-arid tropics, particularly in the Sahel belt of Africa (Plan of Action of the U.N. Conference on Desertification, Nairobi, 1977). In addition to soil stabilisation, the planting of woody perennials may provide a wide range of benefits including fuelwood, human food, stock fodder, improvement of microclimate (through the provision of shade and shelter) and soil fertility (through N-fixation and mulching), timber and minor products (gums, oils, tannins etc.). In order that the most appropriate species and provenances are used in regeneration programs it is important to speed up the collection and evaluation of the woody flora of the arid zones of the world.

Australia has extensive tropical, arid and semi-arid zones (Fig. 1 and Table 1) and a large number of woody species occur in these areas. In the genus Acacia alone, the distribution maps of Maslin and Pedley (1982) indicate that ca. 140 species occur naturally in tropical, arid areas (i.e. areas north of latitude 24°S with a median rainfall less than 500 mm per annum). By comparison with tropical woody species from riverine locations and the more humid parts of Australia, there have been few well-documented collections of species from arid/semi-arid zones for species and provenance research. An exception is Acacia aneura (mulga) of which the Tree Seed Centre, in cooperation with FAO, has undertaken extensive collections over the past seven years from arid parts of Australia. The A. aneura seed collections have been used to establish international provenance trials in ten countries (Midgley and Gunn, 1985). During the mulga collecting expeditions to the southern part of the Northern Territory (NT) and central Western Australia (WA) the opportunity was taken to collect seed of other multipurpose, arid-zone species. The testing of these species in appropriate environments is being promoted by the Centre when opportunities arise.

1/ Manuscript received in December 1985.

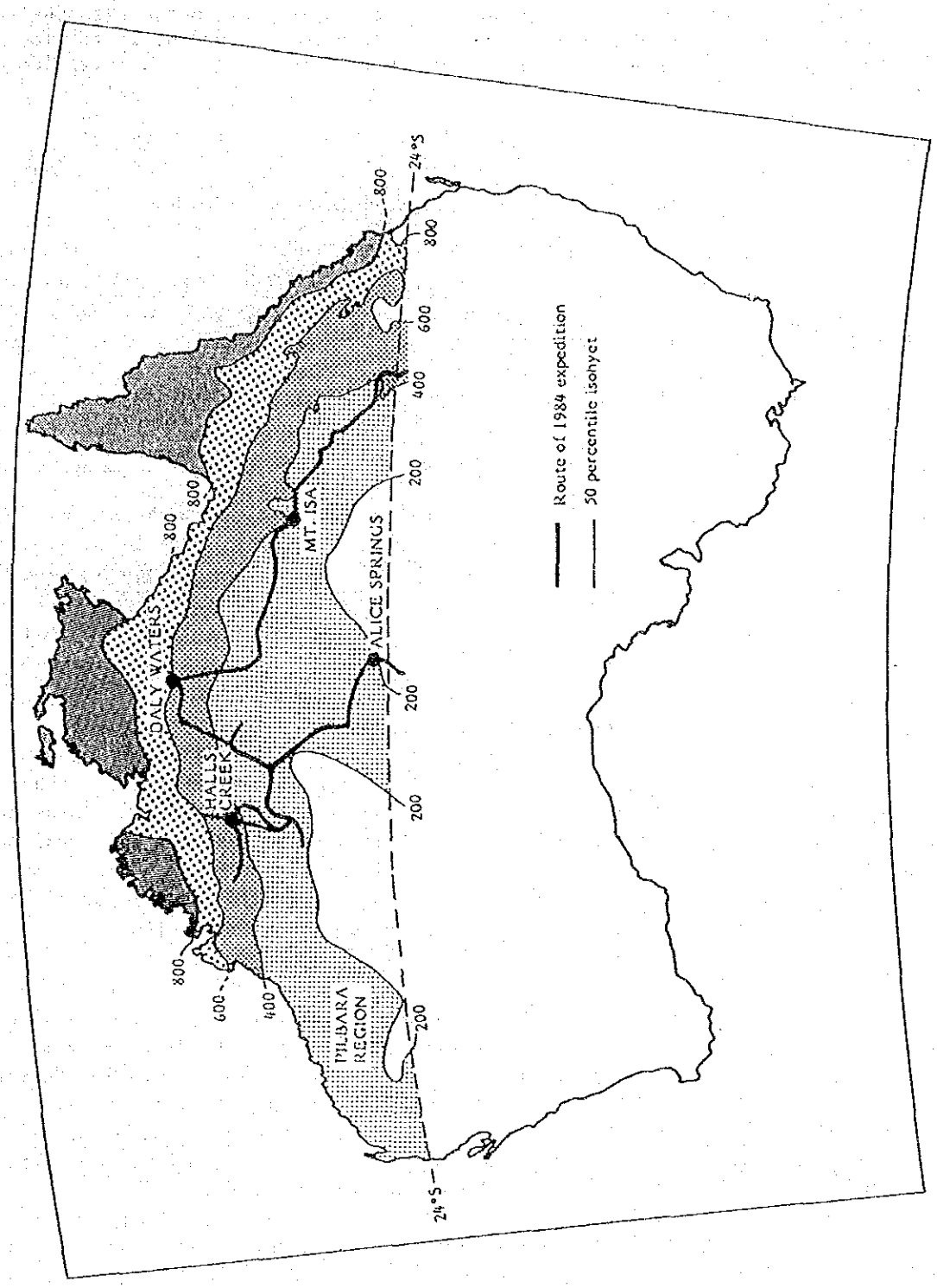


Fig. 1 Map of northern Australia showing the route of the 1984 expedition, 50 percentile isohyets and location of meteorological stations (data presented in Table 1)

The aim of the 1984 expedition was to collect seed of multipurpose shrubs and trees for planting in sub-tropical/tropical arid and semi-arid parts of the world. Therefore the main collecting area was located further north of the previous expeditions, in central NT and adjacent parts of WA (see Fig. 1). The collecting area is characterised by infertile soils, in particular deep sands and skeletal lateritic types. The species collected, predominantly Acacia spp., were those considered to have potential for the production of fuelwood and/or fodder as well as other uses such as soil stabilization and nitrogen fixation.

Table 1 Climatic data for meteorological stations in the collecting region of the 1984 expedition

Station location details				Temperature (°C)					Mean monthly rainfall (mm)												Mean annual rainfall (mm)
				January		July															
Name	Lat. (°S)	Long (°E)	Alt. (m)	Mean min.	Mean max.	Mean min.	Mean max.	Average no. of frosts per year	J	F	M	A	M	J	J	A	S	O	N	D	
Mt Isa	20°44'	139°28'	356	23	33	17	29	0	84	92	53	17	20	19	6	2	7	21	24	57	402
Daly Waters	16°16'	133°22'	212	24	39	11	29	0	154	147	115	23	6	5	1	2	4	19	53	100	629
Halls Creek	18°14'	127°40'	423	24	37	12	27	0	132	115	66	17	9	6	7	3	4	13	33	76	481
Alice Springs	23°36'	133°36'	547	22	37	5	19	12	39	42	28	17	16	15	10	9	8	20	24	36	264

Data from Hall et al (1981)

The expedition was jointly funded by FAO, CSIRO and CTFT. The CTFT was keen to follow-up the northern Australian collections undertaken by Cossalter in 1973-74, with collections of woody plants from more inland parts of tropical, arid Australia. A number of species and provenances from the 1973-74 collections have shown considerable promise in tropical Africa, e.g. Acacia holosericea in Senegal, but sometimes have not exhibited satisfactory drought tolerance or longevity. The expedition was undertaken in collaboration with CCNT, whose staff have a considerable knowledge of the distribution and characteristics of woody species naturally occurring in the Northern Territory.

SEED COLLECTIONS

The collecting team consisted of the authors, Dr. M. Cossalter, Mr. C. Cossalter (CTFT) and for part of the expedition Mr. P. Kube and Mr. S. Hester (CCNT). Between 12 September and 16 October 1984 the collecting team gathered 220 kg of seed in 102 seedlots (2471 parent plants) from the area indicated in Figure 1. The species included members of the genera Acacia, Callitris, Cassia, Casuarina, Dodonaea, Eucalyptus, Geijera, Grevillea, Melaleuca, Petalostigma, Templetonia and Terminalia. The following discussion concentrates on the acacias of which seed of 41 species was collected.

Timing

While there was variation in the stage of fruit development between species and districts, it was apparent that the optimal time for Acacia seed collection in central NT and adjacent parts of WA was September-October in 1984. The optimal collecting time is affected by climate, and may vary by several weeks between different years (P. Latz, pers. comm.).

Collecting techniques

For Acacia spp. the most appropriate collecting technique varies between species and with stage of fruit maturity; a wide variety of other factors will also affect the collection method to be adopted. On the 1984 expedition the most frequently used technique was to saw or break small branches and beat these on a large tarpaulin, laid out underneath the plant. Where the fruits were relatively green and consequently more difficult to dislodge from the branches, hand stripping proved to be a more satisfactory approach. Where the fruits were fully mature (i.e. dry, brittle, brown and shedding seed), sticks were used to beat them down onto a tarpaulin; in some cases the plant was shaken vigorously to achieve the same end. Doran et al. (1983) give detailed information on collecting and cleaning techniques for Acacia seed used by CSIRO Division of Forest Research.

Sampling strategy

An effort was made to collect from more than one locality (provenance) for the more promising and widely distributed species. In these cases collecting sites were usually geographically well separated (i.e. more than 100km apart) and wherever possible collections were made from populations occuring on different soil types. Populations growing on harsh sites, such as rocky outcrops, sand dunes and saline soils, were especially sought.

The main aim of sampling was to ensure that each collection was representative of a particular species at any collection site. The sampling pattern adopted depended on factors such as the pattern of distribution, plant density and extent of area over which fruit-bearing individuals were present. For trees or large shrub species it was considered desirable to collect seed from a minimum of ten trees spaced at least (50-)100 m apart. For shrubs, or larger plants with small seed crops, a 'sub-site' sampling approach was adopted whereby a number of plants were collected at each of a number of sub-sites (preferably five or more) which were well-spaced i.e. at least (50-)100 m apart. The latter approach facilitated a more rapid collection of a suitable quantity of seed, than if each sampled plant had been at wider intervals.

Most seed collections were bulked in the field. Individual plant collections were undertaken for some species of proven value and which were carrying particularly heavy seed crops, such as A. holosericea, A. cowleana and A. shirleyi.

Documentation

In addition to gathering standard data (see Doran et al. 1983) detailed information was recorded on associated species (frequency, stature) and soil type (profile description and soil analysis). It may be expected that where certain forms are identified as adapted to particular conditions elsewhere, many of their native associate species or provenances will be adapted to those same conditions. Detailed soil information for seed collection sites will be used in attempts to match species and provenances to potential planting sites.

Wood sampling

Wood samples were collected in order to assess the fuelwood potential of the sampled species. The Division of Chemistry-Energy of CTFT has since evaluated the chemical and energy characteristics of the wood samples. They concluded that, with the exception of Terminalia arostrata, the sampled species (which included members of Acacia, Eucalyptus, Grevillea and Melaleuca) had high calorific values and a reasonable potential for charcoal production. The species with the best properties for charcoal production were Acacia monticola, A. adsurgens, A. torulosa, A. difficilis, A. jennerae, A. tumida, A. acradenia, Melaleuca glomerata and Grevillea wickhamii.

COMMENTS ON SPECIES

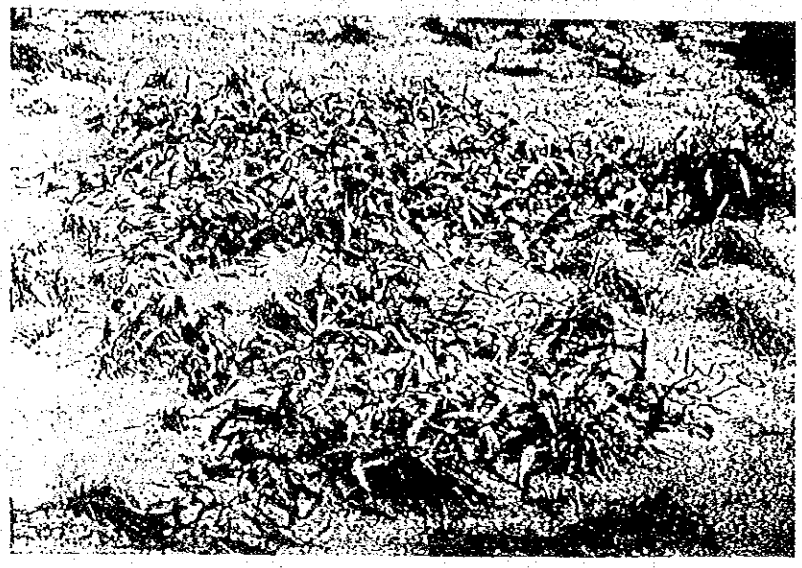
The collections included a number of promising multi-purpose species described in detail by Turnbull (1986): A. ampliceps, A. ancistrocarpa, A. cowleana, A. difficilis, A. holosericea, A. ligulata, A. lysiphloia, A. monticola, A. pachycarpa, A. shirleyi and A. tumida.

Our field observations confirm that A. ampliceps (Fig. 2), a fast-growing species, has an excellent potential for fuelwood and fodder production in the wet/dry tropics and in arid areas where subsoil moisture is seasonally available. It typically occurs on heavy, occasionally saline, alkaline soils along drainage lines. A prostrate form grows together with the typical upright form on the floor of the Wolf Creek Meteorite Crater in WA (Fig. 3). The prostrate form has considerable potential for use as an ornamental groundcover.

Figure 2

Acacia ampliceps - fast growing, salt-tolerant species at Spice Creek (NT)

Figure 3



Acacia ampliceps - prostrate form at Wolf Creek Crater (WA)

Substantial provenance collections were made of A. holosericea and A. cowleana (Fig. 4), fast-growing species with a high potential for fuelwood production in tropical, arid zones (Cossalter 1985). Other noteworthy species for which seed was collected were A. gonoclada (a close relative of A. cowleana) - this species grows on harsh sites, typically rock outcrops, and may have potential for fuelwood production on skeletal soil types in arid areas; and A. adsurgens - a fast-growing, multistemmed shrub which has potential for soil stabilization and fuelwood production on sandy soils.

From botanical material collected during the 1984 expedition, a new species with affinity to A. tephrina (Fig. 5), which occurs around the margins of Lake Gregory and nearby depressions, is to be described by L. Pedley (Queensland Herbarium). The existence of this tree was known but its taxonomic status was uncertain (B. Maslin, pers. comm.). A. 'maconochieana' Pedley is a fast-growing, upright tree (to ca. 10 m tall) with potential for the production of posts, small poles, fuelwood and fodder in situations similar to that described above for A. ampliceps. Field observations indicate that the new species is highly tolerant of periodic inundation.

Figure 4

Acacia cowleana - seed collections at "Carranya" (WA)

Figure 5

Acacia 'maconochieana' Pedley - a new species from Lake Gregory (WA)

COMMENTS ON ACACIA DISTRIBUTION

On the 1984 expedition many acacias were observed growing in areas where they had not previously been recorded (cf. Maslin and Pedley 1982). The more favourable moisture regime in central Australia over the past ten years has encouraged the proliferation of woody vegetation, in particular fast-growing, precocious, heavy seeders such as A. holosericea, A. cowleana, A. laccata, A. tumida and A. stipuligera. Some of these 'opportunistic' species, particularly those dispersed by birds (see Davidson and Morton 1984), may have undergone recent expansions in distribution. For example A. cowleana, which has been considered an uncommon species (Pedley 1978; Maslin 1981), was found to be widespread and abundant over a large part of northern arid Australia. In some species, range extensions are the result of previously incomplete botanical exploration e.g. two small patches of A. aneura (mulga) were found in a remote part of the Tanami Desert, south-east of Hooker Creek. This collection extended the northern recorded range for this species from 19° 18'S to 18° 48'S.

PROPOSAL FOR INTERNATIONAL TRIALS OF TROPICAL, ARID/SEMI-ARID ZONE AUSTRALIAN SPECIES

There is a need for a more substantial co-ordinated research program to evaluate the potential of promising woody species and provenances from the arid/semi-arid tropics of Australia for cultivation. This program will complement related research being undertaken by ACIAR and CTFT in the dry tropics, and FAO Forestry Department's project on the improved utilisation of genetic resources of woody species of arid and semi-arid zones. We propose that this expanded program, "Trials of Australian woody plants in the dry tropics" should be undertaken on a collaborative basis, using seed made available by the Tree Seed Centre and that individual trials, the responsibility of individual collaborators, should be planned and reported with regard to the guidelines and objectives set out in this paper.

From the seedlots currently held by the Tree Seed Centre we have made a selection of 20 of the most promising species and provenances for evaluation for certain major uses under certain environmental conditions, viz.

(1) Fuelwood species - arid (i.e. < 500 mm average annual rainfall)
(2) " " - semi-arid (i.e. 500-800 mm average annual rainfall)
(3) Fooder species - arid (i.e. < 500 mm average annual rainfall)
(4) " " - semi-arid (i.e. 500-800 mm average annual rainfall)

(5) Soil stabilization and other uses - sand dunes/deep sands
(6) " " " " " - skeletal, rocky soils
(7) " " " " " - low-lying areas (heavy soils; seasonally high water table, including brackish or saline sites).

Table 2 gives details of the 'standards' (species and provenances to be included in all trials) and other seedlots available for each trial. These selections have been based on preliminary field trial results from Africa and Australia, our field observations and the available literature. It is suggested that the material be evaluated against a small number of the most promising indigenous and other exotic species already included in planting programs in the area of the trial.

Organizations wishing to participate in these species and provenance trials should indicate their interest to the Tree Seed Centre of the CSIRO Division of Forest Research. Detailed information on the proposed testing site(s) (i.e. latitude, longitude, altitude, climatic and soil conditions) should be given, together with an indication of the preferred date for the receipt of the seed and possible import permit requirements. Initially collaborators will be supplied with seed and information on the origin and viability of all seedlots, recommended seed pretreatments, sources of rhizobium (in situations where inoculation may be required), and suggested guidelines for the establishment of research trials.

Seed will be supplied free-of-charge to collaborators in developing countries who undertake to supply the Tree Seed Centre with detailed information on the results of their trials. This response will enable the Tree Seed Centre to collate and maintain records on the performance of species and provenances in different trials through a computerised data base (TREDAB) under development at the Division of Forest Research, CSIRO (Brown, pers. comm.). Active collaborators will be supplied with progress reports at appropriate intervals.

FUTURE COLLECTIONS

In 1986 it is planned to make seed collections in the Pilbara region (see Fig. 1). Seed from this and other collections will be available at a later date to collaborators.

ACKNOWLEDGEMENTS

The authors would like to thank Mr. C. Cossalter (CTFT), Dr. M. Cossalter, the staff of the Tree Seed Centre (CSIRO), Dr. J.W. Turnbull (ACIAR), Mr. P. Kube, Mr. S. Hester and Mr. P. Sandell (CCNT), Central Lands Council and Mr. B.R. Maslin (WA Herbarium) for their valued contributions to the success of the 1984 expedition, and the FAO for providing financial support. Dr. D.J. Boland, Mr. J.C. Doran, Dr. M.I.H. Brooker and Mr. A.G. Brown provided valued comments on a draft of this report.

Table 2. Details of seedlots for international trials of multipurpose woody species from Australia in tropical/subtropical arid and semi-arid climate zones

Seedlot No.	Species	Location	Lat. °S	Long. °E	Alt. m	No. of parents	Major use/environment^ 1	2	3	4	5	6	7
Standards													
13720	Acacia aneura	Floodout Bore, N.T.	21 47	131 09	580	10	*	*	*	*	*	*	*
14655	Acacia cowleana	Carranya, W.A.	19 13	127 46	340	16	*	*	*	*	*	*	*
14651	Acacia holosericea	Carranya, W.A.	19 14	127 46	340	20	*	*	*	*	*	*	*
13923	Eucalyptus camaldulensis	Katherine, N.T.	14 29	132 15	95	12	*	*	*	*	*	*	*
Other seedlots													
14644	Acacia acradenia	W. of Rabbit Flat, N.T.	20 09	129 51	420	48					*		
14667	Acacia acradenia	E. of Halls Creek, W.A.	18 18	127 50	430	60						*	
13738	Acacia adsurgens	Kilton Park, N.T.	23 16	132 53	600	10	*						
14652	Acacia adsurgens	Carranya, W.A.	19 14	127 46	340	15	*	*			*		
14631	Acacia aspliceps	Wave Hill, N.T.	17 26	130 56	230	10		*	*	*	*		*
14668	Acacia aspliceps	E. of Halls Creek, W.A.	18 26	127 51	400	26		*		*			*
14647	Acacia ancistrocarpa	Carranya, W.A.	19 16	127 39	340	22	*	*			*		
13481	Acacia aneura	Charleville, Qld.	26 25	146 17	300	10				*			
14061	Acacia aneura	Giles, W.A.	24 55	128 17	500	13			*				
14665	Acacia argyraea	W. of Halls Creek, W.A.	18 31	127 18	420	39						*	
14958	Acacia bidwillii	ENE of Georgetown, Qld.	18 12	143 57	385	5				*			
14039	Acacia calcicola	Uluru N.P., N.T.	25 13	130 20	530	40						*	*
14597	Acacia cambagei	Barcaldine, Qld.	23 32	144 58	265	5		*					*
14602	Acacia chisholmii	NW. of Mt Isa, Qld.	20 15	139 00	315	46			*	*	*		
14049	Acacia coriacea	W. of Docker R., N.T.	24 51	129 03	680	10	*		*			*	*
13768	Acacia coriacea	Rabbit Flat, N.T.	20 15	130 02	380	10			*		*		
14613	Acacia cowleana	Helen Springs, N.T.	18 31	133 53	295	56		*		*			
14634	Acacia cowleana	SE. of Hooker Creek, N.T.	18 48	131 13	300	22	*		*				
14050	Acacia cuthbertsonii	Docker River, N.T.	24 53	129 07	640	15						*	
13776	Acacia dictyophleba	Wannabi Hill, N.T.	22 21	131 18	710	5	*					*	
14619	Acacia difficilis	Elliot, N.T.	17 24	133 30	250	46		*					
14653	Acacia drepanocarpa ssp latifolia	Carranya, W.A.	19 14	127 46	340	25					*		
14973	Acacia farnesiana	Julia Creek, Qld.	20 40	141 35	80	20			*	*			
14633	Acacia gonoclada	Wave Hill, N.T.	17 36	130 52	300	9	*		*			*	

Table 2 (Cont'd)

Seedlot No.	Species	Location	Lat. °S	Long. °E	Alt. m	No. of parents	Major use/environment[A] 1	2	3	4	5	6	7
14657	Acacia hemignosta	N. of Halls Creek, W.A.	17 30	127 56	395	10						*	
14601	Acacia hilliana	N. of Mt. Isa, Qld.	20 32	139 28	350	12						*	
14632	Acacia holosericea	Wave Hill, N.T.	17 37	130 53	300	11	*		*				
14660	Acacia holosericea	Turkey Creek, W.A.	17 04	128 12	400	26		*		*			*
14685	Acacia inaequilatera	Chilla Well, N.T.	21 31	130 59	460	11						*	
14689	Acacia jennerae	Newhaven, N.T.	22 46	131 15	490	34		*					
13737	Acacia kempeana	Milton Park, N.T.	23 17	132 56	600	5			*	*			
14656	Acacia laccata	S. of Halls Creek, W.A.	18 55	127 43	430	29	*	*					
14659	Acacia limbata	Turkey Creek, W.A.	17 08	128 10	400	41						*	
14055	Acacia ligulata	Giles, W.A.	24 59	127 16	520	40	*		*		*		*
14662	Acacia ligulata	Fitzroy R., W.A.	18 29	125 45	180	110							*
14671	Acacia ligulata	Sturt Creek Hstd., W.A.	19 08	128 11	350	45						*	
15066	Acacia ligulata	Southern N.T.	22 00	131 00	500	20					*	*	
14638	Acacia lysiphloia	SW. of Hooker Ck., N.T.	18 32	130 11	400	45	*		*	*	*		
14676	Acacia maconochieana MS	Bulbi Plain, W.A.	20 17	127 19	260	23		*	*	*			*
13796	Acacia maitlandii	Uluru N.P., N.T.	25 20	131 15	580	15					*		
14008	Acacia monticola	S. of Broome, W.A.	18 50	121 40	25	6	*		*	*			
14609	Acacia monticola	SE. of Banka Banka, N.T.	18 55	134 07	310	59						*	
14646	Acacia monticola	Billiluna, W.A.	19 31	127 39	320	18			*				
13781	Acacia murrayana	Uluru N.P., N.T.	25 13	130 53	580	6		*					*
14672	Acacia pachycarpa	Billiluna, W.A.	19 33	127 41	300	33				*			*
14629	Acacia pallidifolia	Top Springs, N.T.	16 41	131 46	200	5				*			
14626	Acacia platycarpa	Yellow Water Hole, N.T.	16 45	132 19	280	16		*					
14696	Acacia plectocarpa	Kimberley Region, W.A.	16 18	128 15	150	13				*			
14625	Acacia shirleyi	Hidden Valley, N.T.	16 38	133 01	260	10		*		*		*	
13488	Acacia stenophylla	Windorah, Qld.	25 06	142 50	120	5				*			
14670	Acacia stenophylla	Cow Creek, W.A.	18 41	128 21	340	10	*	*	*	*			*
14636	Acacia stipuligera	SE. of Hooker Ck., N.T.	18 45	131 06	300	17		*			*		
13798	Acacia strongylophylla	Standley Chasm, N.T.	23 45	133 28	720	15						*	
14603	Acacia tenuissima	NW. of Buckley R., Qld.	20 06	138 48	295	20					*		
14620	Acacia torulosa	Newcastle Waters, N.T.	17 26	133 28	240	20		*			*		
14681	Acacia translucens	E. of Billiluna, W.A.	19 53	128 13	370	88					*		
14661	Acacia tumida	Fitzroy River, W.A.	18 19	125 37	150	20		*	*	*	*		

Table 2. (Cont'd)

Seedlot No.	Species	Location	Lat. °S	Long. °E	Alt. m	No. of parents	Major use/environment[A] 1	2	3	4	5	6	7
14675	Acacia tumida	S. of Lake Gregory	20 10	127 34	260	58	*		*		*		
13797	Acacia validinervia	Tylers Pass, N.T.	23 41	132 22	600	40						*	
13204	Allocasuarina decaisneana	Hermannsburg, N.T.	23 45	132 41	580	5	*				*		
14976	Atalaya hemiglauca	W. of Georgetown, Qld.	18 17	143 14	220	25				*			
14608	Cassia oligophylla	Phillip Creek, N.T.	19 13	134 10	320	50			*				
14100	Casuarina obesa	Wiluna, W.A.	26 34	120 03	550	6							*
14692	Dodonaea viscosa ssp. mucronata	Kulgera, N.T.	25 55	113 14	510	10			*			*	
14642	Eucalyptus brevifolia	NE. of Tanami, N.T.	19 22	129 58	420	9	*					*	
14530	Eucalyptus camaldulensis	Wyndham, W.A.	15 31	128 12	5	8							*
14024	Eucalyptus ganophylla	W. of Olgas, N.T.	25 05	130 03	610	7	*						
14026	Eucalyptus gongylocarpa	Curtin Springs, N.T.	24 58	131 30	400	5							*
14089	Eucalyptus intertexta	Gary Hwy., W.A.	25 04	124 59	500	7		*					*
15067	Eucalyptus microtheca	Carnarvon basin, W.A.	23 30	114 00	30	15							*
15072	Eucalyptus microtheca	Marble Bar/Pilbara, W.A.	20 05	119 25	100	20		*					
14682	Eucalyptus odontocarpa	Billiluna, W.A.	19 53	128 17	370	10					*		
14641	Eucalyptus pachyphylla	NE. of Tanami, N.T.	19 23	129 58	420	8	*				*		
14906	Eucalyptus thozetiana	Alice Springs, N.T.	23 32	134 29	600	6	*					*	
14690	Melaleuca glomerata	Curinya Bore, N.T.	22 49	131 48	560	20	*						*
14095	Melaleuca lasiandra	Carnegie Station, N.T.	25 28	123 23	470	10							*
14099	Melaleuca pauperiflora	Wiluna, W.A.	26 34	120 03	550	8							*

[A]Key to major use/environment

1. Fuelwood species - arid (i.e. < 500 mm. average annual rainfall)
2. Fuelwood species - semi-arid (i.e. 500-800 mm. average annual rainfall)
3. Fodder species - arid (i.e. < 500 mm. average annual rainfall)
4. Fodder species - semi-arid (i.e. 500-800 mm. average annual rainfall)
5. Species for planting on sand dunes/ sand-stabilization species
6. Species for planting on skeletal, rocky sites
7. Species for planting on low-lying areas (heavy soils/high water-table including brackish/saline sites)

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FOREST GENETIC RESOURCES

INFORMATION No. 15

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 1987

NOTES ON SEED PRETREATMENT CODES

0 = No pretreatment required

Seed germinates readily without any pretreatment or stratification when given appropriate conditions of temperature, moisture and light.

1 = Cold, moist stratification

Seed of some *Eucalyptus* species from high altitudes require cold, moist stratification to break dormancy. To stratify, sow the seed onto a moist substrate in a germination container, cover the container with a lid or plastic sheet to minimise drying and place in a refrigerated environment (1-4°C). Check occasionally to see that the substrate remains moist. 3 weeks stratification is essential to break the dormancy of *E. perriniana* seed and will also ensure more rapid and even germination for *E. amygdalina, E. dives, E. nitens, E. pauciflora* ssp. *pauciflora, E. regnans* and *E. stellulata*. 4 weeks stratification is essential for the germination of seed of *E. glaucescens* and *E. pauciflora* ssp. *niphophila*; 6 weeks is required for *E. kybeanensis, E. mitchelliana* and *E. pauciflora* ssp. *debeuzevillei*, while *E. delegatensis* requires 6-10 weeks, depending on seed source. On subsequent transfer to warm temperatures germination should commence within 3-5 days.

2 = Manual nicking

Using either a sharp scapel or nail clippers remove a small piece (about 1 mm^2) of the seed coat at the distal (cotyledon) end of each seed (see Figure 1).

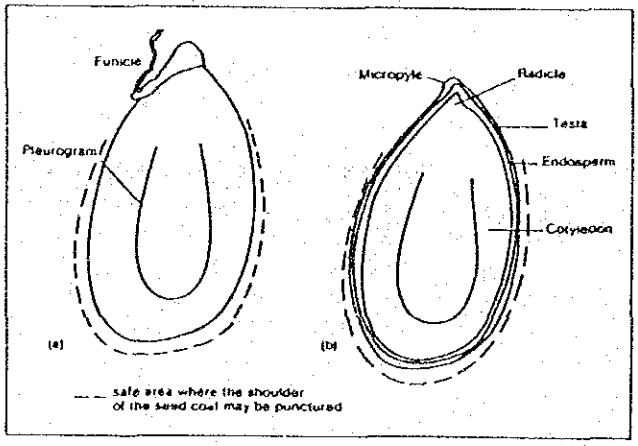

Figure 1. Area where the shoulder of the seed coat is punctured to promote germination. (a), An *Acacia* seed with funicle; (b) an *Acacia* seed without funicle showing relative position of strophiole, hilum, and micropyle.

Manual nicking or similar techniques are suitable pretreatments for most hardseeded species, and may be especially suited to small and valuable research seedlots. The technique has the drawback of being time-consuming and may cause damage to the embryo and cotyledons. Seedlots of some species, e.g. *Acacia coriacea* and *A. pachycarpa*, respond unfavourably to nicking pretreatments.

3 = Boiling water, pour and soak till cool

Place the seeds in 10 times their volume of boiling water, remove the heat source and allow the seed to soak in the gradually, cooling water for at least 2 hours. The seed may be left to soak for 12-24 hours, in which case those seeds which have imbibed (i.e. swollen to 2-3 times their original size) are ready for sowing. The procedure may then be repeated on unswollen seeds.

4 = Boiling water (100°C), immersion for 1 minute

Seeds are immersed in a large volume of rapidly boiling water and promptly removed after 60 seconds. It is imperative that the water remains boiling during the immersion period.

5 = Boiling water (100°C), immersion for 5 minutes

Seeds are immersed in a large volume of rapidly boiling water and promptly removed after 5 minutes. It is imperative that the water remains boiling during the immersion period.

6 = Hot water (90°C), immersion for 1 minute

Seeds are immersed in a large volume of hot water (90°C) and removed after 60 seconds.

資料１２

Australian Acacias for Saline, Alkaline Soils in the Hot, Dry Subtropics and Tropics

L. A. J. Thomson*

THERE is an acute need to dramatically increase the scale of revegetation, for fuelwood and fodder production and for soil conservation and shelter, in many hot, dry parts of the world. For example, 18 of the 25 developing countries given by Spears (1983) as having acute fuelwood shortages are located in subtropical and tropical dry zones. This represents a vast area and includes countries such as Kenya, Senegal, Somalia, Sudan, Yemen Arab Republic and Peru where high salinity of soil and water may impede establishment of shrubs and trees. India and Pakistan, countries of medium fuelwood deficit, have extensive areas of saline/alkaline wastelands.

Australia has an extensive tropical and subtropical, dry (< 500 mm) zone, covering 1.7×10^6 km^2 (north of 24 °S lat). The woody vegetation of this zone is dominated by the 120 or so species of *Acacia* which occur there. By way of comparison, the other major Australian woody plant genus *Eucalyptus* has about half this number of species in this zone. Many Australian dry-zone *Acacia* species have promise for planting on harsh sites, including saline and/or alkaline soils. Some of their potential uses include: wood production, especially fuelwood (firewood and charcoal) and round timber (posts and small poles); fodder, shade and shelter for animals; and human food reserves during famine (their seeds can be easily prepared for long-term storage).

As well as utilisation of degraded saline sites, some species have a potential role in the rehabilitation of such areas through: protection, shading and mulching of soil surface (their low foliar salt concentrations avoid recycling salt to the soil surface, *cf.* halophytes such as *Tamarix* and chenopods which accumulate high salt concentrations in their shoots); salt binding, especially root-suckering species; soil improvement, and nitrogen-fixation; and lowering saline water-tables (species which coppice following harvesting and rapidly recover leaf area, and transpirational capacity).

This paper provides information on a survey of potentially suitable Australian acacias for planting on saline, alakaline sites in the hot, dry subtropics and tropics, and discusses some of the factors which have constrained their use on these sites in the past.

Species with Potential

The characteristics and potential uses of *Acacia* species from Australia's subtropical and tropical (< 24 °S), dry (< 500 mm annual rainfall) zone have recently been reviewed (Thomson, Turnbull and Maslin, paper in preparation). Details of species considered to have potential for planting on saline, alkaline soils are given in Table 1. The most promising species adapted to these conditions, i.e. those with high salt tolerance and several useful traits including a comparatively moderate to fast growth rate and a moderate to high coppicing ability, are *A. ampliceps, A. cuspidifolia, A. ligulata, A. maconochiana, A. salicina, A. sclerosperma, A. stenophylla* and *A. victoriae*.

During a seed collection expedition in Western Australia in March–April 1986 the opportunity was taken to further study some of the promising species. Data on soil properties and mineral composition of phyllodes for natural stands growing on apparently saline sites are given in Table 2.

Discussion

There exists a need for more detailed information and research on the species in Table 1. As most of the data on species characteristics and their potential uses and functions is based upon field observations of natural populations, there is a need to more accurately quantify these values through experimentation. Published and unpublished information has been gathered for some of the more

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promising species and species digests will be published soon (Turnbull 1986) (species 3, 6, 7, 10, 13, 14, 19, 23 and 25) and in CSIRO's *Acacia* leaflet series (species 4, 5, 8, 15, 18).

Together with site rehabilitation and fuelwood production, the production of fodder is a major potential benefit of revegetating salt-affected lands with *Acacia* species. Data in Table 2 indicate that certain *Acacia* species growing in saline environments do not accumulate the high foliar ion concentrations commonly observed for halophytes such as *Atriplex, Suaeda* and *Disphyma* (see Neales and Sharkey 1981); in fact their Na^+ and Cl^- levels are an order of magnitude lower. A number of chenopod halophytes such as *Atriplex* and *Maireana* have a very good potential for fodder production on saline soils, but a disadvantage is their high foliar salt concentrations. Sheep may be ced to reduce their intake of chenopods, es- cially if their drinking water is brackish or saline, and/or increase their consumption of water when grazing chenopod-dominated shrublands (Leigh 1986). There exists a potential to maximise the fodder potential of salt-affected lands through the establishment of complementary forage plantings of species which accumulate only moderate salt concentrations in their foliage, such as certain acacias, and those which accumulate very high foliar salt concentrations such as certain chenopods.

Supply of Germplasm

Seed supply has been the major constraint to the planting of the species listed in Table 1. Many of the species/provenances of interest are located in remote parts of Australia and only hold mature seed for a brief period. For those few species which hold mature seed over a longer period, e.g. *A. salicina*, it has been difficult to collect adequate quantities of seed because at any one time only a proportion of crop is at a suitable stage for collection.

In 1986 the Tree Seed Centre DFR/CSIRO received funds from the National Biotechnology Program—Research Grants Scheme of the Australian Government's Department of Industry, Technology and Commerce to collect seed of useful salt-tolerant woody plants. This is part of a collaborative project with Alcoa of Australia Pty Ltd and other organisations, which aims to select and clone superior individuals. In September–November 1986 we are planning to collect seed and root symbionts of salt-tolerant woody plants from inland and northwestern Australia. The focus of these collections will be acacias, especially *A. ampliceps*. Seed of acacias from this and earlier collections will be available from the Tree Seed Centre for research purposes.

Recommendations for Future Research

With the exception of research by the Centre Technique Forestier Tropical (France) into the introduction of Australian acacias into dry, tropical Africa (Cossalter 1985), there has been limited research on acacias from Australia's subtropical dry zone. There is a need for considerably expanded research activity into the potential value of these species for a broad range of uses, especially fuelwood and fodder. Part of this field-orientated research program should be to evaluate the more promising species for saline, alkaline soils. Modes of establishment including direct seeding, coppicing and root suckering as well as site preparation techniques, especially mounding, require investigation. A significant component of this research could be usefully undertaken within Australia on salt-affected soils in northwestern Australia and the Northern Territory by organisations based in these areas.

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Tables 1 and 2 following pages

Table 1. Characteristics and potential uses of *Acacias*, from the subtropical and tropical (< 24°S), dry (< 500 mm) zone of Australia with potential for planting on saline, alkaline soils.

		Natural occurrence			Soil properties						Species characteristics				Potential uses and functions										
															Wood					Seed		Services			
Subgenus/section No. Species	Related species	Australian States	Latitudinal range (°S)	Rainfall range (mm/year-median)	Drainage lines	Climate zone	Frost incidence	Texture	pH	Soluble salts	Plant dimensions (height × width in m)	Growth rate	Longevity	Expected coppicing ability and root suckering habit	Fuelwood	Charcoal	Posts/small poles	Sawn timber	Stock fodder	Human food source	Aril character	Shade	Windbreak	Live fence	Soil stabilisation
Acacia																									
1. *A. farnesiana*		NSW, Qld, NT, SA, WA, (probably naturalised)	12–36	150–1300	*	1–3	*	SL–C	Ac–Al	—	2–7 × 3–9	2	2–3	3	2–3	3	3	3	1–2	3	3	3	2–3	1–2	2
2. *A. sutherlandii*		Qld, NT	16–24	350–900	*	2(N)	—	SL–C	Ac–Al	*	7–10 × 4–8	2–3	1–2	1	2–3	3	2	2	1–2 (C)	?	3	2	3	2	3
Phyllodineae																									
3. *A. ampliceps*	4,6 7,8	NT, WA	14–26	200–800	**	1	—	S–C	Al	**	3–9 × 6–12 0.2 × 10	1	2–3	1R	1	1	3	2–3	1	2	2–3	3	1	3	3
4. *A. bivenosa*	3,6 7,8	WA	15–27	200–700	—	1	—	S–CL	N–*Al*	*	2–4 × 4–6	2	?	1	1	3	3	3	2	3	2	3	1–2	3	1
5. *A. cuspidifolia*	10	WA	23–27	200–350	*	2(S)	*	SL–C	N–*Al*	*	3–6 × 4–9	2	1	2	1–2	1–2	3	3	1–2	2–3	3	2–3	1	2	1
6. *A. ligulata*	3,4,7,8	Vic, NSW, Qld, NT, SA, WA	14–38	100–700	—	1–3	**	S–SL	Ac–*Al*	**	2–5 × 4–9	1–2	2	1	1	2–3	3	3	2	3	1	3	1	2–3	1
7. *A. salicina*	3,4,6,8	Vic, NSW, Qld, NT, SA	18–37	100–1200	**	1–3	**	SL–C	Ac–*Al*	**	3–20 × 4–12	1	1	1R	1	1	1–2	1	1–2(T)	3	1	1	1–2	3	1
8. *A. sclerosperma*	3,4,6,7	WA	20–29	150–350	*	2(S)	*	S–CL	Ac–*Al*	**	2–6 × 3–8	2–3	1	3	1	2–3	3	3	2–3	3	3	2	1	3	1
9. *A. tetragonophylla*		NSW, Qld, NT, SA, WA	21–33	100–450	*	1–3	**	S–C	Ac–Al	*	2–7 × 1–8	3	1–2	1	2	3	3	3	2–3	3	1	3	2	1	2
10. *A. victoriae*	5	Vic, NSW, Qld, NT, SA, WA	14–36	100–1000	*	1–3	**	S–C	Ac–*Al*	**	2–10 × 5–15	1	2–3	1R	1	2	3	3	1	1–2	3	2–3	2	1	2
11. *A. wiseana*		NT, WA	20–28	200–300	*	1	*	S–CL	?	*	2–5 × 3–5	?	?	?	3	3	3	3	3	?	?	3	2	1	2
Plurinerves																									
12. *A. anaticeps*		WA	18–24	150–550	—	1	—	S	N–Al	*	3.5–5 × 2–4	1–2	2	1R	1–2	2–3	3	3	3	2	3	2–3	1–2	3	1
13. *A. cambagei*	14	NSW, Qld, NT, SA	17–32	150–700	*	1–3	*	SL–C	Ac–*Al*	*	4–15 × 3–12	3	1	2(R)	1	1–2	1–2	2–3	3	?	3	1	2–3	3	2
14. *A. harpophylla*	13	NSW, Qld	20–34	350–750	*	3(E)	**	L–C	Ac–Al	*	7–24 × 5–10	3	1	1R	1	1	2	1–2	2–3	3	3	1	2	3	1
15. *A. maconochieana*		NT, WA	18–21	250–400	**	1	*	S–C	N–AL	*	8–12 × 5–7	2	1	?	1	2	1	2	1–2	2	3	1	3	3	2
16. *A. microcephala*	13	Qld, NT	20–26	450–600	—	3(E)	—	L–C	Al	*	6–9 × ?	?	?	?	1	1–2	?	?	?	?	3	?	?	3	?
17. *A. oswaldii*		Vic, NSW, Qld, NT, SA, WA	20–36	100–700	*	3(S)	**	S–C	N–*Al*	*	2–8 × 3–7	3	1	1–2	1	2	3	3	2–3	2	1	2	1–2	3	1
18. *A. sibilans*		WA	22–28	200–250	*	3(S)	—	S–L	N–*Al*	**	3–12 × 5–15	3	1	2	1	1	2–3	2	3	?	3	1	3	3	2
19. *A. stenophylla*		Vic, NSW, Qld, NT, SA, WA	17–37	100–800	**	1–3	**	L–C	Ac–*Al*	**	4–15 × 5–12	2	1	1R	1	1	1	2	2	2	3	1	2–3	3	1
20. *A. translucens*		NT, WA	12–24	150–1100	—	1	—	S–L	Ac–Al	*	0.5–2 × 2–5	2	2	1–2	3	3	3	3	3	3	3	3	3	3	3
Juliflorae																									
21. *A. grasbyi*		WA	22–29	200–350	—	2(S)	*	S–C	N–*Al*	*	2.5–6 × 3–9	3	1–2	2	1	1–2	3	3	2–3	2	?	2	2–3	3	2
22. *A. hemsleyi*		Qld, NT, WA	12–22	350–1400	**	2(N)	—	S–CL	?	*	3–8 × 3–5	1	2–3	?	1	1–2	2–3	3	3(S)	?	3	2	2–3	3	2
23. *A. holosericea*		Qld, NT, WA	11–27	250–1600	*	1	—	S–L	Ac–Al	*	3–9 × 3–6	1	3	3	1	1	3	3	2–3	1	1	2	2	3	2
24. *A. intorta*		WA	23–27	200–250	*	2(S)	*	L–C	N–*Al*	*	2–4 × 4–6	3	1	?	1	1	3	3	?	?	3	2–3	2–3	2	2
25. *A. xiphophylla*		WA	20–27	200–350	*	2(S)	*	SL–C	N–*Al*	*	3–5 × 5–12	3	1	2	1	1	3	3	3	?	3	2	1–2	3	1

Notes on Table 1

Related species: Numbers indicate the most closely related species that occur in the subtropical dry zone.

Natural occurrence: (Drainage lines) ** species typically occurring in the lower parts of the landscape, in close association with drainage lines; * species which sometimes grow along drainage lines, especially in the drier parts of their range; — species not usually occurring in close proximity to drainage lines. (Climate zone) 1 species typically found in the subtropical dry zone; 2 species found frequently to infrequently in the subtropical dry zone; 3 species with a marginal occurrence in the subtropical dry zone; 1–3 species with very wide distributions; N,S & E denotes that distribution extends to the north, south and east of subtropical, dry zone. (Frost incidence) ** heavy frosts in most years over a substantial part of the range; * low incidence of frost in some parts of the range; — nil or very low incidence of frost throughout the range.

(Soil properties—italics indicates dominant category): *Texture* S = sand, SL = sandy loam, L = loam, CL = clay loam, C = clay; *pH* Ac = acid (pH < 6), N = neutral (pH 6–7.5), Al = alkaline (pH > 7.5); (Soluble salts) ** high levels of soluble salts (saturation extract EC > 4 mS cm^{-1}) in upper soil horizons in some locations; * high levels of soluble salts (saturation extract EC < 4 mS cm^{-1}) in lower soil horizons in some locations; — low levels of soluble salts in soil in most locations.

Species characteristics: Plant dimensions—the dimensions given are the range for fully-grown plants in their native habitat; Growth rate: 1 = fast; 2 = moderate; 3 = slow. Longevity: 1 = long-lived (> 50 years); 2 = moderate life-span (10–50 years); 3 = short lived (< 10 years). Expected coppicing ability and root suckering habit: 1 = high; 2 = moderate (i.e. variable); 3 = low; R = root suckering habit (brackets indicate low frequency of root suckering).

Potential uses and functions: Fuelwood & charcoal: 1 = highly suitable; 2 = occasionally suitable; 3 = unsuitable. Posts/small poles & sawn timber: 1 = suitable; 2 = occasionally suitable; 3 = unsuitable. Stock fodder: 1 = useful; 2 = limited usefulness (drought fodder value); 3 = nil or very limited usefulness. Potentially toxic compounds in foliage and legumes are indicated as follows: C = cyanogenic glycosides; S = saponins; T = tannins.

Seed (Source of food for humans): 1 high-yielding and easily harvested species whose seed is reported to have been utilised as a food source by aborigines; 2 species which have limited potential for food; 3 species which have nil or very limited potential for food; T indicates seed of this species may be toxic and should not be consumed. (Aril character): 1 expanded, oil-rich aril; 2 somewhat expanded aril of low to moderate oil content; 3 aril absent or little expanded and of low oil content.

Services (Shade, windbreak & live fence): 1 = useful; 2 = limited usefulness; 3 = nil or very limited usefulness. (Soil protection): 1 = very useful; 2 = useful; 3 = limited usefulness.

Table 2. Mineral composition of phyllodes and soil properties for natural stands of some *Acacia* species growing on apparently saline sites in Western Australia.

		Phyllode mineral composition[a]				Soil properties[b]							
							pH	EC	Cl^-	Na^+	K^+	Mg^{2+}	Ca^{2+}
Species	Location	Cl^- % DW	Na^+ % DW	K^+ % DW	Mg^{2+} % DW	Texture		mS cm^{-1}		(in mmol l^{-1})			
A. ampliceps	Karratha township	1.5	1.42	0.91	0.45	Sandy clay	8.3	9.5	91	96	1.4	5.8	1.3
A. ampliceps	Eighty-Mile Beach (4 km NE of Wallal Downs Homestead)	2.5	0.12	1.31	0.53	Clay	8.3	24.0	209	258	9.2	4.2	0.47
A. sclerosperma	Murchison River, SE of Twin Peaks Homestead	1.2	0.06	1.01	0.65	Sandy clay	8.1	4.8	38	38	1.5	4.4	3.6
A. sclerosperma/ *ligulata* complex	4 km S of 26th Parallel (along Gt. NW Hwy)	1.8	0.05	0.57	0.58	Clay	8.2	8.0	55	4.1	3.5	6.1	23.3
A. victoriae	1.3 km E of Cue	1.1	0.34	0.84	0.96	Clay	8.2	2.1	13	6.4	0.72	3.1	5.2

[a] Fully expanded phyllodes were sampled from 5–10 plants in March/April 1986. Chemical analyses were performed on 10 mmol HNO_3 extracts.

[b] Soil samples were taken from 5–10 locations at 10 cm depth and bulked. Soil chemical properties were assessed on saturation extracts.