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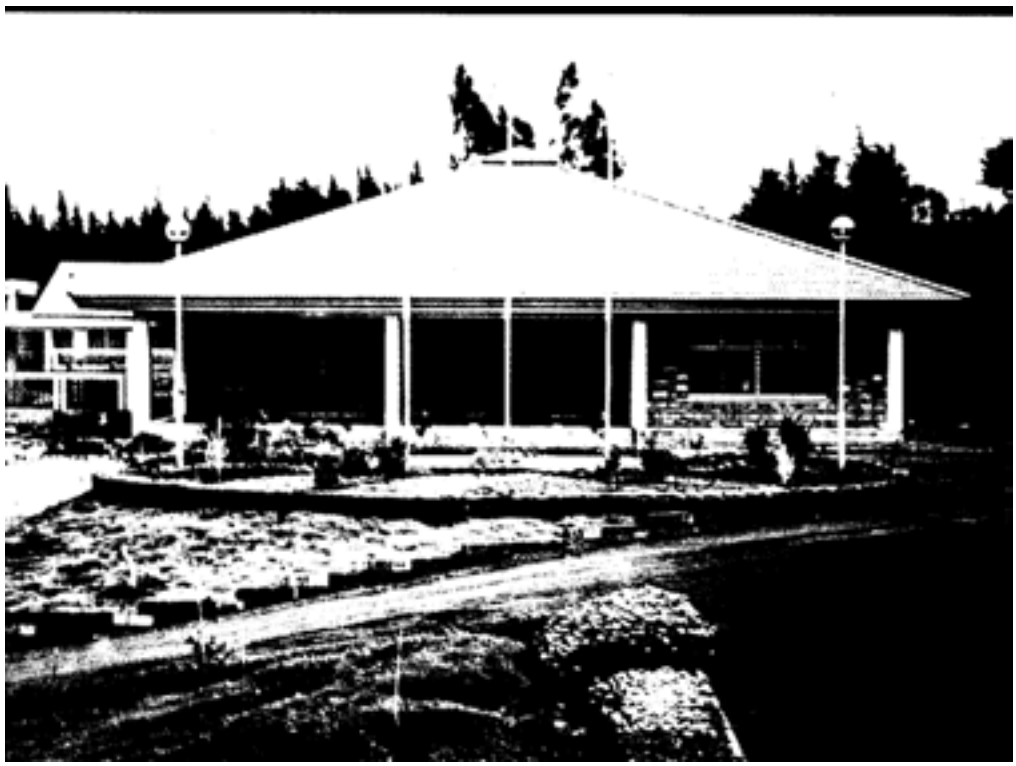

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Growth Response in a Thinning Trial of *Cupressus lusitanica* Crop

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INTRODUCTION

The main purpose of thinning a crop is to allow free growth of individual of a stand thus giving room for unimpeded development. By removal of diseased, damaged or suppressed trees, thinning enhances the value of the final crop and also generates revenue in the case of commercial thinning.

The. first thinning schedules of Cupressus lusitanica in Kenya was developed by Graham in 1949. This schedule recommended seven thinnings at two-year intervals starting at the age of seven years when average dominant height was 10.0m. The first thinning reduced the initial stocking from 1680 to 990 trees per hectare while final thinning at 21 years left 250 stems per ha.

This thinning regime aimed at production of a crop with mean diameter (dbh) of 46cm at the age of 40 years on average site. However, the development of the schedule was based on data from young plantations and was therefore tentative. The present experiment was therefore established to investigate the effect of four thinning regimes on development of nd to generate data on which to design the future thinning schedule of this species for various management objectives.

Materials and Methods

Registered experiment 217 was established at Molo Forest Reserve in 1960 in a 12 year old crop of C. lusitanica. The site was on an average altitude of 2680 m above sea level and received a mean annual rainfall of 1290 rum. The experiment consisted of a plot of 1.93 ha divided into four adjacent sub-plots each 0.48 ha of 29x29 planting spots. The plot was selected by quarters at right angles at an escarpment of 2.4x2.4m square.

The thinning plots were not replicated. The plantation had been previously thinned at age 8. The four plots were thinned at age 12 to differing densities (Table I). Initial thinning prescription required final crop density of the lightest thinned plot to be reached at age 26, second lightest at age 23 and the other two plots to be reached at ages 22 and 17 years. The laid down thinning schedule was not however closely followed and delayed thinnings are observed in plots A and B (Table I). Also included in Table I is the initial prescribed thinning programme for the experiment. The current thinning schedule for C. lusitanica plantation sawtimber crops is included in the Table for comparisons.

Table I Prescribed Thinning Treatment (RE. 217)

		Stems/ha After Thining								
	Age	0	8	12	14	17	20	22	23	26
PLOT	A	1680	1010	620	560	490	370	370	310	250
	B	1680	870	490	490	370	370	310	250	250
	C	1680	830	420	420	330	330	330	250	250
	D	1980	960	300	300	250	250	250	260	250

The analysis and interpretation of the data were handled in the light of treatment and measurements (Table Ⅱ) recorded in the course of growth until clear felling of the crop at age 34 years.

Table II Thinning Treatment Carried Out (R.- 217)

		Stems/ha After Thinning							
	Age	0	8	12	14	17	20	22	34
PLOT	A	1680	1010	610	560	490	370	370	370
	B	1680	870	490	490	470	310	310	310
	C	1680	830	420	420	330	330	330	250
	D	1980	960	300	300	250	250	250	250
	CKS	1660	890	530	-	350	-	270	-

' CKS - Current Kenya thinning schedule for saw timber crops (Forest Department, 1969)

Results And Discussion

Height Growth

Top height was assessed according to schedule on five occasions and Figure 1 shows smoothed dominant height for the four plots. There was no marked difference in dominant height among the plots. On comparing the smoothed dominant height trend for the four trial plots combined (Figure 1) with the curve for top height growth for average Kenya site (Pudden, 1958), it was observed that in the study, dominant

height was superior from age 10 onwards by about 4'% over the average Kenya site. Under 10 years, height growth was inferior by an average of 2%. The top height/age curve in the experiment closely follows schedule 2 (height growth mainly between 100 - 110% country average) of sawtimber cypress management (Kenya Forest Department, 1969). At the time of clearfell, top height had not been influenced by thinning history (Table III).

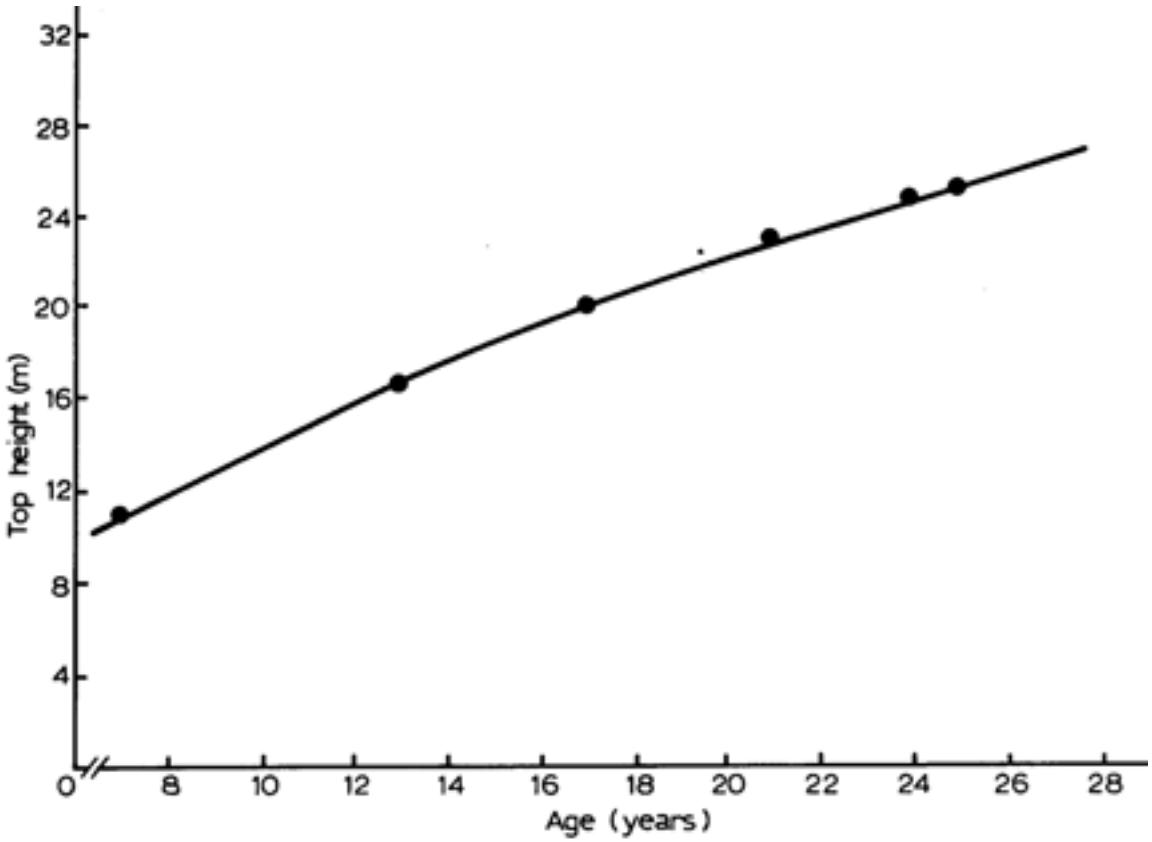

FIG.1. HEIGHT AGE CURVE

Diameter Growth

Figure 2 shows the trend of diameter change with thinning history. First thinning did not yield any marked difference in diameter growth. Thinning at age 12 resulted in the heaviest thinned plot D growing faster in diameter and the lightest thinned plot A growing slowest in diameter. Diameter growth was affected by density. Sensitivity in response is better observed with plots A and B where a slight heavier thinning of plot B at age 20 resulted in faster diameter growth than plot C. A slight heavier thinning of plot C than B two years later resulted in C growing faster in diameter.

It is observed in Figure 2 that plot D got to rotation diameter (48 cm) at age 29, plot C at age 32.5 but plots A and B did not reach the rotation mature age diameter at the time of clearfell. This suggest that final tree diameter size at time of clearfell was influenced by thinning history (Table III).

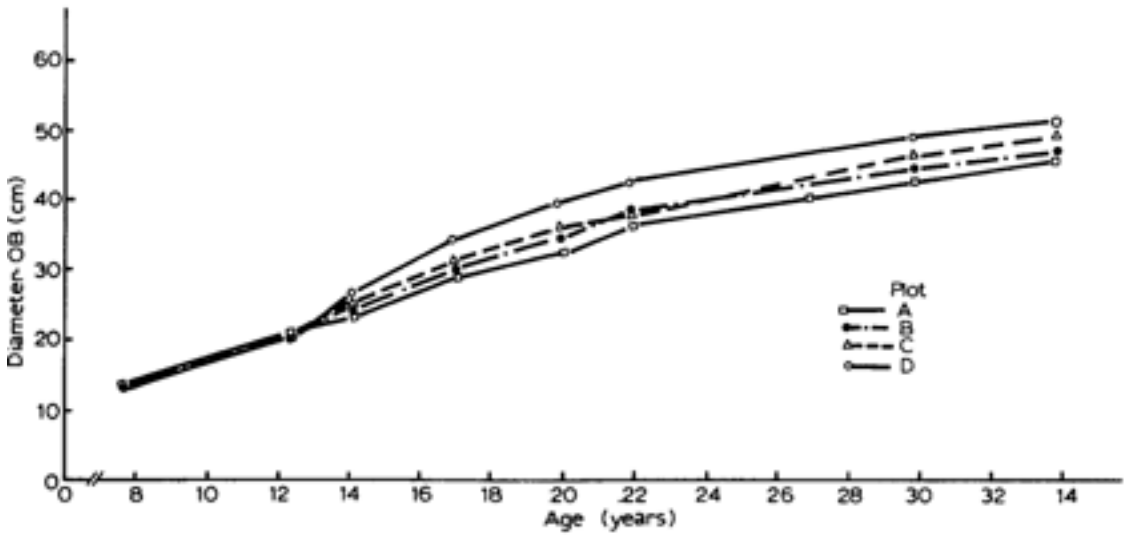

FIG.2. GROWTH IN DIAMETER$_2$ (dbh - ab)

Basal Area Growth

Heavier thinning resulted in lower cumulative basal area production and vice versa (Figure 3). Standing cumulative basal area at the time of clearfell suggest that basal area was influenced by stocking history (Table III).

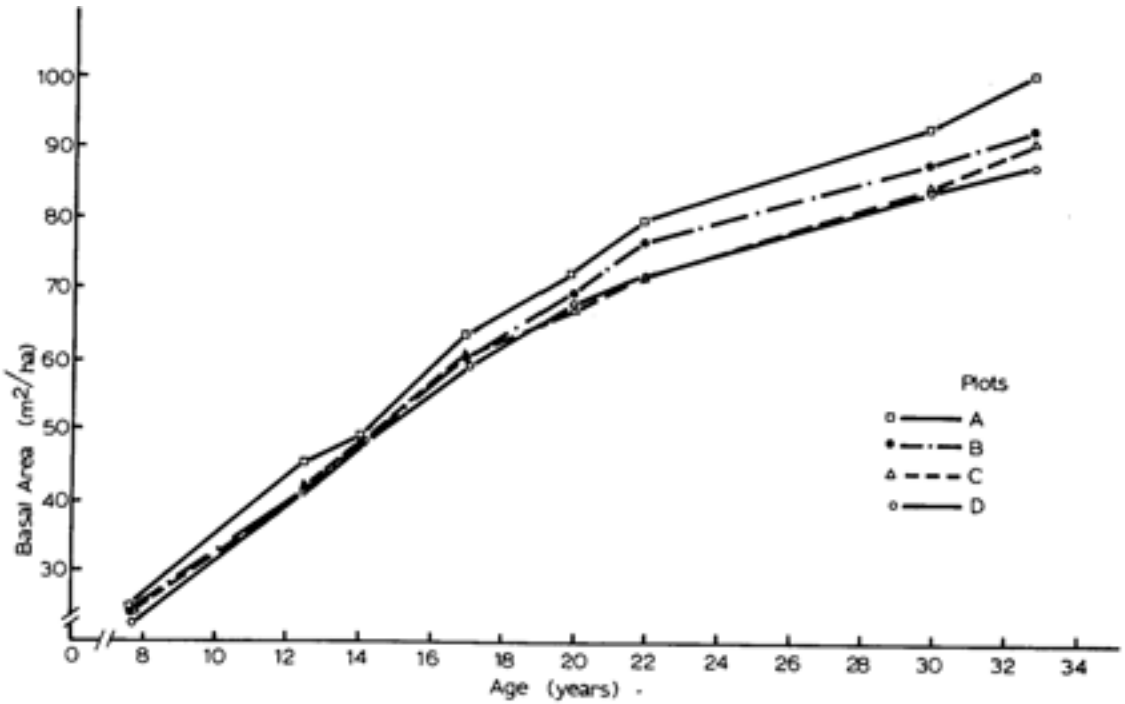

FIG.3. CUMULATIVE BASAL AREA WITH TIME

Volume Growth

Figure 4 shows total volume production with age. Cumulative volume yield was little affected by thinning treatment. The average true differences in total volume production was estimated at 19% over the growing period. Average accumulated volume production was slightly higher than forecasts for average Kenya site crops (Paterson, 1969). At time of clearfell, average accumulated volume was higher by 15% than the average site Kenya crops (Table III).

Mean annual volume increment for the plots culminated between ages 17 and 22 (Figure 5). After age 22, volume increment started to decline. At age 22, average tree diameter for the four plots was about 38 cm and therefore 10 cm short of crop maturity size. Volume rotation at this age may not therefore be feasible. Since each unit increment in tree size is associated with a higher premium, it would be more profitable to keep the crop to maturity diameter. The heavier and medium thinned plots C and D indicated that this size will be achieved between ages 29 and 32 years.

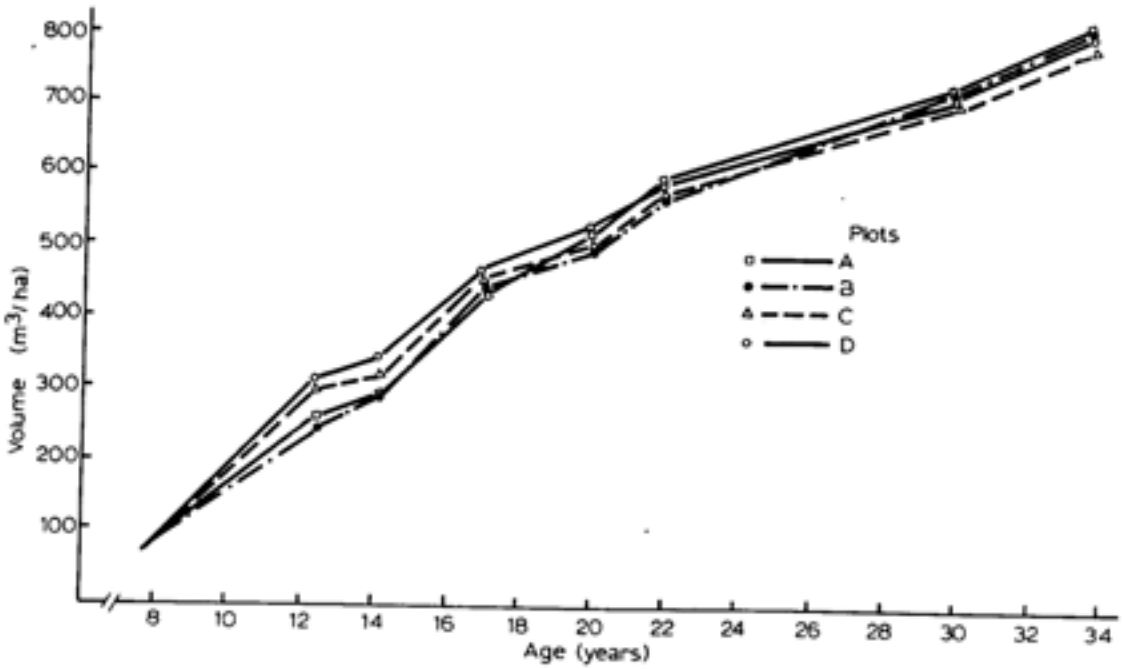

FIG.4. CUMULATIVE VOLUME PRODUCTION WITH TIME

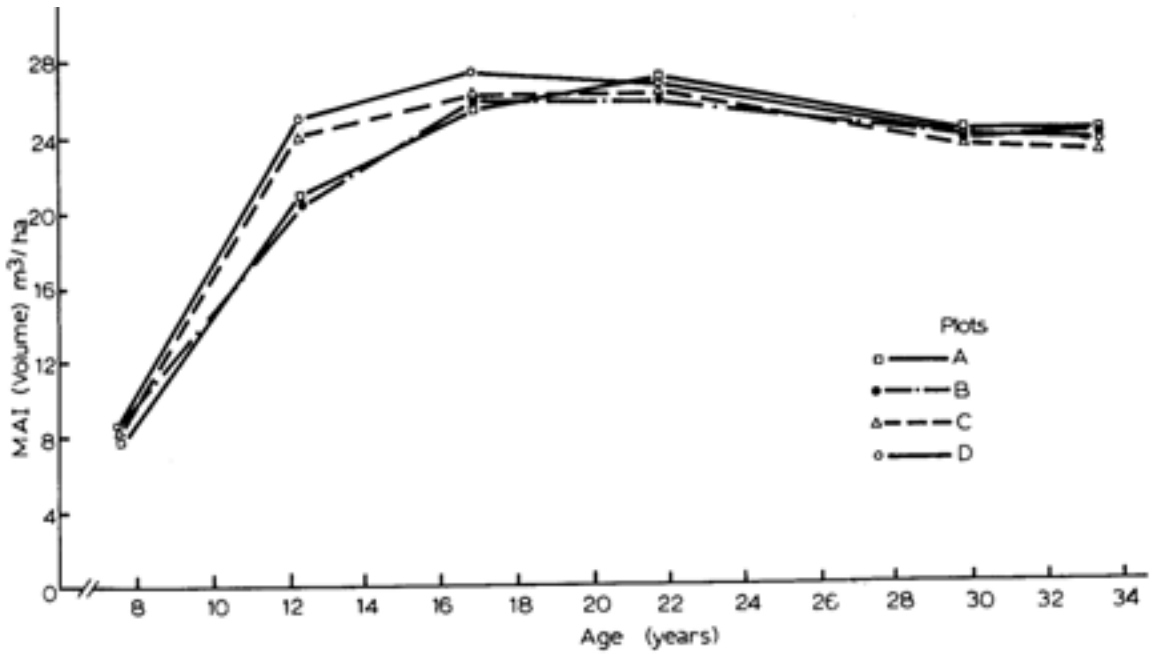

FIG. 5. MEAN ANNUAL VOLUME INCREMENT

Table lII Final Volume Estimate and

Growth Status of C. **lusitanica** at 34 Years

Parameter	A	B	C	D
Stems/ha	370	310	250	250
Final dbh (cm)	45.6	47.2	49.6	513
Mean top height (m)	323	343	32.8	33.4
Total basal area (m^2/ha)	101	93	91	88
Total volume (OB) (m^3 /ha)	817	812	780	813
MAI (m^3/ha)	24.0	23.9	22.9	24.7
Age & (dbh) of maximum Vol. MAI & Basal are (m^2/ha)	22(36.2)	17(30.0)	17(30.0)	17(34.3)
(After thinning)	38	26	30	23

Summary and Conclusions

RE 217 was unreplicated and the prescribed thinning schedule was not closely followed. The main objective of the study may not therefore be fully realized but the result accruing from the measurement offered important stand development data relevant to the management of C. **lusitanica.**

At age 20, the crop achieved a top height of 22.5 m (site index 23), a performance very close to an average site Kenya crop of C. **lusitanica.** Density did not have marked effect on dominant height. Higher stocking had a depressing effect on diameter growth. Stocking rates will thus influence age of crop maturity.

Total volume production compared well with production of average site Kenya crop. Thinning treatment did not show marked influence on cumulative volume production. Lightest thinning treatment however produced 20% more total volume than heaviest thinning treatment. Volume increment culminated at About age 20 and since the standing stems are of small diameters at this age, volume rotation may not be feasible with sawtimber or plywood produce. To achieve these end-products, value rotation should always be considered. Heavier and medium thinning intensities, very close to the current cypress practice achieved better results in terms of shorter rotation and superior log size at about 30 years.

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