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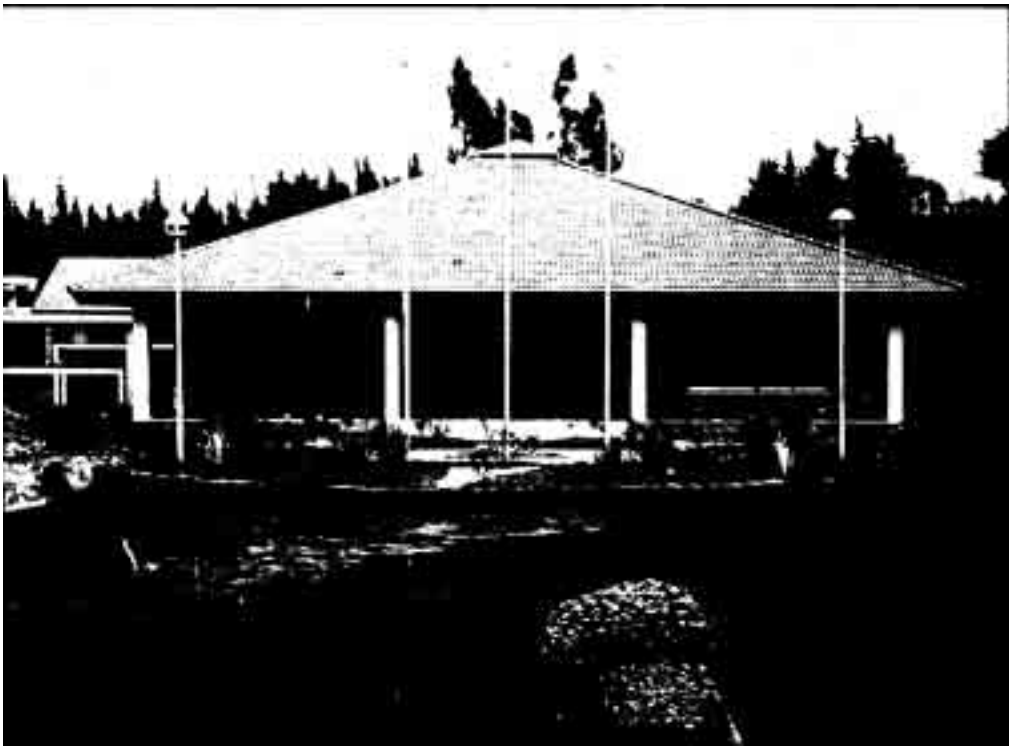

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INTERIM RESULTS OF A PROVENANCE TRIAL OF *Liquidambar styraciflua* IN KENYA

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Summary

A provenance trial of Liquidambar styraciflua was established on two sites at Kakamega and Lugari in 1986. Assessments for height and survival were done at ten months and two years at Kakamega and at one year at Lugari. The differences in height and survival were significant. The provenances from Honduras (Las Lajas and Tutule) had the best growth while the U.S.A. provenances (Franklin, Virginia and Hunstsville, Texas) had the poorest growth. Generally the height growth increased with decreasing latitude of seed origin. However, the early growth of this species in Kenya was not as fast as expected.

Introduction

Liquidambar styraciflua L., a broad-leaved hardwood native to tropical and Central America, occurs at latitudes of between 12 - 16°N. In its natural range, it grows well on well drained acidic forest soils with annual rainfall in the range of 1,500 - 1,800 mm and mean annual temperatures between 13.6 -21.40C. The species is tolerant to a wide range of soils but reaches its best development on deep clay loams (Fowells 1965). It can grow to 45 m in height and one metre in diameter and has an excellent form - straight stems, light branching and narrow crowns (McCarter and Hughes 1986). It regenerates by sprouting (Barret and Mullin 1976). It is used for production of a wide range of products including sawn timber, firewood, pulp, and wood for general construction.

Fifteen provenances of L. styraciflua were established in Kenya as an International Provenance Trial. This marked the first time that this species was introduced in Kenya. The species has been tried in Zimbabwe (Barret and Mullin 1976) and South Africa (Poynton) 1957).

The objective of undertaking the provenance trial in Kenya was to test the performance of L. styraciflua as fast growing timber species and to test provenance variation in terms of growth. The third objective was to serve as ex-situ gene conservation for a few of the provenances in danger of extinction. This paper reports on interim results of this trial.

Materials and Methods

The experiment was established at two Forest Reserves, Kakamega (latitude 0° 47'N; longitude 35° 06'E). The Kakamega

replicate was sited in Alosi Block compartment 8. The site stands at 1,676m above sea level and receives mean annual rainfall and temperature of 1,978 mm and 22°C respectively. The site has deep, acidic (pH 4.5 - 5.0) loamy clays. The planting site was formerly under cultivation.

The replicate at Lugari was located in compartment 1 (W). Lugari stands at an elevation of 1,600 m.a.s.l. and receives mean annual rainfall of 1,450 mm and mean annual temperature close to that of Kakamega. The soils are shallow dark red loams derived from Basement complex rocks. The site was previously under Pinus patula.

The provenances represented are given in Table 1. Out of the fifteen provenances, three did not germinate and two germinated poorly and were therefore excluded from the trial. The ten

provenances originated from Guatemala (2), Honduras (3), Mexico (2), Nicaragua (1) and U.S.A. (2). The design was randomised complete block of five replications on each site. Each plot had thirty six trees in espacement of 2.5 mx 2.5 m. Planting was done in May 1986 and each plot covered 1.13 ha on each site.

Table 1: Provenances and Locality

CFI Seedlot	Provenance	Lat.	Longit.	Altitudinal Range (m)	Rainfall (mm)
5/84	Fica, Las Victoria - Guatemala	15°12'N	89°22'N	800-1,000	1,750
2/85	Franklin, Virginia - USA	36°41'N	76°58'W	-	-
1/85	Huntsville Texas - USA	30°43'N	95°34'W	-	-
47/43	Las Laja-Honduras	14°48'N	87°34'W	1,100-1,200	1,500-2,000 estimated
83/83	Tutule, Lapaz-Honduras	14°12'N	87°50'W	1,400-1,700	1,500-1,800 estimated
45/83	Montebello, Chiapas - Mexico	16°04'N	91°44'W	1,460-1,540	1,800-2,200 estimated
6/84	Tactic Cobas-Guatemala	15o19'N	90o21'W	1,380-1,420	2,075
48/83	Yucul Matagalpa-Nicaragua	12o55'N	85o48'W	800-1,100	1,400-1600 estimated
46/83	Los Alpes-Honduras	14o33'N	87o58'W	1,250-1,350	1,400-1600
82/83	Huatusco, Veracruz, Mexico	19o05'N	97o00'W	1,350-1,500	1,746

Measurements on height were carried out at five and eight months after pricking out in the nursery. The first field assessment for height and survival were done at ten months and one year for Kakamega and Lugari replicates respectively. Second assessment on height and survival was carried out at two years for Kakamega plot only. Analysis of variance was carried out on the parameters assessed. Arc sine transformation on survival percentages was done before analysis.

Results

Height Growth

Table 2 gives summarised results of the initial height measurements done in the nursery. At five months the fastest growing provenance was the Las Lajas (Honduras) while the least growing was

the Montebello, Mexico. At **eight** months, however, the Guatemalan provenance from Finca Las had the best height while the Montebello provenance was still the poorest.

The summary of field results at Kakamega (at ten months and two years) and Lugari (at one year) are given in Table 3. After one year at Lugari the mean **heights** varied from 20.6 cm to 43.9 cm and differed significantly at 1 per cent probability level. The best two provenances were the Tutule and the Las Lajas from Honduras. These provenances were among the best three at eight months after pricking out in the nursery. The poorest provenance was the Franklin from Virginia in U.S.A.

Survival

Survival at Lugari was generally poor and the only provenance with good survival was the Huntsville from U.S.A. Survival of the others varied from 21 - 37 per cent.

Table 2: Initial height at 5 and 8 months after pricking out

Provenance	Mean Height (cm)	
	5 months	8 months
Finca Las V. Guatemala	22.3	32.1
Virginia, U.S.A.	25.8	26.7
Huntsville, Texas, U.S.A.	23.8	26.1
Las Lajas, Honduras	26.0	30.3
Tutule, Lapaz Honduras	22.4	27.7
Montebello, Chiapias Mexico	13.8	19.7
Tactic, Guatemala	21.3	26.7
Yucul, Nicaragua	19.0	26.9
Los Alpes, Honduras	15.0	20.1
Veracruz, Mexico	14.0	21.4

At Kakamega, growth in height differences were significantly different at ten months and also at two years. The best provenances at ten months were again the Las Lajas and Tutule from Honduras. At two **years the Guatemalan** (Finca Las) **provenance had the best height and was closely followed** by the Las Lajas and Tutule provenances. Most trees in the two U.S.A. provenances had dead and broken tops. Growth at Kakamega was better than at Lugari.

Survival was good for all provenances at Kakamega and did not differ significantly at ten months. At **two years, however,** the **difference.** was significant at 5 per cent level. Survival of the two U.S.A. provenances had decreased slightly at two years.

Discussion

Generally, the growth of the provenances increased with decreasing latitude of seed origin. This trend was apparent even at nursery stage. Since latitude is inversely related to temperature, it is most likely that the temperatures at Kakamega and Lugari were too high for the growth of the provenances from high latitude (the Franklin and Huntsville provenances).

Growth and survival of the provenances were better at Kakamega than at Lugari. This was probably because of higher rainfall, absence of drought and deeper soils. The two U.S.A. provenances had lower mean height at two years compared to at ten months because most of the trees had either dead or broken tops. This was an indication of the unsuitability of these provenances to the site.

Although the provenances at Kakamega had better performance, height growth was still slower than expected for this fast growing hardwood. Reports from Zimbabwe (Barret and Mullin 1976) and South African (Poynton 1957) indicate that the species is capable of growing faster. Kormanik et al (1982) have reported faster growth of this species through inoculation with Vesicular Arbuscular mycorrhizae (V.A.M.). It is possible that absence of effective mycorrhizae could result in poor growth of L. styracif lua at Kakamega and Lugari.

Table 3: Summary of mean height and survival at Kakamega and Lungari

		Lugari (one year)		Kakamega			
Seedlot No.	Provenance	Height cm	Sur. %	Height cm	Sur. %	Height cm	Sur. %
5/84	Finica Las, Victoria - Gatumala	38.8	33	65.8	99	119.2	99
2/85	Franklin, Virginia USA	20.6	32	38.6	97	35.0	75
1/85	Hunsville, Texas USA	32.5	69	52.8	99	48.2	77
47/83	Las Lajas - Honduras	43.3	32	89.2	99	116.2	99
83/83	Tutule, Lapaz Honduras	43.9	21	66.0	98	115.2	98
45/83	Montebello, Chipas Mexico	31.8	27	49.6	99	93.6	97
6/84	Tactic Cobas Guatamala	42.5	30	61.0	100	106.3	99
46/83	Yucul Matagalpa Guatamala	35.5	29	57.2	98	110.4	97
48/83	Los Alpes - Honduras	28.4	34	46.8	98	102.1	95
82/83	Huatusco, Veracruz Mexico	27.7	37	43.2	100	85.4	91
	L.S.D. at 5% level	7.8	20.0	4.5	n.s	14.2	n.s
	L.S.D. at 1% level	10.5	n.s	n.s		24.9	

Conclusion

Provenances of Liquidambar styraciflua from southern limits of its natural range grew better than those from northern limits. The performance of this species was better at Kakamega than Lugari. However, its overall performance during the initial two years was not impressive. The experiment should be maintained for further observation.

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