

## PROJECT SUMMARY

**TITLE OF PROJECT:** Fodder quality studies on *Gliricidia sepium* and other tropical multipurpose trees.

**R NUMBER:** R4726

**RNRRS PROGRAMME:** Forestry

**PROGRAMME MANAGER:** OFI

**SUB-CONTRACTOR:** OFI

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

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

**COMMODITY BASE:** Tree fodder

**BENEFICIARIES:** Resource-poor farmers

**TARGET INSTITUTIONS:** National research institutions, ICRAF

**GEOGRAPHIC FOCUS:** Worldwide

**START DATE:**01/08/91**FINISH DATE:**31/03/97

**TOTAL COST:**£331,792

### 1. Project purpose:

Previous ODA-funded OFI research projects assembled provenance seed collections of several fodder-producing multipurpose tree species. Subsequently, these were used for creating international provenance trial series designed primarily for evaluating within-species genetic variation in terms of growth and yield. Experience with feeding some species to animals, however, has revealed wide variation in palatability from place to place. It is not known if this is caused by variation in genetics, site factors, management regimes or the animals. Therefore, there is a need to evaluate tree species for differences in the quality, as well as in the quantity, of the fodder they produce so that **strategies for the improved management of tree based systems, integrated with animal and crop production systems, may be developed and promoted.**

### 2. Outputs:

The overall project objective was **to evaluate specific multipurpose tree species for variation in the nutritive value and palatability of their fodder.** The specific objectives were:

- 1)to determine the effect on the nutritive value and palatability of *Gliricidia sepium* leaves of: (i) genotype; (ii) site (soil and/or climatic effects); and (iii) season (phenological changes); and interactions between these effects;
- 2)to identify species and subspecies of *Leucaena* and *Albizia* with potential as leaf fodder, in terms of *in vitro* nutritive value and digestibility, and to evaluate the relative palatabilities of the *Leucaena* taxa in a short-term preference test;
- 3)to assess variation in pod quality in an even-aged stand of *Acacia erioloba* in terms of *in vitro* nutritive value, and to investigate the relationship between fodder value and variation in pod morphology.

The project's "dissemination" extension approved in 1995 added the following objectives:

- 4)to determine the relative palatability to sheep of nine *Albizia* species growing in a trial in Honduras;
- 5)to publish the results of research on *Gliricidia*, *Leucaena* and *Albizia* fodder quality, at least four papers to be submitted for publication by March 1996;
- 6)to provide seed for the establishment of at least four new *Gliricidia* seed orchards;

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

The above objectives were substantially achieved, thus contributing to the knowledge needed for **increasing the contribution of trees to the productivity of tree/crop based systems.**

The project addressed fodder quality issues for species and genera, germplasm collections of which had already be assembled under previous or ongoing ODA-funded projects at the OFI. The evaluation of fodder quality took place at three levels:

- at the species level for *Leucaena* and *Albizia*, most of which are little used, if at all, for fodder in their native ranges but nonetheless may have fodder potential;
- at the provenance level for *Gliricidia sepium*;
- at the within-population level in *Acacia erioloba*.

The evaluation of *Leucaena* and *Albizia* was largely a 'first look' at leaf chemical composition to identify taxa of potentially high nutritive value. The analyses were carried out in collaboration with NRI and the University of

Reading. They included two methods for tannins, an important class of anti-nutritional compounds. *In vitro* digestibility was also measured at Reading, and relative palatability was assessed in short-term 'cafeteria' trials in Honduras. More detailed studies and longer-term feeding trials will be needed for both genera before the fodder value of previously untested species can be determined conclusively.

*G. sepium* is widely used for fodder worldwide, although its perceived value varies greatly from place to place because of apparent differences in palatability. It was not known whether this is due to genetic variation in *G. sepium* or to differences in site, management practices or in the animals being fed. The rangewide provenance seed collections assembled previously under R3174 and R4091 provided a unique opportunity to investigate this question, both *in vivo* and *in vitro*. Provenance-based feeding trials were implemented in Colombia, Costa Rica, Indonesia, Nigeria and Sri Lanka. The *in vitro* research consisted of fermentation studies and analysis of leaf samples for coumarin.

The *A. erioloba* component of the project investigated the genetic variation in pod nutritive values in a natural stand in Zimbabwe.

The *Leucaena* research found that:

- Great variation exists within the genus for all the fodder traits tested (crude protein, organic matter, fibre, total tannin, condensed tannin, *in vitro* digestibility, relative palatability).
- The most promising taxa include *L. shannonii* subsp. *shannonii*, *L. collinsii* subsp. *zacapana* and *L. multicapitula*.
- None of the previously untested taxa were as palatable as the well-known species *L. leucocephala* and *L. diversifolia*, both of which are already widely used as fodder.

The implications are that *L. shannonii* subsp. *shannonii*, *L. collinsii* subsp. *zacapana* and *L. multicapitula* merit further testing, including full feeding trials. None of these taxa scored as high as *L. leucocephala*, and for this reason their introduction as exotics may not be justified, but they could prove to be useful supplementary fodders within their natural ranges.

The research on *Albizia* and close relatives found that:

- Three of the six species tested were palatable to sheep to some degree: *Pseudosamanea guachapele* (highly palatable); *Albizia niopoides* (fairly palatable) and *Hesperalbizia occidentalis* (slightly palatable).
- Of these, *A. niopoides* was of below average quality in terms of crude protein and *in vitro* digestibility, as well as being slow growing.

The implications are that the other two species merit further testing, although probably not for use outside their native ranges.

The *G. sepium* research found that:

- Sheep and goats can distinguish between provenances of *G. sepium*, and show a strong preference for material to which they have been previously accustomed. Apart from this, there is no evidence that some provenances are intrinsically more palatable than others.
- Although there was a significant effect of provenance on total dry matter intake in one of the feeding trials, this was not reflected in any differences in live weight gain, and neither was any provenance effect on intake observed in any of the other feeding trials.

The implications are that *G. sepium* provenances may be selected on the basis of high yield only, without any risk of a deterioration in fodder quality.

The *A. erioloba* research found that:

- All the pod quality traits assessed (crude protein, fibre, lignin, carbohydrate, starch) showed a high level of within-population variation.

The implications are that, even if only a small proportion of the tree-to-tree variation in nutritional value of the species is under genetic control, there could be considerable potential to increase yield by selection and breeding.

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

See PROREC output.

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

In addition to the dissemination products recorded above, four papers have been submitted for publication in scientific journals.