PROVENANCE TRIAL OF *ACACIA AURICULIFORMIS* IN PENINSULAR MALAYSIA: 12 - MONTH PERFORMANCE

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NOR AINI AB SHUKOR, KAMIS AWANG, MANSOR MOHD RASHID & ABD LATIB SENIN. 1994. Provenance trial of *Acacia auriculiformis* in Peninsular Malaysia: 12-month performance. A trial of 28 provenances of *Acacia auriculiformis* was assessed for survival and growth at age 12 months. Of these provenances, 7 were from Queensland and 15 from Northern Territory, Australia, and 6 from Papua New Guinea. All provenances survived very well (> 92%), but they differed very significantly ($p < 0.001$) in their growth performance. A selection of provenances from Northern Territory and Queensland were among the top performers, with East Alligator River (16152) being the best. The results indicate the presence of genetic diversity in this species and support the need for genetic improvement.

Key words: *Acacia auriculiformis* - provenance - survival - growth - genetic diversity

NOR AINI AB SHUKOR, KAMIS AWANG, MANSOR MOHD RASHID & ABD LATIB SENIN. 1994. Ujian provenans *Acacia auriculiformis* di Semenanjung Malaysia: prestasi 12-bulan. Kemandirian dan pertumbuhan *Acacia auriculiformis* pada umur 12 bulan di kaji. Ujian yang melibatkan 28 provenans, 7 dari Queenslands, 15 dari Northern Territory, Australia, dan 6 dari Papua New Guinea. Kesemua provenans memberikan kemandirian yang baik (>92%) tetapi prestasi pertumbuhan berbeda dengan sangat bererti ($p < 0.001$). Pilihan provenans dari Northern Territory dan Queensland menunjukkan prestasi baik, dengan East Alligator River (16152) merupakan yang terbaik. Keputusan yang diperolehi menunjukkan kewujudan kepelbagaian genetik pada spesies ini dan menyokong keperluan pembaikbiakan genetik.

Introduction

Acacia auriculiformis A. Cunn. ex Benth., native to Australia, Papua New Guinea and Indonesia, is a fast-growing, nitrogen-fixing tree and has shown adaptability to a wide range of environmental conditions. It has proven to be especially suitable for rehabilitating difficult sites such as tin tailings (Mitchell 1957), *Imperata cylindrica* grassland (Voogd 1948), eroded land (Ali 1986), wasteland (Jha 1987) and overburden mining areas (Prasad & Chadhar 1987). It thrives well on acidic (Turnbull 1986), alkaline (Basappa 1983), or saline soils (Midgley *et al.* 1986), and in areas polluted by industrial gases (Agrawal *et al.* 1986, Kong 1988).

Since its introduction to Peninsular Malaysia in 1931 (Barnard & Beverage 1957), *A. auriculiformis* has been commonly planted as an ornamental or shade tree in parks, gardens, or along roadsides. However, it possesses wood properties which make it suitable for a wide range of uses such as fuelwood (Brewbaker *et al.* 1983), plywood (Patanaprapapan 1980), carving (Rajan *et al.* 1979), flooring

and furniture (Chomcharn *et al.* 1986), and pulp and paper (Ku & Chen 1984, Logan 1987). It is, therefore, a potential industrial species, but the heavy branching and crooked stems commonly exhibited are often main drawbacks which restrict its wider planting. These characteristics could be genetically controlled, probably perpetuated from a narrow genetic base of the earlier introductions. Apart from the work on its hybridization with *A. mangium* through controlled pollination (Zakaria 1991), little improvement of this species has been attempted in Malaysia.

In 1987 the Forestry/Fuelwood Research and Development (F/FRED) Project of Winrock International and the Australian Tree Seed Centre of Commonwealth Scientific and Industrial Research Organisation (CSIRO) jointly funded the first extensive provenance seed collection of *A. auriculiformis* in Papua New Guinea and northern Australia (Gunn *et al.* 1987). As a follow up, the F/FRED Project further collaborated with the Australian Centre for International Agricultural Research (ACIAR) to evaluate the provenances by establishing multi-locational trials in 1989. The trials were set up in Zimbabwe and seven other countries in Asia including Malaysia. This paper reports on the survival and growth recorded at 12 months of the trial established at the Universiti Pertanian Malaysia (UPM).

Materials and Methods

Seedling establishment

Twenty-eight seedlots of *A. auriculiformis* provided by the Australian Tree Seed Centre (ATSC) were used in the trial. These provenances cover a major part of the species natural distribution. Details of the seed origins are given in Table 1.

Nursery establishment followed the guidelines provided in the manual for field operation (Boland & Pinyopusarerk 1988). The seeds were pretreated by soaking in hot water at 80° *C* for 30 *sec* and then soaked in water at room temperature for 10 *min.* The procedures were repeated three times. The seeds were then air dried and sown in containers filled with washed river sand. No special inoculation with microorganism (*Rhizobium*) was made in the nursery. Seedlings were about four months old at the time of planting.

Table 1. Details of the 28 provenances of *Acacia auriculiformis*

No.	CSIRO Seedlot no.	Provenance		Lat. (S)	Long. (E)	Alt. (*m*)	No. parents
2	15697	S Coen, Cape York	Qld	14° 7'	143° 16'	160	10
3	15985	Mt Molloy, Rifle Ck	Qld	16° 41'	145° 17'	380	10
4	16142	Coen River	Qld	13° 53'	143° 3'	170	7
5	16145	Wenlock River	Qld	13° 6'	142° 56'	130	20
6	16484	Morehead River	Qld	15° 3'	143° 40'	50	6
7	16485	Kings Plain	Qld	15° 42'	145° 6'	150	7
8	16147	Noogoo Swamp King Ck	NT	12° 23'	131° 0'	28	5
9	16148	Manton River	NT	12° 50'	131° 7'	100	10
10	16149	Douglas River	NT	13° 51'	131° 9'	70	10
11	16151	Mary River	NT	13° 56'	132° 8'	120	8
12	16152	E Alligator River	NT	12° 17'	132° 55'	10	10
13	16153	Cooper Ck	NT	12° 6'	133° 11'	40	5
14	16154	Goomadeer River	NT	12° 8'	133° 41'	50	9
15	16155	Mann River	NT	12° 22'	134° 8'	60	4
16	16156	Yarunga Cr	NT	12° 18'	134° 48'	50	6
17	16160	S. Alligator River	NT	13° 16'	132° 19'	100	10
18	16163	Elizabeth River	NT	12° 36'	131° 4'	40	9
19	16187	Melville Island	NT	11° 55'	130° 50'	1	7
20	16101	N Bensbach to Weam	PNG	8° 50'	141° 15'	20	16
21	16103	1 hr S Balamuk	PNG	9° 0'	141° 15'	10	7
22	16105	Balamuk on Bensbach R	PNG	8° 55'	141° 17'	20	12
23	16106	3 km N Mibini	PNG	8° 49'	141° 38'	40	35
24	16107	Old Tonda Village	PNG	8° 55'	141° 33'	40	19

Results

All the provenances survived very well, with percentage ranging 92 - 100% and no statistical differences among themselves (Table 2). The 16106 North Mibini PNG provenance recorded the lowest survival, while six provenances including 16145 Wenlock River QLD, 16148 Manton River NT, 16154 Goomadeer River NT, 16155 Mann River NT, 16162 Reynolds River NT and 16105 Balamuk on Bensbach River PNG had full survival.

Table 2. Analysis of variance of survival, height, basal diameter and diameter breast height

Parameter	Source of variation	df	Mean square	F-ratio	P.value	CV (%)
Survival	Replication	5	52.45	3.74	0.0034	
	Provenance	27	20.02	1.43	0.0971	
	Residual	135	14.04			
						3.8
Height	Replication	5	1.18	6.24	0.0000	
	Provenance	27	0.53	2.82	0.0000	
	Residual	135	0.19			
						13.7
Basal diameter	Replication	5	1.52	3.84	0.0027	
	Provenance	27	1.62	4.08	0.0000	
	Residual	135	0.40			
						16.5
Diameter breast height	Replication	5	1.30	5.21	0.0002	
	Provenance	27	0.90	3.68	0.0000	
	Residual	135	0.25			
						23.1

The provenances, however, showed significant differences in their growth performance. This was true for all the growth parameters recorded (Table 2). The coefficient of variation ranged from 3.8% for survival to 23.1% for DBH. There were also significant differences among the six replicates, probably due to variations in the site. Marked variations were also shown among the provenances of each geographic region (Table 3). There were little variations among the top ten provenances, although their rankings were not consistent for all the three parameters.

Table 4 shows their overall ranking based on the mean of the ranks assigned for each parameter. None of the Papua New Guinea provenances is among these

Table 3. Ranking for mean height, basal diameter (BD) and diameter at breast height (DBH). The vertical lines indicate that they are not significantly different (p = 0.05)

	Provenances		Height (*m*)		Provenances		BD (*cm*)		Provenances		DBH (*cm*)
16152	E. Alligator River	NT	3.7	16152	E. Alligator River	NT	4.6	16485	Kings Plain	Qld	2.8
16149	Douglas River	NT	3.6	15483	Archer River	Qld	4.5	16152	E. Alligator River	NT	2.7
16161	Howard Springs	NT	3.6	16485	Kings Plain	Qld	4.4	16142	Coen River	Qld	2.6
15697	S. Coen, Cape York	Qld	3.5	16148	Manton River	NT	4.4	15483	Archer River	Qld	2.6
16142	Coen River	Qld	3.5	16147	Noogoo Swamp King Ck	NT	4.3	16147	Noogoo Swamp King Ck	NT	2.6
15483	Archer River	Qld	3.5	16142	Coen River	Qld	4.3	16148	Manton River	NT	2.5
16485	Kings Plain	Qld	3.5	16149	Douglas River	NT	4.2	16149	Douglas River	NT	2.5
16107	Old Tonda Village	PNG	3.3	16106	3km, N. Mibini	PNG	4.2	16484	Morehead River	Qld	2.4
16160	S. Alligator River	NT	3.3	16158	Gerowie Ck	NT	4.1	16145	Wenlock River	Qld	2.4
16147	Noogoo Swamp King Ck	NT	3.2	16484	Morehead River	Qld	4.1	15697	S. Coen, Cape York	Qld	2.3
16108	Mari Village	PNG	3.2	16101	N. Bensbach to Weam	PNG	4.0	16106	3km, N. Mibini	PNG	2.3
16158	Gerowie CK	NT	3.2	16107	Old Tonda Village	PNG	4.0	16160	S. Alligator River	NT	2.3
16151	Mary River	NT	3.2	15697	S. Coen, Cape York	Qld	3.9	16107	Old Tonda Village	PNG	2.3
16484	Morehead River	Qld	3.2	16145	Wenlock River	Qld	3.9	16158	Gerowie Ck	NT	2.3
16145	Wenlock River	Qld	3.2	16160	S. Alligator River	NT	3.8	16161	Howard Springs	NT	2.2
16187	Melville Island	NT	3.2	16156	Yarunga Ck	NT	3.8	16101	N. Bensbach to Weam	PNG	2.2
16148	Manton River	NT	3.1	16153	Cooper Ck	NT	3.8	16151	Mary River	NT	2.2
16153	Cooper Ck	NT	3.1	16151	Mary River	NT	3.8	16153	Cooper Ck	NT	2.1
16106	3 km N Mibini	PNG	3.1	16161	Howard Springs	NT	3.7	16187	Melville Island	NT	2.0

Table 4. List of the 10 best provenances

Rank	Seedlot no.	Provenance	
1	16152	E. Alligator River	NT
2	16485	Kings Plain	QLD
3	15483	Archer River	QLD
4	16142	Coen River	QLD
5	16149	Douglas River	NT
6	16147	Noogoo Swamp King CK	NT
7	16148	Manton River	NT
8	15697	S. Coen, Cape York	QLD
9	16484	Morehead River	QLD
10	16158	Gerowie CK	NT

Discussion

The results showed marked differences among provenances in their performance in terms of height, BD and DBH growth. These differences are associated

These early results are important as they provide basic information which may be used to determine suitable provenances for future breeding work. In addition, the growth rates obtained are comparable to those reported for *A. mangium*, the species widely planted in the country (Sim & Gan 1991). This reinforces the view that *A. auriculiformis* has a potential to be used for industrial planting.

Although the results indicate that there were clear differences in provenance

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