STUDY OF AFFORESTATION TECHNIQUES IN GRASSLANDS OF KERALA

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CONTENTS

		Page	File
1	Introduction	1	r.52.2
2	Trials at Chandanathode	1	r.52.3
3	Results and discussion	2	r.52.4
4	Conclusion and recommendations	4	r.52.5

INTRODUCTION

Grasslands form an important vegetation type in the high ranges of Western Ghats in the states of Karnataka, Kerala and Tamil Nadu, mostly between 1000-2200 m above msl. The extent of grasslands in Kerala had been estimated as 98 km^2, which constitutes 1.3% of the total forest land. Most of the grasslands have been formed due to degradation of the montane subtropical evergreen forests Although the grasslands fulfil a number of ecological functions, their contribution towards wood production is negligible. Considering the increased demand for wood, attempts were made in Kerala to bring selected grasslands under tree cover with varying degree of success.

Systematic efforts for afforestation of the grasslands in Kerala were not made in the past. However some attempts have been made by the Forest Department to raise species of *Eucalyptus.* The method adopted was preparing the site by uprooting the grasses, heaping them along the contours and planting seedling of *E. grandis* and *E. rereticornis* in pits of 30x30x30 cm size. Scraping the soil around the pits to a radius of 30 cm was also carried out. An espacement of 3m was followed for *E. grandis* and *2.5* m for *E. tereticornis.* A prophylatic treatment was also recommended with an insecticide (aldrin) and a fungicide.

The artempts in Wynad Division date back to 1965. Although *Eucalyptus tereticornis* and *E. grandis* were planted, the results were not encouraging. In species trials conducted in the high rainfall areas of Karnataka, *Acacia auriculiformis. Casuarina equisetifolia. Swietenia macrophylla. Grevillea robusta* etc. were found to perform well.

TRIALS AT CHANDANATHBDE

Locality factors

The present study was conducted at Chandanathode in the Wynad plateau situated at an elevation of 700 m, above mean sea level (Fig. **i).** The topography, in general, is hilly and rugged and most of the grasslands are located on the upper slopes and hill tops The terrain is steep to undulating and the area receives a high annual rainfall of 6000 mrn or more About 90% of the total rainfall is during the months June-September. Relative humidity is very high throughout the year Mean minimum and maximum daily temperatures are 13°C and 32°C respectively Frost is not reported to occur.

There are two prevailing winds. The westerly wind, that blows during the south west monsoon, is mild. A strong dry wind blows from the east during November-April. This dry wind enhances fire hazard

The grasslands in the study area (Fig. ii) occur interspersed with patches of evergreen forests mostly in the protected valleys 14 species of grasses were

recorded from the study site The most common grasses were *Arthraxon lanci-folius. Eulalia trispicata. Heteropogon contortus. Ischaemum indicum. Penni-setum polystachyon* and *Themeda tremula.* Other dominant plants were *Careya arborea. Cassia leschenaultiana. Crotalaria umbellata. Curculigo orchioides, Curcuma netlgherrensis. Dalbergia latifolia. Desmodium triquetrum, Flemingia hracteata, Lobelia nicotianifolia. Osbeckia truncate. Pycnospora lutescens, Swertia lawii.* and *Tephrosia tinctoria.*

Fire is frequent in this grassland. During January-April there is definite fire risk Ground fires, that occur every year, are often fierce in the tall grassy areas and mild in other areas.

Profile ddta shows that the soil in the study area is loamy and medium deep. Surface sample data reveal loamy texture, strongly acidic nature, fairly high level of organic carbon and relatively low base content. There is enough evidence to conclude that the area is subjected to strong leaching.

Choice of species

Fast growth was regarded *as* the main criterion for selection of species for the trials. Though the study site received very high rainfall, it was feared that the strong and continuous wind during the dry months had a desiccating effect on plan1 and soil. This presumption gave the idea of trying fairly drought resistant species like *Acacia nilotica* and *Santalum album. Dalbergia latifolia* was chosen because of its natural occurrence in the stuay site. Inclusion of *Grevillea robusta. Casuarina equisetifolia. Eucalyptus grandis, E. tereticornis* and *Pinus caribaea* for trials, was based on the indications of their suitability in similar sites elsewhere. List of species tried are shown in Table 1.

Experimental Design

Randomised Block Design was followed for the trial. There were 16 treatments replicated thrice with 100 plants in each treatment. Planting was done at 2x2 m spacing. Scraping around individual plants and formation of a platform of 60x60 cm with a hillward slope was done in all cases. The plots were protected against grazing and fire and maintained free from weeds by knife weeding.

RESULTS AND DISCUSSION

Height Growth

The mean annual height increment for the various species is given in Fig. III. *Eucalyptus grandis, Eucalyptus tereticornis* (stump) and *Casuarina equisetifolia* registered a mean annual height increment (m.a.h.i.) above 60 cm, the standard set for a species to qualify as fast growing during early years of growth. *Paraserianthes falcataria* and *Grevillea robusta* had a m.a.h.i. between 40 and 60 cm placing them under the moderately fast growing category. All other species recorded m,a,h,i. below 23 cm.

Table 1. List of species planted during the study period

SI. No.	Species	Propagule	Year of planting 1977	1978	1979	1980	1981	1982
1	*Erythrina subumbrans*	Branch cutting, 1 m long, 6-7cm dia.	*		*			
2	*E. subumbrans*	Branch cutting, 1 m long 6-7cm dia. prerooted			*			
3	*Paraserianthes falcataria*	Seedling, bare root, 4 months	*					
4	*Eucalyptus tereticornis*	Seedling. bare root, 18 months	*					
5	*E. tereticornis*	Stumps 15 cm tap root. 2 5 cm shoot prepared of sl no. 4	*					
6	*Bombax ceiba*	Seedling, bare root, 6 months	*					
7	*Eucalyptus grandis*	Seedling bare root. 6 months	*					
8	*Grevillea robusta*	Seedling, bare root, 6 months	*				*	
9	*Acacia nilotica*	Seedling. potted, 4 months				*		
10	*Calliandra caloth yrsus*	Seedling, potted, 4 months				*		
11	*Leucaena leucocephala*	Seedling, potted, 4 months				*		
12	*Casuarina equisetifolia*	Seediing. bare root, 9 months					*	
13	*Dalbergia latifolia*	Root sucker, potted					*	
14	*Aegle marmelos*	Wildling. potted					*	
15	*Santalum album*	Seedling. potted, 12 months						
16	*Pinus caribaea* var. *hondurensis*	Seedling, potted, 5 rnonths						*

Survival

Casuarina equisetifolia and *Eucalyptus grandis* registered survival percentage above 70 and in the case of *Eucalyptus tereticornis* (,stump), *Grevillea robusta* and *Bombax ceiba* it was between 40 and 70 (Fig. iv-vii). Although, as a thumb rule, a plantation with a stocking above 70 percent could only be regarded as successful, taking into account the adverse sire factors and the fact that the casualty replacements were not done in the trial plots, it might be proper to regard a survival above 40 percent as moderately satisfactory. Thus, *Casuarina equisetifolia. E. grandis, E. tereticornis* (stump), *Grevillea robusta* and *Bombax ceiba* stand above other species. The observations on *Pinus caribaea* and *Santalum album* were taken only for 7 months (Fig viii), and hence too early to draw any conclusion.

Though *Bombax ceiba* satisfied the minimum survival standards, the growth rate was not satisfactory and hence did not qualify as a suitable species for the grasslands. The better survival and growth performance of sturnp as a planting material in the case of *E. tereticornis,* unless estabiished on a large scale, cannot be taken for granted.

Identification of commercially valuable species for afforestation and standardisation of economic methods of raising plantations were the two objectives of the project. But much work could not be carriedout on the latter aspect. Neverthless, it could be suggested that fire and grazing, which are the two major hazards in any regeneration area, should be kept away by effective methods. Excess growth *of* grass also should be controlled by a few knife weedings, the frequency of wnich may be decided based on local conditions.

CONCLUSIONS AND RECOMMENDATIONS

Based on the species performance trials conducted at Chandanathode during 1977-83. *Casuarina equisetifolia* (Fig ix), *Eucalyptus grandis, E. tereticornis* (using stump as planting marerial) and *Grevillea robusta* (Fig x) are found to be satisfactory species for identical grasslands, Hcjwever, large scale plantations may be attempted only on the basis of pilot scale plantings. It is noteworthy that *Eucalyptus grandis* cultivation in the grasslands is aiready in vogue. During the course of 'the study. serious pest or disease incidence were not observed on any of the species and as such the recommendation with ragard th species selection does not take into account the probabiiity of damage to the plants due to pests and diseases.

As a measure to conserve soil and moisture. it is recommended that platforms of 60x60 cm with a hillward slope may be formed around each plant at the establishment of tha plantation. The detrimental effects of fire in younger plantations are universally recognised and it is essential that adequate fire protection measures be implemented during the fire season Three to four knife weedings a year will prevent the plants from getting smothered by weeds and also reduce the fire hazard in the area.

Fig. II. A view of the study site.

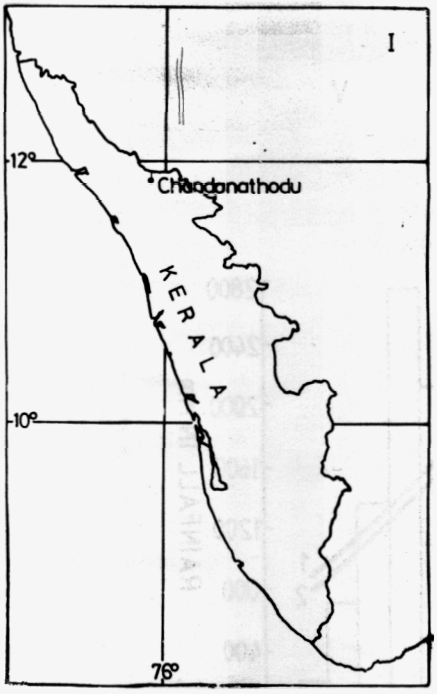

Fig. I. Location of the study area.

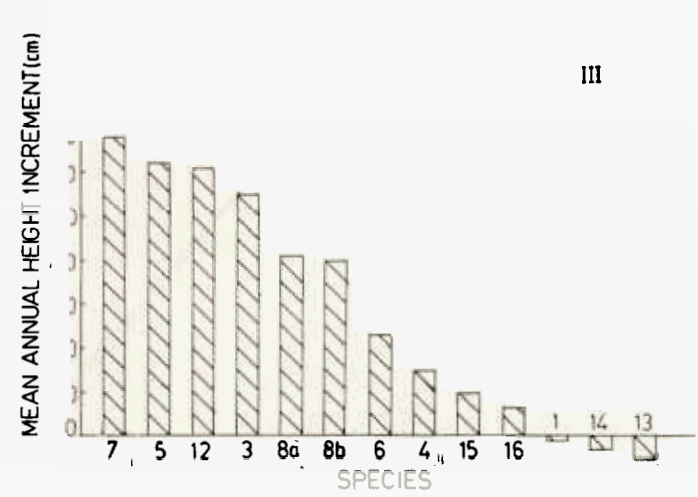

Fig. III. Comparative growth performance of various species at Chandanathode. Negative increment in 1, 14 and 13 is due to drying up of leading shoot and development of shoots from below.

1. ERYTHRINA SUBUMBRANS, 3. PARASERIANTHES FALCATARIA, 4. EUCALYPTUS TERETICORNIS, 5. EUCALYPTUS TERETICORNIS (stump), 6. BOMBAX CEIBA, 7. EUCALYPTUS GRANDIS, 8a. GREVILLEA ROBUSTA 1977 trial, 8b. G. ROBUSTA 1981 trial, 12. CASUARINA EQUISETIFOLIA, 13. DALBERGIA LATIFOLIA, 14. AEGLE MARMELOS, 15. SANTALUM ALBUM, 16. PINUS CARIBAEA var. HONDURENSIS.

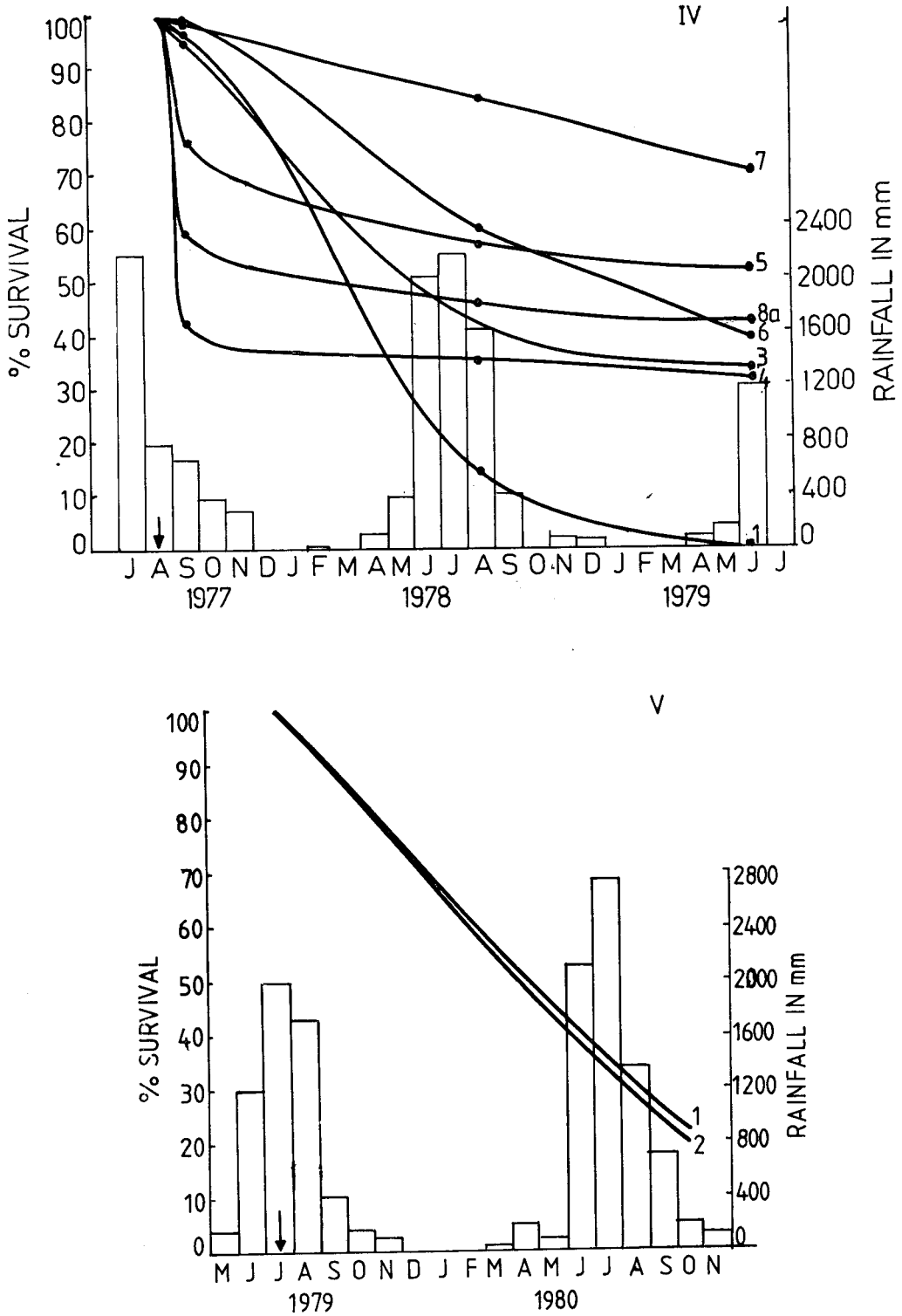

Fig. IV-V. Survival of different species planted in 1977 (Fig. IV) and 1979 (Fig V). Smooth curve indicates survival and bar monthly rainfall. Arrow on x - axis indicates time of planting. 1. ERYTHRINA SUBUMBRANS, 2. E. SUBUMBRANS (pre rooted branch cuttings), 3. PARASERIANTHES FALCATARIA, 4. EUCALYPTUS TERETICORNIS 5 EUCALYPTUS TERETICORNIS (stump), 6. BOMBAX CEIBA, 7. EUCALYPTUS GRANDIS, 8a GREVILLEA ROBUSTA.

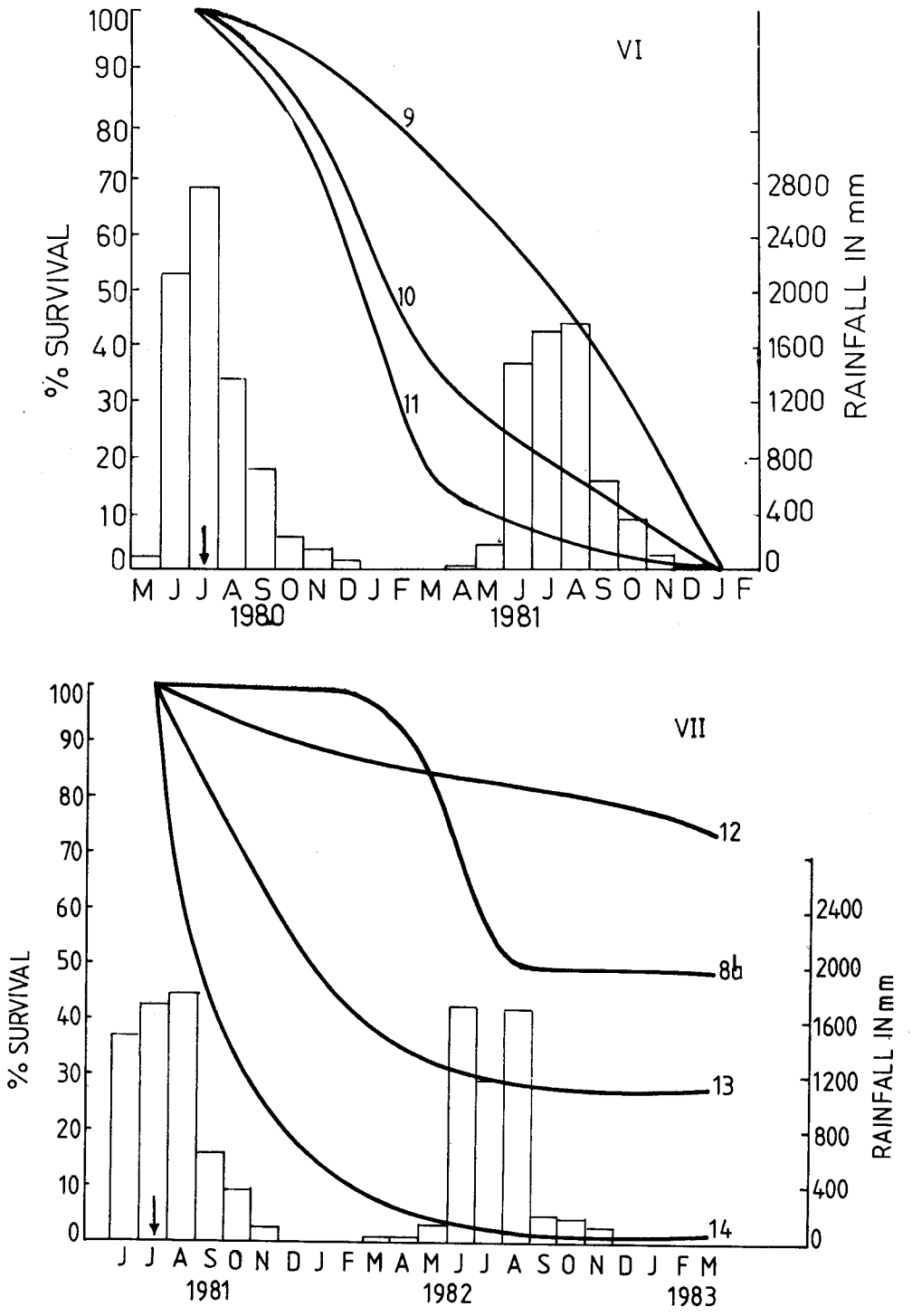

Fig. VI-VII. Survival of different species planted in 1980 (Fig. VI) and 1981 (Fig. VII)
8b. GREVILLEA ROBUSTA, 9. ACACIA NILOTICA, 10. CALLIANDRA CALOTHYRSUS, 11. LEUCAENA LEUCOCEPHALA, 12. CASUARINA EQUISETIFOLIA, 13. DALBERGIA LATIFOLIA, 14. AEGLE MARMELOS.

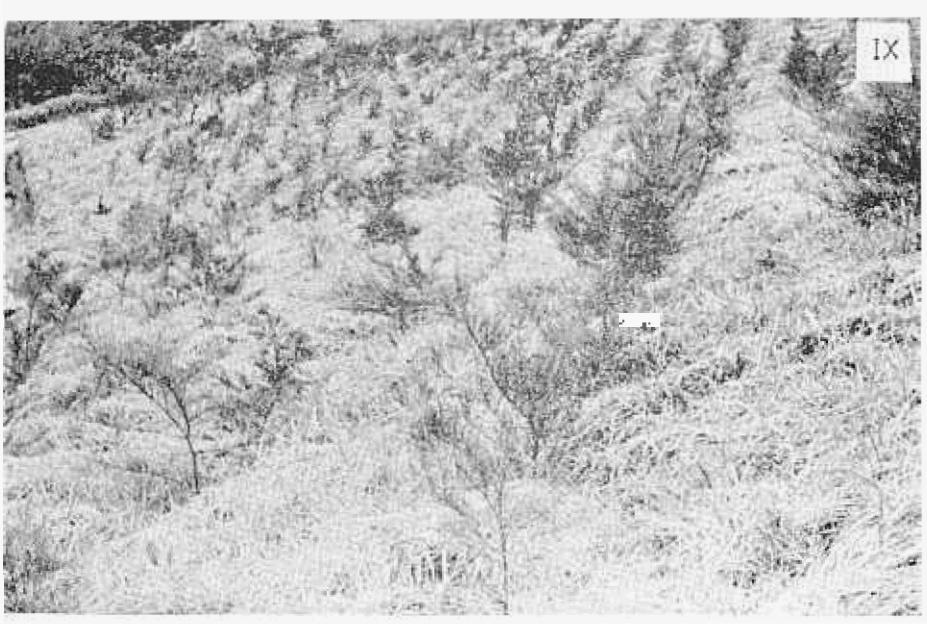

Fig. IX. Established plot of CASUARINA EQUISETIFOLIA 27 months after planting.

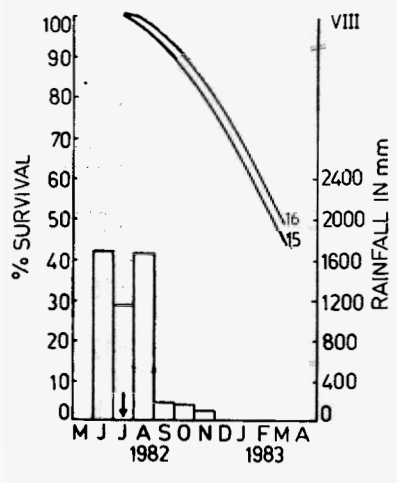

Fig. VIII. Survival of the two species planted in 1982.
15. SANTALUM ALBUM,
16. PINUS CARIBAEA var. HONDURENSIS.

Fig. X. Established plot of GREVILLEA ROBUSTA 27 months after planting.