

## PROJECT SUMMARY

**TITLE OF PROJECT:** Genetic improvement of *Calliandra calothyrsus*.

**R NUMBER:** R5728

**RNRRS PROGRAMME:** Forestry

**PROGRAMME MANAGER:** OFI

**SUB-CONTRACTOR:** OFI

**RNRRS PROGRAMME PURPOSE:** Contribution of trees to productivity of tree/crop based systems increased.

**RNRRS PRODUCTION SYSTEM:** Forest/agriculture interface

**COMMODITY BASE:** Timber and tree fodder

**BENEFICIARIES:** Smallholder farmers

**TARGET INSTITUTIONS:** Forestry and agriculture research institutions, forest and agriculture policy departments, NGOs

**GEOGRAPHIC FOCUS:** Worldwide

**START DATE:**01/01/1994**FINISH DATE:**31/04/1996

**TOTAL COST:**£135,444

### 1. Project purpose:

*Calliandra calothyrsus* is a woody legume that is native to Central America and Mexico. The species also occurs widely throughout the humid tropics as an exotic. The origins of these introductions, however, have been poorly documented and it is likely that they suffer from a narrow genetic base that poorly reflects the species' true growth potential. Therefore, the ODA has funded a programme of research designed to explore, evaluate and improve the genetic resources of *C. calothyrsus*. The natural distribution, ecology and taxonomy were systematically investigated under R4585. Range-wide provenance seed collections were assembled and distributed for trials across diverse environments, from which data on inter-provenance differences are emerging. However, if this information is to be used to its best potential a sound understanding of the reproductive biology, ecology and genetic diversity of *C. calothyrsus* is needed in order **to secure and improve the germplasm of this multipurpose species.**

### 2. Outputs:

The project's overall objective was:

**to obtain the knowledge needed for securing and improving germplasm of *C. calothyrsus*.**

The specific objectives were:

- 1)to investigate the reproductive biology of the species to lay a sound basis for improvement programmes;
- 2)to study the hybridization potential of *C. calothyrsus* and *C. houstoniana*;
- 3)to continue the programme of provenance evaluation;
- 4)to diagnose units of conservation for *C. calothyrsus*.

### 3. Contribution of outputs to project goal:

The project made substantial progress with achieving all four objectives, and in doing so created knowledge needed for **increasing the contribution of trees to the productivity of tree/crop based systems.**

Isozyme analysis (objective 3) revealed that the Indonesian and Kenyan landraces had less genetic variation than expected, indicating the likelihood that these exotic populations originated from only a few individuals and that there was subsequent inbreeding. In contrast, variation among the natural populations was found to be high, with distinct differences between populations, some of which have shown superior agronomic traits in early field trial evaluations. There are, therefore, good prospects of being able to introduce exotic populations that have the desirable growth traits needed for meeting farmers' requirements, combined with the broad genetic diversity necessary for adaption to various environments. Seed collection in support of such a policy should be from trees that are widely and evenly spaced within natural populations, and preferably undertaken throughout the fruiting season.

Isozyme analysis was also used as the basis for dividing *C. calothyrsus* into four conservation groups that correspond to differences in morphology and site adaption across the natural range (objective 4). A conservation strategy should include populations that are representative of each of the four groups.

Pollination of *C. calothyrsus* in the natural populations is most commonly brought about by nectar-feeding fruit bats (objective 1). The same species of bats are also native to West and Central Africa, Southeast Asia, the Pacific islands and northern Australia. They are likely to be the most efficient pollinators of *C. calothyrsus* when it is planted in these regions. Elsewhere, other species of bats visit *C. calothyrsus*, although their feeding habits may

differ. Recommendations to be followed when setting up seed production stands are:

- to choose a site where bats are present;
- to isolate each stand from other *C. calothyrsus* stands by at least 2 km;
- to assess the likelihood of other food sources distracting the bats.

A full analysis of the data collected for studying the hybridisation potential (objective 2) remained to be completed but preliminary observations indicated that hybridisation occurs between *C. houstoniana* and *C. calothyrsus*, and between *C. houstoniana* and *C. juzepczukii*. A trial to investigate the extent of hybrid vigour was established. Observations of natural hybrids suggested that not all hybrid crosses may be fertile.

Also concerned with objective 2 was a taxonomic revision of *Calliandra* series *Racemosae*, which is to be published as a *Kew Bulletin*. This comprises an introduction to *Calliandra* series *Racemosae* Benth. with a discussion of: vegetative and reproductive morphology; pollination biology; distribution; hybridisation; chromosome numbers and economic uses, leading into a taxonomic treatment. Seven species from Mexico to Panama which comprise series *Racemosae* are described and illustrated: *Calliandra calothyrsus*, *C. grandiflora*, *C. houstoniana*, *C. juzepczukii*, *C. longepedicellata*, *C. palmeri* and *C. physocalyx*.

#### **4. Dissemination products:**

See PROREC output.

#### **5. Follow-up:**

Information that emerged during the course of the project, indicated the need for further research concerning seed orchard establishment, the validation or otherwise of the existence of subspecies, and the resolution of ambiguities in the taxonomy of *C. calothyrsus* and its close relatives in the series *Racemosae*. This is being undertaken as R6535.