

PROJECT SUMMARY

TITLE: *Cordia alliodora* - study of the breeding systems and development of breeding strategies for an agroforestry species.

R NUMBER: R4484 and R4724 (an extension to R4484)

STRATEGY AREA: Plantations and agroforestry

PROGRAMME MANAGER: OFI

SUB-CONTRACTOR: OFI

START DATE: 01/10/88 **FINISH DATE:** 31/03/91

TOTAL COST: £100,687

START DATE: 01/04/91 **FINISH DATE:** 31/01/93

TOTAL COST: £ 83,281

1. Background:

Cordia alliodora, a neotropical tree, is frequently used in agroforestry systems, providing valuable timber and income to small farmers. OFI initiated a programme of provenance trials in 1977 (R3158) and their assessment (R4101) indicated the outstanding performance of provenances from the Atlantic lowlands of Costa Rica and Honduras. Great variation between trees within the best provenances showed the potential for genetic improvement. However, sound progress in long-term breeding requires adequate information on population structure, pollination biology and breeding systems. Little is known for *C. alliodora*, which gives problems for developing effective strategies.

2. Objectives:

- 1) To determine the type of pollination and any incompatibility system in *C. alliodora*.
- 2) To determine the level of heterozygosity, by isoenzyme analysis, found in natural stands of *C. alliodora* where trees have been selected for the CATIE breeding population, and the relation, if any, to growth rates in progeny trials.
- 3) To determine the effect of related crossings and selfing on initial growth rate.
- 4) To develop a breeding strategy for *C. alliodora* on the basis of the information gathered in objectives 1-3.

3. Results:

The project achieved its objectives. Practical knowledge was derived that will provide a sound basis for the implementation of a *C. alliodora* breeding programme.

A sporophytic diallelic one-locus incompatibility system linked to cryptic heterostyly was demonstrated for *C. alliodora*. From studies of incompatibility and mating systems, using the multilocus mixed mating model, it is apparent that the species is predominantly outcrossed, with very low levels of actual selfing. Departures from the mixed mating model, and individual tree outcrossing rates, suggested some non-random mating contributing to limited inbreeding and population substructuring. The population studied also showed both spatial and temporal substructure, due to variation in flowering and stand density. Gene flow within the population occurs over considerable distances. Pollen dispersal estimates indicated higher probability of crossing with nearest neighbours which, in areas of low tree density, combines with the spatial clustering of genotypes to promote crossing between related individuals. In such cases, the incompatibility mechanism leads to some trees being highly outcrossed while others have low outcrossing rates. Differences in flowering and pollination were evident between wet and dry zone populations.

Conclusions with respect to tree improvement programmes and for conservation purposes were drawn for *C. alliodora*, from which work can now proceed with confidence. Some of the conclusions have wider applicability. Guidelines for the collection of tropical tree germplasm were shown to be wanting in their recommendations for the spatial separation of trees used in seed collection. This work and other studies indicate that many provenance collections of tropical trees will contain a narrower genetic base than was previously thought, and therefore raises doubts as to how effective such collections have been in evaluating patterns of genetic variation within tropical tree species, and their use for conservation purposes.

4. Dissemination products:

See PROREC output.

5. Follow-up:

R5399 (adaptive research project): Intensified transfer of forest genetic technology and information in Central America. (01.11.92 to 31.10.95).