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Trial Planting of *Acacia holosericea* Species in the Central Dry Zone of Myanmar.

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ဩစတြေးလျမှ ဟိုလိုရှား (*Acacia holosericea*) သစ်မျိုးများကို မြန်မာပြည်အလယ်ပိုင်းဒေသတွင် စမ်းသပ်စိုက်ပျိုးခြင်း

ဦးစောဝင်း၊ (B.Sc. (For) (Rgn.), Grad Dip. Sc. (For.) (SUNY))
လက်ထောက်ညွှန်ကြားရေးမှူး၊ သစ်တောသယံဇာတဌာန
နှင့်
ဦးမောင်မောင်တင့်၊ (B.Sc. (For.) (Rgn.))
ဦးစီးအရာရှိ၊ သစ်တောသုတေသနဌာန

စာတမ်းအကျဉ်းချုပ်

မြန်မာနိုင်ငံအလယ်ပိုင်း မိုးနည်းရေရှားဒေသကို သဲကန္တာရအဖြစ်မှ ကာကွယ်နိုင်ရန် သစ်တော ဦးစီးဌာနမှ ကိုးခရိုင်စိမ်းလန်းစိုပြည်ရေးစီမံချက်ဖြင့် ထင်းစိုက်ခင်းနှင့် ကျေးရွာသစ်တောများ အများအပြား တည်ထောင်လျက်ရှိပါသည်။ ထိုဒေသများတွင် ရည်ရွယ်ချက်အမျိုးမျိုးအတွက်သင့်တော်သည့်သစ်မျိုးများကို ဖော်ထုတ်ရန်လိုအပ်ပါသည်။ လက်ရှိမြေ၏အပင်ပေါက်ရောက်မှု စွမ်းအားကိုမကျဆင်းစေဘဲထင်းထွက်ရှိမှု အများဆုံးပေးစွမ်း နိုင်သောသစ်မျိုးနှင့်၄င်းတို့၏ မူလဒေသများကို သိရှိရန် အလွန်အရေးကြီးပါသည်။ အဆိုပါလိုအပ်ချက်ကို ဖြည့်ဆည်းရန်အတွက် ဩစတြေးလျနိုင်ငံ ဒေသအမျိုးမျိုးမှ နိုက်ထရိုဂျင်ဓါတ် ထုတ်လုပ်နိုင်သည့် *Acacia holosericea* သစ်မျိုးများစမ်းသပ်မှုကို ၁၉၉၁ခုနှစ်ကျောက်ပန်းတောင်းမြို့နယ် ၌ စမ်းသပ်ရန် ဖြစ်ပေါ်လာပါသည်။ ဩစတြေးလျ မြောက်ပိုင်း Cooper Creek ဒေသမှ အမျိုးသည် အခြားဒေသများနှင့် နှိုင်းယှဉ်လျှင် အကောင်းဆုံး ဖြစ်ကြောင်းတွေ့ ရှိရပါသည်။ မြန်မာနိုင်ငံ အလယ်ပိုင်း မိုးနည်းရေရှားဒေသ မြေညံ့များတွင် သစ်တောများ ပြန်လည်ထူထောင်ရာ၌ *A.holosericea* သစ်မျိုး စိုက်ပျိုးရန် သင့်တော်ကြောင်း အကြံပြုတင်ပြထားပါသည်။

Trial Planting of *Acacia holosericea* Species in the Central Dry Zone of Myamar

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Abstract

Large scale fuelwood plantations and village woodlots for Nine District Greeding Programme has been launched in the Central Dry Zone of Myanmar by the Forest Department as a remedial measure against desrtification. Identification of a broad range of species suitable for different purpose in these areas is needed. It is of utmostimportance to find out which species/provenances can give the highest fuelwood yield for the particular site without impairing the site productivity. Such a necessity calls for Nitrogen Fixing Tree species trials of *Acacia holosericea* from different provenances of Australia to be conducted at Kyauk-padaung Township in 1991. Cooper Creek provenance, Northern Territory was found to be the best compared to other provenances. *A.holosericea* is advisable for reforestation of denuded area of central dry zone of Myanmar, next to *Eucalypts* species.

Contents

1. Introduction

The world's forests and woodlands are decreasing at a great pace due the heavy demand for their productive resources (Turnbull, 1986). Myanmar is also one of the countries hard pressed of fuel wood shortages, not only for the heavy demand by rural communities but also for urban dwellers due to insufficient alternative energy sources, such as electricity, natural gas etc. About 80% of the population in Myanmar are rural people whose day to day needs for fuel is far below the capacity produced from the areas set aside for their needs (i.e., from local supply forests and public forests) resulting in the heavy encroachment into the more productive commercial forest areas. The only remedy to such a problem is by establishing fast growing fuelwood plantations within the reach of the rural populace. Present day forestry is oriented towards social or community forestry, rather than emphasizing on production forestry for trade as in the past. This measure will relieve heavy pressure and reliance on productive forest areas thereby checking forest degradation in these areas which is quite alarming in developing countries around the world.

Myanmar is also facing this problem and particularly the problem become more acute in the Central Dry Zone of the country, where rain fall is very low and where the soil resource is deficient of nutrients for proper tree growth (Sein Thet and Tin Tin Ohn, 1983). In so far as the species trial in the dry zone for fuelwood is concerned *Eucalyptus camaldulensis* is the best though it is controversial and it is now being debated whether to continue planting at a large scale or to ban totally for planting.

In order to find out substitute species, which will perform well on such adverse sites without impairing the site potential, it is worth trying Nitrogen Fixing Tree (NFT) species. One of the promising species which are performing quite satisfactorily in the African countries is the Australian Acacias, which not only provide fuelwood supply for the rural people but also improve the nutrient budget of the fragile, soil through amelioration measures by the nitrogen fixing root nodules of these species (Tumbull, 1986.) However, the distribution of Acacias in Australian is quite extensive such that selection of appropriate species to mach 0up with the site in question is urgently needed. This study is a preliminary study on the performance of one of the promising species, *Acacia holosericea,* in the dry zone of Myanmar which is performing quite will in the African countries so far. The general characteristic of *Acacia holosericea* are presented in Appendix (1). (Myint Swe 1991) .

2. Materials and Methods

The experiment was carried out in Sebauk area in Kyaukpadaung township. Randomised Complete Block Design (RCBD) was applied in this experiment. Seeds of *Acacia holosericea* from four different provenances of Australia were tried. The source and the specification of seeds are shown in Table (1).

Table(1). Seed sources and specification of *Acacia holosericea* seeds.

The experiment was replicated five times and within each plot 25 seedlings were planted for four provenances listed above. For site preparation pits were dug at a spacing of 12' x12' as practised in the Central Dry Zone of Myanmar. Patching, weeding and working operations were also carried out in accordance with those methods practiced normally in the district.

Soil samples from the locations were also collected for determination of texture, P^H, and NPK contents. These soil samples, were analysed at the soil laboratory in FRI. The data of the soil of the experimental area are presented in table (2).

Climatic data for the Sebauk area was obtained from the nearest meteological station. Monthly rainfall data were presented for 11 years from 1983 to 1993 (see appendix 2).

Survival counting and height measurement were carried out in the month of April every year. Comparisonal of the survival in the first year and height measurements in the first and third years were statistically analysed.

3. Results

The results of the survival percent in the first year and average height in the first and the third year for different provenances are given in table (3).

Table(3) Survival percentage and average height in the first and third year.

Provenance	Survival Percentage	Average height (ft)	
		In first year 1992	in third year 1994
Cairns (OLD)	90.4	1.514	6.914
Cooper Creek (NT)	91.2	2.014	8.332
Beagle Bay (WA)	84	0.864	6.798
Jabiru Area (NT)	96	1.296	6.114

The result of the statistical analyses were presented in Appendices (3) to (5).

The difference in survival of different provenances tested were significant at 95% provability level (See Appendices (3) to (5) of the four provenance tried, seeds from Jabiru area (NT) in the best with 96%. The survival percent for all four provenances are over 80% and the seeds from Cooper Creek and Jabiru areas of Northern Territory are better than the other two provenances with 96% and 91.2 % respectively.

The height measurements taken in the first year (1992) and the third year (1994) were found to be significantly different at 95% probability level (See Appendix (3) and (4)). The seeds from Copper Creek area, Northern Territory performed best in the height growth with 2.014 ft and 8.332 ft in the first and third year respectively.

The comparisons of height growth of different species tired in the central dry zone are given along with the *Acacia holosericea* in table (4) and (5). In the first year, *Acacia senegal* showed the best height growth in Kyew- Kan are with 2.49 ft and *Acacia leucophloea* in Wat-ma-sut area the worst with 0.59 ft. *Eucalyptus camaldulensis* tried in Daung-ne area performed second in height growth with 2.2 ft, the height growth of all *Acacia holosericea,* except from Beagle, Western Australia are generally good compared with other species.

In table (5) average height of *E. camaldulensis* though it is two year growth with 7.18 ft is better than the three year growth of other species except that of *A.holosericea* of Cooper Creek (NT) with 8.33 ft. *Acacia holosericea* showed better height growth than the remaining species in two years.

4. Discussion

A considerable number of exotic species as well as local species were tried in the dry zone area for afforestation purpose. (see table 4& 5).

Eucalyptus camalduensis tends to be the species of great potential both in terms of height and diameter growth. The species was also well accepted by the local populace for use as fire wood, farm implements, local construction wood and also for post and poles.

However, there have been some adverse reactions against planting of *Eucalyptus* (FAO). The criticism is based on a range of technical, ecological and socio-economic arguments. Nevertheless, one outstanding quality of the Eucalyptus is that it can grow on sites of very low nutrient status, particularly the sites deficient in nitrogen and phosphorous like those sites in Dry Zone are (Sein Thet and Tin Tin Ohn). That is the reason why a substitutes species is on search to replaces. *E. camaldulensis* in adverse sites with poor nutrition status.

The reason why Australian Acacia were put on trial in place of Eucalyptus is probably due to its nitrogen fixing ability which is the most essential nutrient for tree growth. Table 5 indicated that *Acacia holosericea* species has great potential in the dry zone area, next to Eucalyptus species. Different Acacia species perform quite differently specified locations; however among the local Acacias and exotics so-far tried *A. holosericea* performs remarkably well.

5. Conclusion

The results of the study lead to the following conclusions;

(1) It is advisable to plant *Acacia holosericea* species in the dry zone especially for multipurpose woodlots and fuelwood plantations with poor soil formation.
(2) In order to get a reasonably good height growth, it is advisable to plant *Acacia holosericea* in areas where the rainfall is 24 inches and above.
(3) Among the proveances tested, provenance from Coopers Creek, Northern Territory has proven to be the best compared to other provenances.
(4) It is also advisable to replicate this experiment on other localities in the dry zone and study their performance there.
(5) Growth and yield studies should also be tried at the age of five to find out the biomass yield for the *Acacia holosericea* for future programs future programs.

Table (4) Average height of Dry Zone species in the first year (ft)

Species	Location						
	Daung - ne	Sepauk	Ziaing	Wat-ma-sut	Sin-ka	Kywe-kan	Chin-myit-kyin
	1993	1992	1987	1987	1987	1987	1987
Eucalyptus camaldulensis	2.2	-	-	-	-	-	-
Acacia holosericea (008/90)	-	1.51	-	-	-	-	-
Acacia holosericea (009/90)	-	2.01	-	-	-	-	-
Acacia holosericea (010/90)	-	0.86	-	-	-	-	-
Acacia holosericea (214/87)	-	1.3	-	-	-	-	-
Acacia auriculiformis	-	-	0.8	1.33	0.89	1.06	-
Acacia Senegal	-	-	1.09	0.89	0.96	2.49	1.36
Acacia catechu	-	-	1.07	0.75	1.37	0.99	1.20
Acacia leucophloea	-	-	0.76	0.59	0.91	-	-
Acacia leucocephala	-	-	-	-	-	-	2.11

Table (5) Average height of Dry Zone species in the second and third years (ft)

Species	Location						
	Daung - ne	Sepauk	Ziaing	Wat-ma-sut	Sin-ka	Kywe-kan	Chin-myit-kyin
	1994	1994	1989	1989	1989	1989	1989
Eucalyptus camaldulensis	7.18	-	-	-	-	-	-
Acacia holosericea (008/90)	-	6.91	-	-	-	-	-
Acacia holoserice a(009/90)	-	8.33	-	-	-	-	-
Acacia holosericea (010/90)	-	6.7	-	-	-	-	-
Acacia holosericea (214/87)	-	6.11	-	-	-	-	-
Acacia auriculiformis	-	-	1.67	1.35	2.24	1.78	-
Acacia Senegal	-	-	1.35	1.38	0.85	3.88	2.91
Acacia catechu	-	-	1.14	1.09	1.36	2.52	1.43
Acacia leucophloea	-	-	1.17	1	1.02	-	-
Acacia leucocephala	-	-	-	-	-	-	1.7

Note : - Average height of *E. camaldulensis* is for two years whereas the height of other species are for three years.

Source:- (1) Trial planting of *A. senegal* and *A. auriculiformis* in the central dry zone of Myanmar (Ko Ko Gyi and Kyi Win) (1991).

General characteristics of *Acacia holosericea*

1. Family - Leguminosae (Mimosoideae).
2. Main attribute - Nitrogen fixing shrub or small tree with an excellent survival and growth rate on a wide range of sites in the sub-humid and semi-arid tropics. Very good for wood, charcoal and wind breaks.
3. Botanical features - A small tree up to 7 m tall. The yellow flowers are on spike 3-6 cm long, main flowering period is from June-August. The pods, in dense cluster are coiled, 3-6 cm long by 2.5-5 mm wide, membranous or slightly woody. The seeds are 3-5 long by 2 mm wide, rectangular, black, shiny with a small yellow aril at the base. Fruit mature August- October.
4. Natural occurrence - Northern Western Australia to Northeast Queensland and southwards into central Australia.
   Latitude - main occurrence = 12º - 21º S .
   Range - 11º - 24º S
   Altitude - main occurrence = 150-450.
   range = near sea level to 750 m
5. Climate - Pot sub-humid zone, mean maximum temperature of hottest month 31º - 34º C up to 38º-39º C, mean minimum temperature 10ºC, rainfall 200-1100 mm (driest record = 125 mm). Most of the area have a monsoonal rainfall pattern and average number of rainfall pattern and average number of rain-days a year is 30-75
6. Physiography and soils - inland plain, hilly upland, coastal lowlands and dune fields.
   Major soil type-shallow acidic sandy lithosols, shallow loamy soils, earthy sands, yellow earths, solonetz and soloised soils.
   Range –low fertility to more fertile red volcanics.
7. Utilization -*Acacia holosericea* has been widely used as an exotic, an although experimental plots have grown well in Niger, Cameroon, Upper volta, Sengal. It is considered one of the most promising fuelwood species for tropical dry Africa. The species has potential as a source of fuelwood and charcoal. (Calorific value = 4670 kcal/kg for wood, 7535 kcal/ kg for charcoal).
   Wood-high density (870 kg/ cubic meter).
   Other uses-wind break, sand dune fixation, ornamental tree.
8. Silviculture features -95,000 seeds/ kg.
   Pre-treatment with boiling water for enhance germination, good growth rate on wide range of soil types, survival well in the area of 585 mm rainfall and 7 months dry season, considerably greater productivity than local Acacia in Africa.
   Longevity of *Acacia holosericea* in storage.

Storage period	14 years
Pre-storage viability	95 %
Pre -storage viability	84%

9. Pest and diseases- No data available.
10. Limitations- Form and size restrict its use for wood products other than fuelwood and charcoal.
    (Source:- Multipurpose Australian trees and shrubs, Turnbull, 1980)

Table (2) Soil condition of the experimental area.

Location Sebauk *Acacia holosericea*

Description	Depth	P^H	Total N%	P%	K%	O.M%	Texture		
							Sand	Slit	Clay
Ridge	0-10	6.685	Trace	0.00012	0.002	1.01	46	16	36
	20-40	7.325	Trace	0.00012	0.0015	1.61	17	16	34
	40-60	6.935	Trace	0.00014	0.0014	0.6	18	16	34
	60-80	6.925	Trace	0.00032	0.0014	0.72	51	18	30
	80-100	7.525	Trace	0.00042	0.0016	0.45	55	18	26
Central	0-10	6.875	Trace	0.00034	0.0013	1.63	53	18	26
	20-40	6.92	Trace	0.00034	0.0015	1.13	53	18	26
	40-60	6.98	Trace	0.00013	0.0016	1.4	54	18	26
	60-80	7.08	Trace	0.0001	0.0016	1.04	54	18	26
	80-100	7.155	Trace	Nil	0.0016	0.84	54	18	26
Lowerpart	0-10	6.94	Trace	0.0002	0.0017	0.29	53	14	22
	20-40	7.094	Trace	0.00008	0.0015	0.15	58	12	28
	40-60	7.135	Trace	0.00016	0.0013	0.18	60	12	26
	60-80	7.275	Trace	0.00026	0.0016	1.07	62	12	24
	80-100	6.995	Trace	0.00036	0.0016	0.12	62	14	22
First Layer		6.7	Trace	0.00018	0.0023	0.09	58	14	28
Second Layer		7.185	Trace	0.0002	0.0017	1.52	51	14	28
Third Layer		7.09	Trace	0.00011	0.0025	0.5	66	12	20

Appendix (2)

Location Sebauk, Kyaukpadaung Township

Annual Rain Fall

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1983	-	-	-	0.17	0.48	3.72	4.78	4.97	4.98	10.33	5.86	-	36.24
1984	-	-	-	3.43	1.72	14.52	1.55	2.16	2.71	4.89	-	0.16	31.14
1985	-	-	-	1.99	3.65	6.30	4.18	4.39	7.35	5.07	2.02	-	34.94
1986	-	-	-	0.28	1.03	4.71	7.54	15.50	6.43	6.43	2.95	-	44.87
1987	-	1.05	0.15	3.20	0.31	3.92	3.23	7.88	2.43	1.89	1.62	-	25.68
1988	-	-	-	0.15	1.93	13.12	6.34	1.29	2.33	8.91	8.69	-	42.76
1989	-	-	0.74	1.65	5.47	6.13	4.02	6.24	7.63	7.62	-	-	39.40
1990	-	-	-	0.52	5.24	6.15	1.72	3.94	5.24	2.50	0.68	-	25.99
1991	-	-	-	1.65	2.15	1.57	3.17	5.44	5.74	3.37	3.05	0.59	24.40
1992	-	0.19	-	0.08	4.19	2.49	2.56	4.82	4.18	8.54	2.33	-	25.84
1993	-	0.41	-	-	4.95	1.30	0.17	2.82	9.63	1.33	-	-	20.61

Appendix (3) Average height of *Acacia holosericea* species at the end of first growing season in 1992.

Prov.	Replicates				
8	1.58	1.58	1.75	1.58	1.08
9	2.33	1.75	2.33	2.58	1.08
10	1.16	1	0.75	1	0.41
214	1.58	1.33	1.16	1.16	1.25

Anova:- Two-Factor Without Replication

Summary	Count	Sum	Average	Variance
8	5	7.57	1.514	0.06428
9	5	10.07	2.014	0.36553
10	5	4.32	0.864	0.08593
214	5	6.48	1.296	0.03023
replicates	4	6.65	1.6625	0.237225
	4	5.66	1.415	0.1063
	4	5.99	1.4975	0.476492
	4	6.32	1.58	0.504267
	4	3.82	0.955	0.138433

ANOVA

Urce of Variation	**SS**	**df**	**MS**	**F**	**P- value**	**F**
Rows	3.4308	3	1.143613	14.33534	0.000285	3.4903***
Columns	1.2266	4	0.306643	3.843802	0.031004	3.25916*
Error	0.9573	12	0.079776			
Total	5.6147	19				

Appendix (4) Average height of *Acacia holosericea* species at the end of third growing season in 1994.

Prov	Replications				
008/90	7.58	7.25	7	5.66	7.08
009/90	10.66	8.42	8	8.58	6
010/90	8.25	8.66	5.33	5.5	6.25
214/87	6.66	6.08	6.42	5.75	5.66

Anova :- Two factor Without Replication

Summary	Count	Sum	Average	Variance
008/90	5	34.57	6.914	0.54098
009/90	5	41.66	8.332	2.75932
010/90	5	33.99	6.798	2.42887
214/87	5	30.57	6.114	0.18288
Replication	4	33.15	8.2875	2.926492
	4	30.41	7.6025	1.409625
	4	26.75	6.6875	1.244892
	4	25.49	6.3725	2.176492
	4	24.99	6.2475	0.366492

ANOVA

Urce of Variation	SS	df	MS	F	P- value	F
Rows	13.006	3	4.335298	4.577091	0.023349	3.4903*
Columns	12.282	4	3.07053	3.241783	0.050743	3.25916
Error	11.366	12	0.947173			
Total	36.654	19				

Appendix (5). Survival percentage of *Acacia holosericea* species at the end of first growing season in 1992.

Prov	Replications				
008/90	92	84	96	92	88
009/90	96	88	96	92	84
010/90	80	88	88	84	80
214/87	100	92	92	96	100

Anova :- Two -Factor Without Replication

Summary	Count	Sum	Average	Variance
008/90	5	452	90.4	20.8
009/90	5	456	91.2	27.2
010/90	5	420	84	16
214/87	5	480	96	16
Replication	4	368	92	74.66667
	4	352	88	10.66667
	4	372	93	14.66667
	4	364	91	25.33333
	4	352	88	74.66667

ANOVA

Urce of Variation	SS	df	MS	F	P- value	F
Rows	364.8	3	121.6	6.204082	0.008665	3.4903**
Columns	84.8	4	21.2	1.081633	0.408342	3.25916
Error	235.2	12	19.6			
Total	684.8	19				

Table 1. Average height of *Acacia holoserica* species at the end of third growing season in 1992

Prov.	Replicates				
008/90	1.58	1.58	1.75	1.58	1.08
009/90	2.33	1.75	2.33	2.58	1.08
010/90	1.16	1	0.75	1	0.41
214/87	1.58	1.33	1.16	1.16	1.25

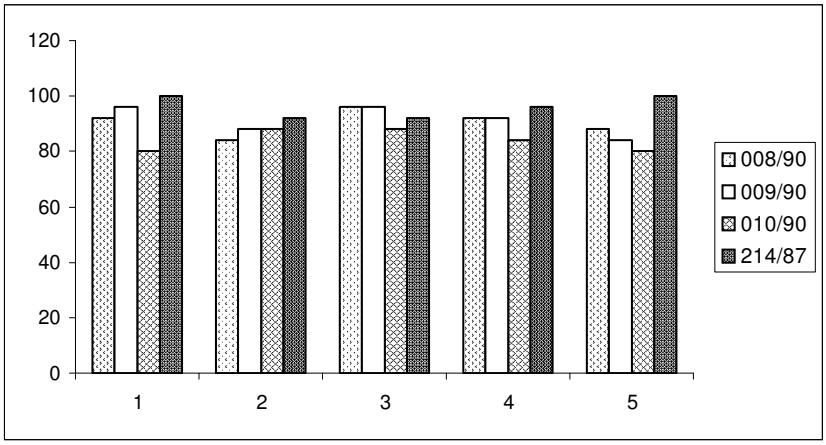


Figure 1. Average height of *Acacia holoserica* species at the end of third growing season in 1992

Table 2. Average height of *Acacia holoserica* species at the end of third growing season in 1994

Prov.	Replicates				
008/90	7.58	7.25	7	5.66	7.08
009/90	10.66	8.42	8	8.58	6
010/90	8.25	8.66	5.33	5.5	6.25
214/87	6.66	6.08	6.42	5.75	5.66

Figure 2. Average height of *Acacia holoserica* species at the end of third growing season in 1994

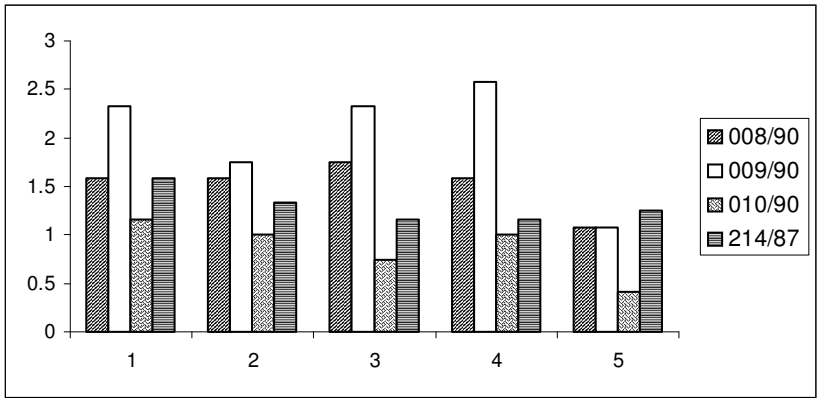
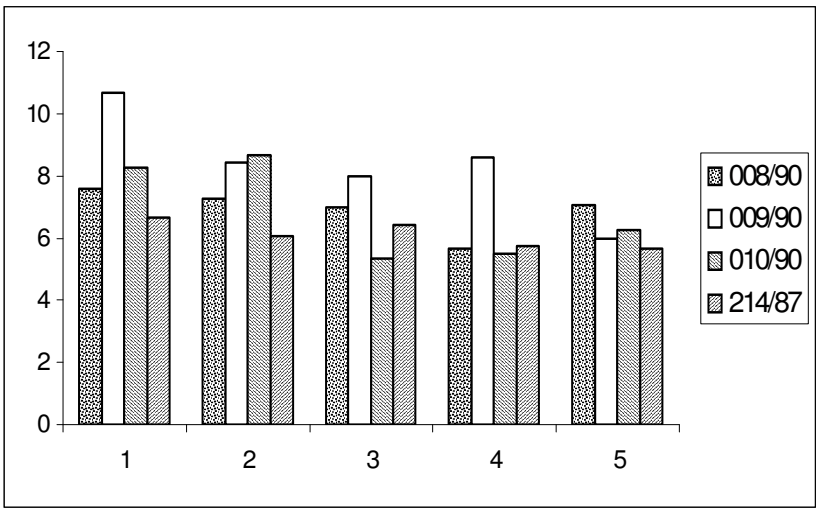


Table 3. Survival percentage of *Acacia holosericea* species at the end of first growing season in 1992.

Prov.	Replicates				
008/90	92	84	96	92	88
009/90	96	88	96	92	84
010/90	80	88	88	84	80
214/87	100	92	92	96	100

Figure 3. Survival percentage of *Acacia holosericea* species at the end of first growing season 1992



Sebauk, Kyaukpadaung Township
Provenance Trial

Experimental plot of *Acacia holosericea* AUSTRALIA

YEAR = 1991-92 AREA = 2.5 Ac

DESIGN = COMPLETELY RANDOMIZED DESIGN

A 1	J 3	K 4	T 2
B 2	I 3	L 1	S 4
C 3	H 1	M 2	R 4
D 1	G 2	N 4	Q 3
E 4	F 2	O 1	P 3

Reference

Each plot 5 x 5 = 25 trees

4 provenances x 5 replicates x 25 trees = 500 trees

F.R.I Lot No. 008/90 = 1

009/90 = 2

010/90 = 3

214/87 = 4

Fig. 1. *Acacia holosericea* species lot no. 009/90

Fig. 2. *Acacia holosericea* lot no. 214/87

Fig. 3. *Acacia holosericea* species lot no. 009/90

Fig. 4. *Acacia holosericea* species Experiment Plot.

References

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