PLANT IMPROVEMENT & SEED PRODUCTION

PROJECT

ANNUAL REPORT FOR 1997

Activity Report for the
Steering Committee Meeting n° 9

(March 1998)

ICSB / CIRAD-Forêt

Effect of the shade treatment on rattan growth at the nursery stage (update and conclusion)

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Introduction

Last year we presented a preliminary study on the optimal shade requirements for rattans at the nursery stage (CIRAD-Foret/ICSB Steering Committee Report, 1997). In 1998 we carried out the second and last assessment of the trial, and here we present its results and conclusion.

This experiment aimed to assess the light requirement at the nursery stage for 4 commercial large-diameter rattan species:

- *Calamus ornatus* (rattan Lasun)
- *C. merrillii* (rattan Palasan)
- *C. manan* (rattan Manau)
- *C. subinermis* (rattan Batu)

Material & method

In this experiment, we compared 3 different sarlon nets with a shade percentage (as specified by the manufacturer) of 30%, 50% and 70%. Our own measurements (by using 10 calibrated LICOR quantum sensors) allowed to estimate the actual shade given by each of the three Sarlon nets once installed in the nursery (Table 1).

Table 1. Estimation of the actual shade given by the Sarlon nets as compared to the manifacturer specifications.

Manufacturer specification shade value	Actual shade value (PISP nursery)	Minimum value (over 8 sensors)	Maximum value (over 8 sensors)
30%	39%	36%	42%
50%	58%	56%	62%
70%	78%	73%	83%

In the experimental nursery reserved for this experiment, the shade variation within each single Sarlon net was of about 5% of the total variation. This was an indication that the whole installation was good.

Three replications (R1, R2 and R3) were used; each experimental unit included 33 plants. The species were randomly arranged within repetitions in order to minimise the competition effect for light. The plants were all raised in the same conditions, by using a slow release fertiliser and 6' x 9' polybags.

The experiment started just after transplanting the seedlings from the seedbeds to the polybags, in June 1996. The first assessment (February 1997) occurred 8 month after transplanting and 2 characters were measured: the shoot length (length between the collar and the last leaf insertion) and the collar diameter. At the second assessment (July 1997), as the diameter was found to be highly correlated with the shoot length and essentially gave similar results, we only measured the shoot length.

The different shade treatments and repetitions were compared by using a variance analysis and then the ranking tested by using a Duncan test. The data were analysed species by species. The statistical model used included 2 factors, repetitions and shade, plus the interaction repetition*shade.

Results

For all species, the model was higly significant. All the main factors (shade and repetitions) and the interaction repetition*shade significantly affected the growth of all species. Only for batu the interaction rep*shade was not significant. Results of the analysis of variance per experimental factor are given in Table 2.

Table 2. Analysis of variance showing the significance level of the effects for each species. Second assessment, 13 months after transplanting.

Calamus manan					
Source	***DF***	***Type III SS***	***Mean Square***	***F Value***	***Pr > F***
SHADE	2	2187.470	1093.735	97.51	0.0001
REP	2	103.145	51.572	4.60	0.0109
SHADE*REP	4	449.560	112.390	10.02	0.0001

Calamus ornatus					
Source	***DF***	***Type III SS***	***Mean Square***	***F Value***	***Pr > F***
SHADE	2	473.330	236.661	28.53	0.0001
REP	2	272.488	136.244	16.42	0.0001
SHADE*REP	4	239.659	59.914	7.22	0.0001

Calamus subinermis					
Source	***DF***	***Type III SS***	***Mean Square***	***F Value***	***Pr > F***
SHADE	2	486.353	243.176	34.51	0.0001
REP	2	58.490	29.245	4.15	0.0167
SHADE*REP	4	46.475	11.618	1.65	0.1621

Calamus merrillii					
Source	***DF***	***Type III SS***	***Mean Square***	***F Value***	***Pr > F***
SHADE	2	2187.470	1093.735	97.51	0.0001
REP	2	103.145	51.572	4.60	0.0109
SHADE*REP	4	449.560	112.390	10.02	0.0001

The rankings of the treatments in terms of shoot length at the first and second assessment are given in Table 3.

Table 3. Shoot length (cm) ranked according to the shade treatment.

First assessment	*C. ornatus*		*C. merrillii*		*C. manan*		*C. subinermis*	
30% shade	10.9	A*	12.7	A	5.6	A	9.8	A
50% shade	10.0	B	11.2	B	6.5	B	9.4	A
70% shade	11.5	A	10.0	C	10.4	C	10.4	B
LSD	*0.6*		*0.6*		*0.7*		*0.5*	

Second assessment	*C. ornatus*		*C. merrillii*		*C. manan*		*C. subinermis*	
30% shade	18.1	A	21.1	A	9.8	A	17.4	A
50% shade	14.7	B	15.7	B	10.2	A	14.6	B
70% shade	15.9	C	14.7	C	14.5	B	14.7	B
LSD	*0.9*		*1.0*		*1.1*		*0.5*	

NOTE: * Duncan ranking. LSD: Least significant difference.

The first thing to note is that batu, lasun and paiasan clearly did better under high light intensity (i.e. low shade percentages), while manau behaved in the opposite way. It is also interesting that the response of the species to the light treatment evolved with the time, lasun and batu seeming quite indifferent to the light at the first assessment, and showing their light demand later.

Finally, it has to be reported that the mortality had been quite low (<10%) for all species and all treatment, except for the higher light intensities applied to manau. In this case the mortality was of 21% under a shade of 50%, and 29% under a shade of 30%. Under the higher light intensities, manau not only grew more slowly, but also suffered higher mortality.

Collar diameter

The collar diameter was measured for all the plants at the first assessment. Table 4 shows the treatment effect on collar growth, as well as the correlation among the two characters, collar diameter and shoot length.

Table 4. Collar diameter (mm) ranked according to the shade treatment at the first assessment only. The correlation (r^2) among diameter and shoot length is also given.

First assessment	*C. ornatus*		*C. merrillii*		*C. manan*		*C. subinermis*	
30%	11.7	A*	14.0	A	7.8	C	14.0	A
50%	10.1	B	11.4	B	9.9	B	13.0	B
70%	11.4	A	11.7	B	11	A	13.5	A B
LSD (2)	*0.6*		*0.7*		*0.6*		*0.6*	
correlation of collar diam. with shoot length	**0.58** 0.0001**		**0.61** 0.0001		**0.73** 0.0001		**0.38** 0.0001	

Note: *: Duncan test. LSD: Least significant difference. ** probability of $r^2 \neq 0$

At the first assessment, the ranking over treatments for the collar diameter was quite coherent with the ranking obtained for shoot length. However the relative differences among treatments were less important. The correlation values among shoot length and collar diameter were high for most of the species, excepted maybe *C. subinermis*. For this reason, we decided to not measure the collar diameter at the second assessment.

By comparing the collar data at the first assessment and the shoot length data of the second assessment, the coherence among rankings is even more stricking, especially for batu.

Conclusion

The experiment is considered concluded. The results clearly indicated that three of the species (batu, lasun and palasan) clearly preferred high light intensities of around 60-70% (just to remember, the Sarlon net was sold as a 30% shade, but our measurement indicated that the actual shade was of 39%).

Conversely, manau at higher light intensities suffered of more mortality and grew more slowly. For this species it is better to use a Sarlon net at 70% shade, at least for the first 13 months.