

(B) Summary

Title: UNDERSTANDING THE PERFORMANCE OF SELECTED FOREST SPECIES PROVIDING NON – TIMBER FOREST PRODUCTS IN SINHARAJA WORLD HERITAGE SITE, SRI LANKA

Research Institute: Department of Botany, University of Peradeniya, Peradeniya.

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Period of Contract: 16th October 2000 – 16th October 2003
(An extension was requested up to end of March 2004)

The Sinharaja forest, Sri Lanka's only natural World Heritage Site, was selectively logged from 1972 to 1977, when logging was banned. Since then, it has been declared as a conservation forest and *Pinus caribaea* was planted in the buffer zone around it. This study conducted between 2000 - 2004 covered two main aspects. First, the evaluation of the growth performance of selected primary forest species introduced to a part of the *Pinus* buffer zone and second, the regeneration performance of the same species in a selectively logged part of the forest.

In 1991 a field trial, where a part of the *Pinus caribaea* buffer zone was enriched using selected timber and non-timber primary forest species, was initiated after creating different size gaps, by thinning five, three, two and one Pine row/s in the stand. The light intensity at ground level in these respective gaps was 25, 22, 19 and 3 mol m⁻² day⁻¹ and in the unthinned stand, considered as a control, it was 1 mol m⁻² day⁻¹. Since the establishment of this trial, the initial light environments in the gaps have gradually changed, with the growth of the pine trees as well as the introduced species.

In the present study, the light variation at different canopy heights and its diurnal variation in the different size gaps and the control of the field trial were examined. The morphological, physiological and anatomical adaptability of six selected species (*Shorea disticha* (Thw.) Ashton, *Shorea megistophylla* (Thw.) Ashton, *Caryota urens* L., *Calamus ovoideus* Thw., *Coscinium fenestratum* Colebr. and *Elettaria cardamomum* var. *major* Thw.), which provide non-timber forest products, to the different light levels in the treatments and the control of the *Pinus* enrichment trial were also investigated.

The progressive height growth and accompanying crown upliftment of the pine trees and study species, over 10 years, have resulted in a vertical variation in the light environment in the

gap treatments and control of the trial. Between 10 m and 1.5 m above the ground the light intensities decreased. The greatest decrease was recorded from 26/21 to 8.8/5.4 mol m⁻² day⁻¹ in the 5 and 3 pine rows removed treatments. In the smaller gaps this range decreased. In the unthinned control the vertical light variation was least, decreasing only from 3.2 to 1.3 mol m⁻² day⁻¹. Across the different gaps the light intensities at 10m above the ground reduced from 26/21, through 11 to 3.2 mol m⁻² day⁻¹ in the 5/3 rows removed gaps, 1 row removed gap and the control respectively.

In this trial, mortality of *Shorea megistophylla* (significantly), and *Shorea disticha* increased with increasing shade. In both species height, root collar diameter (RCD) and diameter at breast height (DBH) declined significantly with decreasing shade. Stomatal conductance and water use efficiency varied significantly only in *S. megistophylla* and all other physiological traits showed no plasticity among the treatments and control. Among the anatomical traits studied, palisade layer thickness and stomatal index of *S. disticha* and cuticle thickness of *S. megistophylla* declined significantly with decreasing light levels. All other anatomical traits failed to respond to changes in light.

In both liana species, *C. fenestratum*, *C. ovoideus*, mortality was highest in the control, which had the lowest light environment. Height growth in both species and root collar diameter in *C. fenestratum*, also declined significantly with increasing shade. The physiological traits measured in them varied significantly among the treatments and control, but among the anatomical traits, the palisade layer thickness in *C. fenestratum* and thicknesses of the lower epidermis and spongy mesophyll, spongy/palisade ratio and stomatal index in *C. ovoideus* varied significantly.

In *E. cardamomum* mortality was least in the control. Plants grown in the control or the lowest shade level were significantly taller and had significantly higher photosynthetic rates. None of the anatomical traits varied significantly among the treatments and the control. Consequently, this species depicts morphological and physiological plasticity to a small extent but no anatomical plasticity. Therefore, the best vegetative growth of the species is under a low light intensity of about 3 mol m² day¹.

In contrast to all other study species, in *C. urens* mortality increased with shade and was 80% under a light intensity of 3 mol m² day¹. Height and root collar diameter growth and net photosynthetic rate of this species was significantly better in the higher light environments. All the anatomical traits measured, except its stomatal index, failed to vary significantly. These

results suggest that *C. urens* has morphological plasticity, but very little physiological and anatomical plasticity.

Among the study species in this trial, a few of the individuals of *E. cadomomum*, *C. urens* and *C. ovoideus* have already attained reproductive maturity and in the near future their products could be harvested on a commercial scale. *Calamus ovoideus* has already reached the canopy of the pine trees and are competing aggressively with their crowns and those of the enriched tree species and silvicultural manipulations would be required to prevent them from damaging the other species. Their short rotation cycle make them suitable candidates for harvesting their products in the early years in a timber production cycle, when there is no return from timber. This trial provides the basic information for conversion of monoculture pine plantations in the lowland wet zone of the country to multiple species polycultures using primary forest species. Enrichment of pine plantations this way would not only increase their biodiversity but also make them effective corridors between fragmented forests of the lowland wet zone.

Papers published on work done under the contract: See pages ii and iii above.

Thesis completed will be sent separately.

Grantees Signature: Arunatilleke

Comments of the Head of the Department:

Progress has been satisfactory.
Recommended & Forwarded.


Signature of the Head of the Department:

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25/03/2004