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Activities of the Australian Medicago Genetic Resources Centre

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Summary - The Australian *Medicago* Genetic Resources Centre (AMGRC) maintains the world's largest collection of *Medicago* species. In addition, over 10,000 lines of other temperate legume pasture species are also conserved. The centre conducts its genetic resources activities in accordance with internationally recognised standards. The seed increase program and protocols for characterisation and evaluation of germplasm are determined in close consultation with the immediate users of targeted lines. Currently there are changes occurring in the use and nature of the collection as a much wider range of pasture legume species are being conserved and evaluated than the traditional *Medicago* species. The centre is also increasing initiatives to actively promote and diversify the utilisation of the collection with future plans to provide germplasm for viticulture and ornamental horticulture research programs.

Key-words: *Medicago*, pasture germplasm, genetic resources

Résumé - Le centre australien de ressources génétiques sur la luzerne possède la plus grande collection d'espèces du genre *Medicago*. De plus, 10 000 lignées d'autres légumineuses de prairies tempérées sont également conservées. Ce conservatoire de ressources génétiques fonctionne selon les standards internationaux reconnus. Le programme de multiplication de semences et les protocoles de caractérisation et d'évaluation des germoplasmes sont mis au point en étroite collaboration avec les usagers potentiels de ces lignées. Actuellement, l'utilisation et la nature de notre collection a subi des modifications dans le but de couvrir un éventail plus large de légumineuses. Le centre cherche également à promouvoir et diversifier l'utilisation de notre collection pour fournir des cultivars adaptés à l'association avec la viticulture ou à l'horticulture ornementale.

Mots-clés: pâturage, germoplasme, ressources génétiques

Introduction

The South Australian Research and Development Institute's (SARDI) Australian *Medicago* Genetic Resource Centre (AMGRC) has been operating under this name since 1982 when it was designated by Australian Agriculture Council as one of the network of eight Australian Plant Genetic Resource Centres. However, its history begins well before this as the acquisition, evaluation, documentation, storage and maintenance of a pasture plant genetic resources collection has been a major ongoing function of the South Australian Government since the early 1960's.

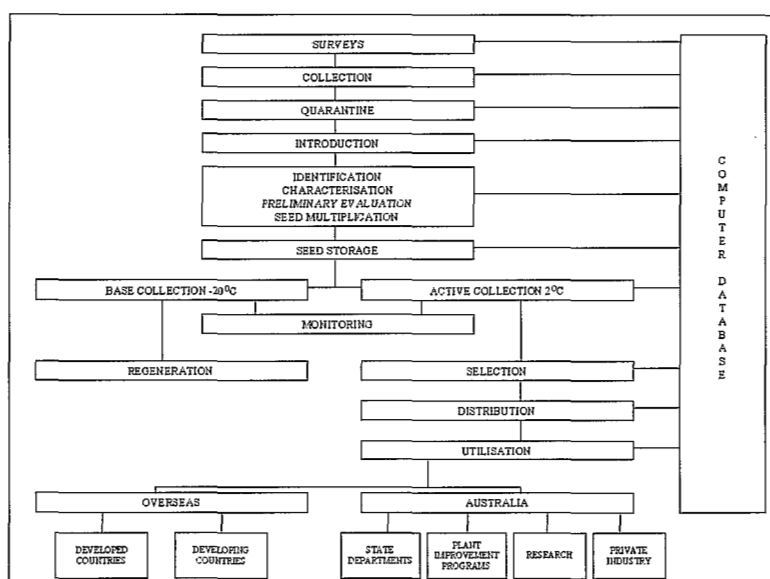
The AMGRC maintains the world's largest collection of *Medicago* accessions with over 25,500 unique accessions from over 60 countries. In addition, the collection includes over 4,500 lines of 117 *Trifolium* species and over 6,000 lines of a range of other lesser-known pasture legume genera including *Hedysarum*, *Lotus*, *Astragalus*, *Trigonella*, *Tetragonolobus* and *Onobrychis*.

The entire operation of the AMGRC is conducted at the Waite Research Precinct in Adelaide, South Australia (Long. 138°50' E, Lat. 35° S, Elevation 350m.).

Activities

Figure 1 outlines a flow chart of the activities undertaken by the AMGRC from the initial collection and introduction of lines through to the selection and distribution of lines for further research.

Figure 1. AMGRC Activities



1. Collection/Acquisition

The AMGRC collection has been assembled predominantly through direct collection of wild lines from natural centres of diversity. Other accessions have been acquired either through receipt of seed from national breeding/evaluation programs or direct exchange with collaborative International Genetic Resource Centres.

The long history of the AMGRC in collecting and conserving is significant as many regions traditionally containing vast reservoirs of germplasm have been seriously depleted through extreme over-grazing, erosion and changing land uses. Samples from these regions held in the AMGRC are in most cases irreplaceable.

The AMGRC will continue to be involved in collection missions to ensure that species of economic importance to agriculture are safeguarded for future generations (Auricht *et al.*, 1999).

2. Introduction

This activity is aimed to establish comprehensive germplasm collections of each mandate species to meet foreseeable breeding requirements either by collecting or targeted acquisition. Upon meeting quarantine requirements the introduced lines are then indexed with a genebank accession number prefixed with a "SA" and passport details are entered into the AMGRC Genebank Data Management System.

3. Seed Increase, Characterisation and Preliminary Evaluation

The overriding objective of this activity is to directly support pasture plant improvement programs by increasing the genetic diversity and variation of germplasm available for utilisation as a basis for improved cultivar development.

Throughout the growing season a wide range of characterisation and preliminary evaluation datasets are recorded for each line. Characterisation datasets are defined as characters that are highly heritable. The types of characters recorded are determined in collaboration with the relevant users and generally depend on the species targeted. Characters recorded include morphological characteristics such as habit, length of internodes, branching and details of leaf, flower, pod and seed characteristics. Evaluation datasets are defined as agronomic characters highly influenced by the growing environment. Generally the data recorded includes winter and spring herbage production, flowering and maturity dates and indications of seed and pods production. All datasets are maintained on the AMGRC database.

The recording of agronomic and morphological characters to provide characterisation and preliminary evaluation data is a fundamental aspect of AMGRC operations. The type and quality of the information recorded provides data which is useful both taxonomically and in the subsequent selection of lines for further evaluation or breeding.

4. Seed Storage

Seed harvested from the characterisation rows forms the basis of the GRC. Seed is handled and stored in accordance with the Food and Agriculture Organisation of the United Nations (FAO) and the International Plant Genetic Resources Institute (IPGRI) standards Genebank Standards, 1994). All storage information pertaining to the seed is updated on the AMGRC database. The AMGRC currently has over 20,000 of the 36,500 accessions in the collection maintained at internationally recognised standards (Hughes and McLachlan, 1999).

5. Maintenance

Maintenance activities performed by the AMGRC occur annually. Seed viability and seed numbers are the two principal factors monitored in order to maintain the genetic diversity and genetic integrity of material within the collection.

6. Distribution/Utilisation

This activity aims to supply seed to national and international breeders and assist Australian researchers with the development of improved temperate pasture legume cultivars.

Under current arrangements, one gram samples of seed and associated data are distributed free of charge for any legitimate research purpose to researchers throughout the world. Larger samples may be provided under certain conditions and where sufficient seed stocks exist.

Continuing high levels of demand of germplasm emphasise the value and strategic importance of ex-situ collections. Table 1 shows the extent of utilisation over the last three years and illustrates that the major users of the collection continue to be national plant improvement programs.

Table 1. Extent of utilization and major users of collection.

Client	Number of Lines Dispatched
National Plant Improvement Programs	5,667
Overseas Developed Countries	2,130
Overseas Genebanks	294
Private Companies	224
National Research Programs	187
Overseas Developing Countries	162
Total	8,664

Status of Collection

The current status of the AMGRC collection of forage legumes from the Mediterranean region is outlined in Table 2. (Sackville-Hamilton *et al.*, 1999).

Table 2. Number of accessions for genera held by AMGRC.

Medicago 24999	Scorpiurus 246	Coronilla 84	Psoralea 6
Trifolium 4240	Ornithopus 155	Tetragonolobus 65	Galega 2
Astragalus/Biserrula 725	Hymenocarpus 151	Anthyllis 56	Lotononis 2
Lotus 599	Lathyrus 140	Securigera 28	Ebenus 1
Vicia 546	Hippocrepis 139	Dorycnium 24	
Trigonella 482	Hedysarum 129	Ononis 15	
Onobrychis 437	Melilotus 91	Lupinus 13	
Total: 33375			

Future Directions

Currently the major emphasis of the AMGRC research activities focuses towards lesser known or alternative pasture legume species. This major change of emphasis away from the more traditional species is being driven by the National Annual Legume Improvement Program. New species are being investigated to develop cultivars suited to regions presently lacking good pasture legumes. In addition species which have the ability to be conventionally harvested and others which could increase the sustainability and stability of ley and phase systems with the capacity to maintain and increase production in response to pressures ranging from economic (improved production efficiency) to environmental (salinity, pests, disease) are of priority. Another aim of these programs is to investigate the use of mixtures rather than relying on monocultures. The need for increased diversity of perennial species is also becoming more important. Demand for greater diversity of perennial germplasm is being driven by an increased awareness of the role of perennials, particularly lucerne and their potential to increase productivity and help resolve increasing environmental issues such as rising water tables, salinity, waterlogging, wind erosion, unseasonal rainfall and drought. It is anticipated that current demand for diversification and cultivar improvement of perennial species for the grain zones and problem environments in southern Australia will continue to increase over the next decade.

The AMGRC aims to operate an efficient and effective user and goal orientated Genetic Resource Centre. Germplasm conservation is a primary concern and utilisation is the driving force of the Centre's activities. Currently the AMGRC is exploring new initiatives and establishing connections with horticultural industries to provide germplasm resources to ornamental and viticultural research programs.

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