

## PROJECT SUMMARY

**TITLE OF PROJECT:** Genetic improvement of non-industrial trees with particular reference to *Gliricidia sepium*.

**R NUMBER:** R4856

**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, non-timber forest products, tree crops, tree fodder

**BENEFICIARIES:** Transmigrant settlers, smallholder farmers

**TARGET INSTITUTIONS:** Forestry and agriculture research institutions

**GEOGRAPHIC FOCUS:** Worldwide

**START DATE:** 01/04/92 **FINISH DATE:** 31/03/96

**TOTAL COST:** £322,399

### 1. Project purpose:

Species and provenance trials of multipurpose tree (MPT) species are identifying the seed sources that are best adapted to providing smallholder farmers with increased supplies of the products that they need. Once trees raised from superior seed sources are available, however, it is uncertain as to what effects farmers' own seed collection activities will have on the genetic diversity of future planting materials. If there is a danger that the release of intensively selected genetic material to farmers will result in inbreeding and subsequent generations of sub-optimal planting stock, it may be advantageous to restrict selection to the provenance level. More information is needed on the genetic diversity within selected seed sources so that a rational strategy can be produced for the **germplasm of multipurpose tree species to be secured and improved**. *Gliricidia sepium* is a prime candidate for such attention because of the past investment in the exploration and provenance evaluation of the species (R3714, R4091, R4525) and an increasing trend internationally for its wider adoption by farmers.

### 2. Outputs:

The objectives listed in section 9 of the project proposal were:

- 1) to assist in the production of locally available seed of *gliricidia* provenances of proven performance;
- 2) to increase production and the stability of *gliricidia* in tropical countries without compromising the genetic diversity of planting stock;
- 3) to determine the variability and genetic control of traits of interest in *gliricidia* thereby allowing recommendations to be made on appropriate genetic composition of breeding populations and seed production areas;
- 4) to test and use molecular markers for determining the genetic diversity at the family, provenance and species levels with a view to supporting decisions on breeding strategy and to identifying areas/populations of high biodiversity for future exploration. This work would primarily be in *gliricidia* but may also include species that are being studied in connection with bilaterally-funded ODA projects (eg *Artocarpus* in Sri Lanka).
- 5) to develop appropriate strategies for the improvement of non-industrial tree species.

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

The MPTS improvement strategy produced by the project reduced the danger of on-farm selection resulting in inbreeding and a decline in the quality of planting stock, thus producing knowledge needed to ensure that the **contribution of trees to the productivity of tree/crop based systems is increased**.

The project achieved its objects. The research focused on *G. sepium*. Previous work (R4525) identified the overwhelming superiority of the Retalhuleu provenance for planting on most sites, compared with other Latin American provenances and local land races. Seed supply from the natural occurrence of this provenance falls far short of demand. Therefore, the distribution of Retalhuleu seed for establishing multiplication stands was seen as the main pathway for transferring the results of previous research to farmers.

The project undertook the evaluation of data from progeny trials established previously to calculate variance components and genetic parameters, and to study the effect of family number on heritability estimates. Molecular markers, mainly randomly amplified polymorphic DNA products (RAPDs), were tested and used to investigate

genetic variation and genetic structure. The results indicated that only low gains would be achieved from a single cycle of selection, consequently there appears to be little prospect for advanced generation breeding in *G. sepium*. There is little merit for selection beyond the provenance level and all the variation should be passed on to farmers so that they can make their own selections.

The main recommendations for a MPTS improvement strategy arising from the project were:

- identification of farmer requirements and desired traits;
- rangewide provenance seed collections;
- provenance evaluation;
- establishment of seed orchards using bulk seed of selected provenances;
- no further selection within seed orchards; all available variation passed on to farmers;
- distribution of seed or cuttings for planting by farmers or establishment of further multiplication stands.

Distribution of seed of the Retalhuleu provenance was a major project activity. In the light of the research findings referred to above, most of the seed was distributed in bulk lots for simple seed multiplication stands.

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

See PROREC output.

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

The findings of the project were included in the species monograph that was published in the *Tropical Forestry Papers* series. One thousand copies of this publication were printed and their distribution will be the main means of disseminating the research findings. This is to be assisted by the International Centre for Agroforestry Research, which has agreed to distribute 200 copies.

Distribution of selected seed of *G. sepium*, and advice on seed orchard establishment, will continue under R6551 (*Evaluation of selected non-industrial tree species and development of approaches to facilitate utilisation of results*).