TREE VOLUME, YIELD PREDICTION AND ECONOMIC ROTATION OF *ALBIZIA FALCATARIA* IN MINDANAO, PHILIPPINES

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Received March 1994

URIARTE, M.T. & PIÑOL, A.A. 1996. Tree volume, yield prediction and economic rotation of *Albizia falcataria* in Mindanao, Philippines. One hundred and sixty-two temporary plots representing a wide range of site quality, stand density (spacing) and age of *Albizia falcataria* in Mindanao were established using point sampling method. Volume and yield equations for total merchantable timber, pulp timber and sawntimber were derived using multiple regression technique. Economic rotation was also determined. Results of validation show that the models are valid when tested to estimate volume yield.

Key words: *Albizia falcataria* - site index - volume equations - yield equations - economic rotation

URIARTE, M.T. & PIÑOL, A.A. 1996. Isipadu kayu, ramalan hasil dan kitaran ekonomi *Albizia falcataria* di Mindanao, Filipina. Seratus enam puluh dua plot sementara yang mewakili satu perbezaan yang luas dari segi kualiti tapak, ketumpatan dirian (jarak) dan umur *Albizia falcataria* di Mindanao telah ditubuhkan menggunakan kaedah pensampelan titik. Persamaan isipadu dan hasil bagi jumlah kayu boleh niaga, kayu pulpa dan kayu digergaji diperolehi menggunakan teknik regresi berganda. Kitaran ekonomi juga telah ditentukan. Keputusan pengesahan menunjukkan bahawa model adalah sah bila diuji untuk menganggarkan hasil isipadu.

Introduction

Albizia falcataria is a fast-growing tree species generally used as raw material for pulp and paper manufacture. The crown is wide-spreading and umbrella-shaped, making the tree suitable as a shade plant. Considering its economic importance, proper management of this species is necessary. This study, therefore, aims to derive growth and yield prediction equations and tables for *A. falcataria* and to determine its economic rotation, growth and yield.

The results of the study could serve as input information that is necessary in the operation of subsequent forest regulations such as economic rotation, cut allocation and scheduling, and forest development schedules. Generally, such information could facilitate the effective and sound management in the business projection for *A. falcataria.*

Materials and methods

The study was conducted in *A. falcataria* plantations in Davao, Agusan and Bukidnon in Mindanao, Philippines. The region has short dry season lasting from one to two months with very pronounced maximum rainfall from November to January. It is generally mountainous. The study included plantations in the reforestation project of the government, in logging concessions and in private tree farms.

A total of 162 temporary plots representing a wide range of site quality, stand density (spacing) and age were established using point sampling method, specifically the Bitterlich Method with basal area factor (BAF) of 2 m^2 ha^{-1}. All "IN" trees were measured for diameter at breast height, merchantable and total heights. For volume computation, measurements of sectional diameter and the corresponding bark thickness were taken. Table 1 shows the distribution of trees by diameter class and location.

Table 1. Number of trees per *DBH* class by location

Diameter class	Location			Total
	Davao	Agusan	Bukidnon	
10	143	82	97	322
15	163	35	76	274
20	157	23	64	244
25	98	25	45	168
30	112	27	47	186
35	93	12	51	156
40	88	10	48	146
45	75	6	36	117
50	83	10	17	109
55	87	10	15	112
60	85	10	9	104
65	16	10	9	35
70	15	10	8	33
75	17	10	6	33
80	10	5	6	21
85	13	5	5	23
90	11	5	4	20
Total no. of trees	1266	294	543	2103
No. of plots	83	30	43	162 plots
Age range (y)	1 - 13	1 - 10	1 - 12	

The prediction models used in the study are of the following forms:

a. Tree volume (*VOL*) function
   $VOL = f(DBH, MH)$;

b. Site Index (*SI*) function
   $\text{Log } SI = f(A, TH)$; and

c. Stand Yield (*Y*) function
   $\text{Log } (Y) = f(A, SI, SP)$

where
DBH = diameter at breast height in cm;
MH = merchantable height in m;
A = stand age in y;
TH = total height in m; and
SP = initial planting spacing in m^2.

Economic rotation was determined by the net present value (NPV) method. Plantation establishment, maintenance and harvesting costs were considered in the process. The costs obtained were assumed for average accessibility only.

Results and discussion

Tree volume equations

Three (3)volume equations were developed for *A. falcataria*. They are as follows:

a. Total merchantable tree volume
   $V_{10} = 0.06168 + 0.00004555 (DBH)^2 (MH)$
   $r^2 = 0.97$

b. Pulp timber tree volume
   $V_{15} = 0.04679 + 0.00004443 (DBH)^2 (MH)$
   $r^2 = 0.96$

c. Sawtimber tree volume
   $V_{20} = 0.03771 + 0.00004520 (DBH)^2 (MH)$

where:
V_{10} = volume up to 10 cm diameter inside bark (dib) in m^3;
V_{15} = volume up to 15 cm top dib in m^3;
V_{20} = volume up to 20 cm top dib in m^3;
DBH = diameter at breast height in cm; and
MH = merchantable height in m.

Tables 2, 3 and 4 show the corresponding tree volumes at different *DBH* and *MH*.

Table 2. Total merchantable tree volume (m^3) for *A. falcataria* at different *DBH*

DBH	*MH* (cm)							
(cm)	3	6	9	12	15	18	21	24
10	0.0753	0.0890	0.1027	0.1163	0.1300	0.1431	0.1573	0.1710
15	0.0924	0.1232	0.1539	0.1847	0.2154	0.2462	0.2769	0.3176
20	0.1163	0.1710	0.2257	0.2803	0.3350	0.3896	0.4443	0.4989
25	0.1471	0.2325	0.3179	0.4033	0.4887	0.5741	0.6595	0.7449
30	0.1847	0.3076	0.4306	0.5536	0.6766	0.7996	0.9226	1.0455
35	0.2291	0.3965	0.5639	0.7312	0.8986	1.0660	1.2334	1.4008
40	0.2803	0.4989	0.7176	0.9362	1.1549	1.3735	1.5921	1.8108
45	0.3384	0.6151	0.8918	1.1685	1.4452	1.7219	1.9986	2.2754
50	0.4033	0.7449	1.0865	1.4281	1.7698	2.1114	2.4530	2.7946
55	0.4750	0.8884	1.3017	1.7151	2.1285	2.5418	2.9552	3.3685
60	0.5536	1.0455	1.5375	2.0294	2.5213	3.0132	3.5052	3.9971
65	0.6390	1.2163	1.7937	2.3710	2.9483	3.5257	4.1030	4.6803
70	0.7312	1.4008	2.0704	2.7399	3.4095	4.0791	4.7487	5.4182
75	0.8303	1.5990	2.3676	3.1362	3.9049	4.6735	5.4421	6.2108

Table 3. Pulp timber tree volume (m^3) for *A. falcataria* at different *DBH* and *MH*

DBH	*MH* (cm)							
(cm)	3	6	9	12	15	18	21	24
15	0.0768	0.1068	0.1368	0.1667	0.1967	0.2267	0.2567	0.2867
20	0.1001	0.1534	0.2067	0.2600	0.3134	0.3667	0.4200	0.4733
25	0.1301	0.2134	0.2967	0.3800	0.4633	0.5466	0.6299	0.7132
30	0.1667	0.2867	0.4067	0.5266	0.6466	0.7665	0.8865	1.0065
35	0.2101	0.3733	0.5366	0.6999	0.8632	1.0264	1.1897	1.3530
40	0.3600	0.4733	0.6866	0.8998	1.1131	1.3263	1.5396	1.7529
45	0.3167	0.5866	0.8565	1.1264	1.3963	1.6662	1.3610	2.2060
50	0.3800	0.7132	1.0464	1.3797	1.7129	2.0461	2.3793	2.7125
55	0.4500	0.8532	1.2464	1.6596	2.0628	2.4659	2.8691	3.2723
60	0.0527	1.0065	1.4863	1.9661	2.4459	2.9258	3.4056	3.8854
65	0.6099	1.1731	1.7362	2.2993	2.8625	3.4256	3.9887	4.5519
70	0.6999	1.3530	2.0061	2.6592	3.3123	3.9654	4.6185	5.2716
75	0.7965	1.5463	2.2960	3.0457	3.7955	4.5452	5.2950	6.0447

Table 4. Sawntimber tree volume (m^3) for *A. falcataria* at different *DBH* and *MH*

DBH	*MH* (cm)							
(cm)	3	6	9	12	15	18	21	24
20	0.0169	0.0715	0.1261	0.1808	0.2354	0.2900	0.3446	0.3992
25	0.0476	0.1330	0.2183	0.3037	0.3890	0.4743	0.5597	0.6450
30	0.0852	0.2081	0.3310	0.4519	0.5768	0.6997	0.8825	0.9454
35	0.1296	0.2968	0.4641	0.6314	0.7986	0.8659	1.1332	1.3005
40	0.1808	0.3992	0.6177	0.8362	1.0547	1.2732	1.4916	1.7101
45	0.2338	0.5153	0.7918	1.0683	1.3448	1.6214	1.8979	2.1744
50	0.3037	0.6450	0.9864	1.3278	1.6691	2.0105	2.3519	2.6933
55	0.3753	0.7880	1.2015	1.6145	2.0276	2.4406	2.8537	3.2668
60	0.4539	0.9454	1.4370	1.9286	2.4202	2.9117	3.4033	3.8949
65	0.5392	1.1161	1.6930	2.2700	2.8469	3.4238	4.0007	4.5776
70	0.6314	1.3005	1.9695	2.6386	3.0770	3.9768	4.6459	5.3170
75	0.7304	1.4985	2.2665	3.0346	3.8027	4.5708	5.3389	6.1070

Site index equation

The site index equation developed was:

$$\text{Log}_{10}\,(TH) = 0.89799 + 0.492458\ \text{Log}_{10}\,(A)$$
$$r^2 = 0.6833$$

The site index (*SI*) equation at base age equals 10 years was:

$$\text{Log}_{10}\,(SI) = 0.492458 - 0.492458\ \text{Log}_{10}\,(A) + \text{Log}_{10}\,(TH)$$

Iean total heights of *A. falcataria* at different ages and site indices are shown able 5 and graphically presented in Figure 1.

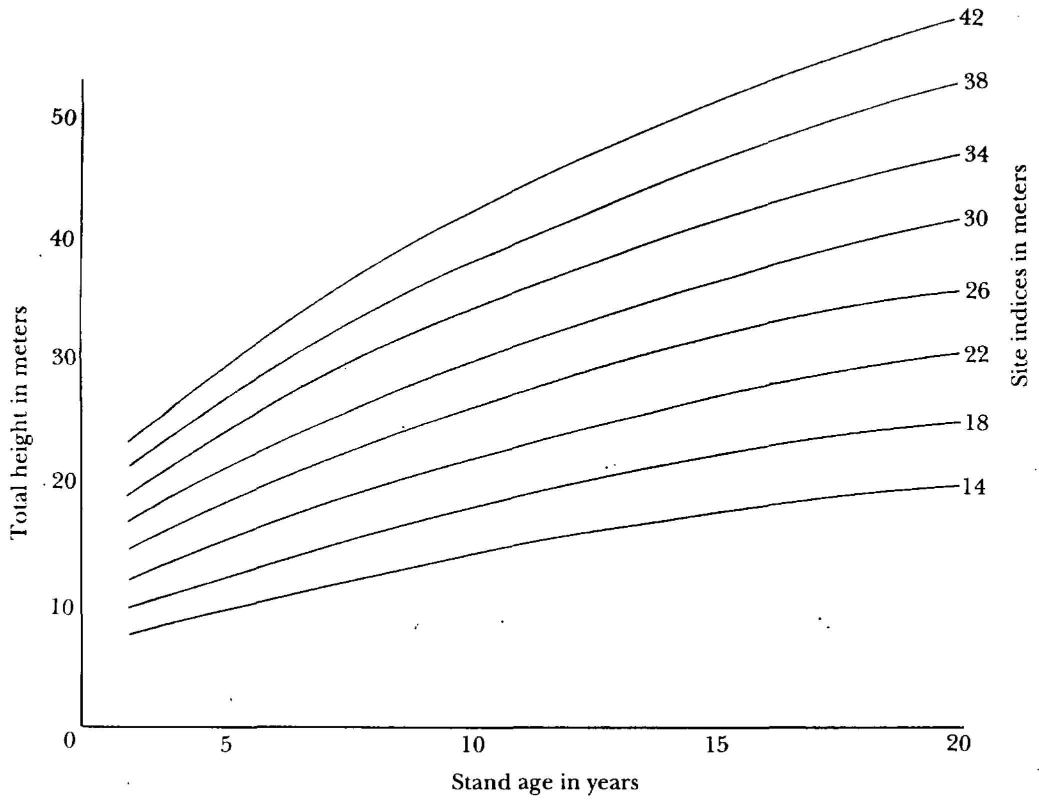

Figure 1. Site index curves of *Albizia falcataria*

Table 5. Mean total height of *A. falcataria* in Mindanao

Age (y)	Site index (m)							
	14	18	22	26	30	34	38	42
2	6.2400	8.1500	9.9600	11.7700	13.5600	15.1900	17.2000	15.9100
3	7.7400	9.9500	12.1600	14.3700	16.5800	18.7900	21.0000	23.2100
4	8.9200	11.4600	14.0100	16.3600	19.1100	21.6500	24.2000	25.7500
5	9.9500	12.7900	15.6400	18.4800	21.3200	24.1700	27.0100	29.8500
6	10.8900	14.0000	17.1100	20.2200	23.3300	26.4400	29.5500	32.6500
7	11.7400	15.1000	18.4600	21.8100	25.1700	28.5200	31.8800	35.2300
8	12.5400	16.1300	19.7100	23.2900	26.8800	30.4600	34.0500	37.6300
9	13.2900	17.0900	20.8900	24.6900	24.4800	32.2800	36.0800	39.8800
10	14.0000	18.0000	22.0000	26.0000	30.0000	34.0000	38.0000	
11	14.6700	18.86.00	23.0600	27.2500	31.4400	35.6300	39.8300	
12	15.3200	19.6900	24.0700	28.4400	32.8200	37.1900		
13	15.9300	20.4800	25.0300	29.5900	34.1400	38.6900		
14	16.5200	21.2400	25.9600	30.6900	35.4100			
15	17.0900	21.9800	26.8600	31.7500	36.6300			
16	17.6500	22.6900	27.7300	32.7700	37.8100			
17	18.1800	23.3800	28.5700	33.7600	38.9600			
18	18.7000	24.0400	29.3900	34.7300				
19	19.2000	24.6900	30.1800	35.6700				

Yield equations

Three yield equations developed for *A. falcataria* were:

a. Total timber yield (Y_{10})

$$\text{Log}_{10}(Y_{10}) = 2.94469 - 1.4139/A - 0.210044\ \text{Log}_{10}(SP) - 7.84248/SI$$

$$r^2 = 0.86$$

b. Pulp timber yield (Y_{15})

$$\text{Log}_{10}(Y_{15}) = 2.95527 - 3.2447/A + 0.04001\ (SI/A) - 9.08308/SI - 0.2047\ \text{Log}_{10}(SP)$$

$$r^2 = 0.88$$

c. Sawntimber yield (Y_{20})

$$\text{Log}_{10}(Y_{20}) = 3.18761 - 2.65207/A - 0.26493\ \text{Log}_{10}(SP) - 16.66331/SI$$

$$r^2 = 0.81$$

Tables 6a and 6b, 7a and 7b, and 8a and 8b give the predicted yields per hectare at different ages and site indices at spacings of 2 × 2 m and 4 × 4 m.

Table 6a. Total merchantable volume yield (m^3 ha^{-1}) table for *A. falcataria* at different ages, site indices and spacing: 2 x 2 m

Age	Site index (m)							
(y)	14	18	22	26	30	34	38	42
2	35.4700	47.3800	56.8600	64.5100	70.7700	75.9700	80.3300	84.0500
3	61.2000	81.5100	97.8300	110.9900	121.7600	130.7000	138.2100	144.6100
4	80.2700	106.9200	128.3200	145.5900	159.7100	171.4300	181.2900	189.6800
5	94.4700	125.8200	151.0000	171.3200	187.9500	201.7400	213.3400	223.2200
6	105.2900	140.2400	168.3100	190.9600	209.4900	224.8600	237.7900	248.8000
7	113.7800	151.5500	181.8700	206.3500	226.3800	242.9900	256.9600	268.8600
8	120.5900	160.6200	192.7600	218.7100	239.9300	257.5300	272.3400	284.9500
9	126.1700	168.0500	201.6800	228.8200	251.0200	269.4400	284.9400	298.1300
10	130.8200	174.2400	209.1000	237.2500	260.2700	279.3700	295.4300	309.1100
11	134.7500	179.4700	215.3900	244.3800	268.0900	287.7600	304.3100	318.4000
12	138.1100	183.9600	220.7600	250.4800	274.7800	294.9500	311.9100	326.3500
13	141.0200	187.8300	225.4200	255.7600	280.5800	301.1700	318.4800	333.2300
14	143.5700	191.2200	229.4900	260.3800	285.6400	306.6000	324.2300	339.2400
15	145.8100	194.2100	233.0700	264.4500	290.1000	311.3900	329.3000	344.5400

Table 6b. Total merchantable volume yield (m^3 ha^{-1}) table for *A. falcataria* at different ages, site indices and spacing: 4 x 4 m

Age	Site index (m)							
(y)	14	18	22	26	30	34	38	42
2	26.5900	35.4100	42.5000	48.2000	52.8900	56.7800	60.0400	62.8200
3	45.7400	60.9200	73.1100	82.9500	91.0000	97.6800	103.3000	108.0800
4	60.0000	79.9100	95.9000	108.8100	119.3700	128.1300	135.4900	141.7700
5	70.6000	94.0400	112.8500	128.0400	140.4700	150.7800	159.4500	166.8300
6	78.6900	104.8200	125.7900	142.7200	156.5700	168.0600	177.7200	185.9500
7	85.0400	113.2600	135.9300	154.2200	169.1900	181.6000	190.0500	200.9400
8	90.1300	120.0400	144.0700	163.4600	179.3200	192.4800	203.5400	212.9700
9	94.3000	125.6000	150.7300	171.0200	187.6100	201.4800	212.9600	222.8200
10	97.7700	130.2200	156.2800	177.3200	194.5200	208.8000	220.8000	321.0200
11	100.7100	134.1400	160.9800	182.6400	200.3600	215.0700	227.4300	237.9600
12	102.2200	137.4800	165.0000	187.2000	205.3700	220.4400	233.1100	243.9100
13	105.4000	140.3800	168.4700	191.1500	209.7000	225.0900	238.0300	249.0500
14	107.4000	142.9200	171.5200	194.6000	213.4800	229.1500	242.3300	253.5400
15	108.9800	145.1500	174.2000	197.6400	216.8200	232.7500	246.1100	257.5100

Table 7a. Pulp timber volume yield ($m^3 ha^{-1}$) table for *A. falcataria* at different ages, site indices and spacing: 2 x 2 m

Age (y)	Site index (m) 14	18	22	26	30	34	38	42
2	6.9400	11.6200	17.2600	24.0300	32.1600	41.9700	53.8300	68.2100
3	19.4300	30.6200	41.7700	55.9800	70.4600	86.4800	104.3300	124.3100
4	32.5300	49.7100	67.3300	85.4500	104.3000	124.1400	145.2300	167.8200
5	44.3000	66.4700	88.3900	110.1300	131.9800	154.2200	177.1200	200.9300
6	54.4400	80.6800	105.9700	130.4300	154.2200	178.2100	202.1800	116.5500
7	63.0700	92.6600	120.6400	147.1900	172.7100	197.6100	222.2200	246.8400
8	70.4300	102.7900	132.9600	161.1500	187.8500	213.5200	238.5400	263.2300
9	76.7500	111.4300	143.4000	172.9200	200.5400	226.7800	252.0700	276.7300
10	82.2000	118.8700	152.3400	182.9500	211.3100	237.9800	263.4300	288.0300
11	86.9500	125.3200	160.0700	191.5900	220.5500	247.5600	273.1100	297.6200
12	91.1200	130.9600	166.8100	199.1000	228.5500	255.8300	281.4500	305.8500
13	94.8000	135.9300	172.7300	205.6900	235.5600	263.0400	288.7100	312.9900
14	98.0800	140.3400	177.9800	211.5000	241.7300	269.3900	295.0700	319.2500
15	101.1000	144.2800	182.6500	216.6800	247.2100	275.0100	300.7000	324.7700

Table 7b. Pulp timber volume yield ($m^3 ha^{-1}$) table for *A. falcataria* at different ages, site indices and spacing: 4 x 4 m

Age (y)	Site index (m) 14	18	22	26	30	34	38	42
2	5.2200	8.7500	13.0000	18.0900	24.2200	31.6000	40.5400	51.3700
3	14.6300	23.0600	32.2100	42.1600	53.0600	65.1300	78.5700	93.6100
4	24.4900	37.4300	50.7000	64.3500	78.5500	93.4900	109.3700	126.3800
5	33.3600	50.0600	66.5600	82.9400	99.3900	116.1400	133.3800	151.3100
6	41.0000	60.7600	79.8100	98.2300	116.2700	114.2100	152.2500	170.6100
7	47.5000	69.7800	90.8500	110.8400	130.0600	148.8100	167.3500	185.8900
8	53.0400	77.4100	100.1300	121.3600	141.4700	160.8000	179.6400	198.2300
9	57.8000	83.9200	107.9900	130.2200	151.0200	170.7800	189.8200	208.4000
10	61.9000	89.5200	114.7200	137.7800	159.1300	179.2200	198.3800	216.9100
11	65.4800	94.3700	120.5400	144.2800	166.0900	186.4300	205.6700	224.1300
12	68.6200	98.6200	125.6200	149.9400	172.1200	199.6600	211.9500	230.3300
13	71.3900	102.3600	130.0800	154.9000	177.3900	198.0900	217.4200	235.7000
14	73.8600	105.6900	137.0300	159.2800	132.0400	202.8700	222.2100	240.2200
15	76.0700	108.6500	137.5500	163.1700	136.1600	207.1000	226.4500	244.5700

Table 8a. Sawntimber volume yield (m^3 ha^{-1}) table for *A. falcataria* at different ages, site indices and spacing: 2 × 2 m

Age (y)	Site index (m) 14	18	22	26	30	34	38	42
2	3.2500	5.9700	8.8000	11.5100	14.0200	16.6900	18.3500	20.2000
3	8.9900	16.5300	24.3600	31.8600	38.7800	45.0800	50.7700	55.8900
4	14.9600	27.5000	40.5200	52.9900	64.5100	74.9900	84.4500	92.9700
5	20.3000	37.3200	54.9900	71.9100	87.5500	101.7600	114.6000	126.1700
6	24.8800	45.7500	67.4000	88.1400	107.3100	124.7400	140.4700	154.6500
7	28.7700	52.9000	77.9500	101.9400	124.1100	144.2600	162.4500	178.8500
8	32.0900	59.0000	86.9300	113.6800	138.4000	160.8800	181.1700	199.4600
9	34.9300	64.2200	94.9200	123.7500	150.6500	175.1200	197.2100	217.1100
10	37.3800	68.7300	101.2700	132.4300	161.2300	187.4100	211.0500	232.3500
11	39.5200	72.6500	107.0500	129.9900	170.4400	198.1100	223.1000	245.6200
12	41.3900	76.0900	112.1200	146.6200	178.5100	207.4900	233.6600	257.2500
13	43.0400	79.1300	116.5900	152.4800	185.6300	215.7700	242.9900	267.5200
14	44.5100	81.8300	120.5700	157.6800	191.9700	223.1400	251.2800	276.6400
15	45.8200	84.2500	124.1300	162.3300	197.6300	229.7200	258.7000	284.8100

Table 8b. Sawntimber volume yield (m^3 ha^{-1}) table for *A. falcataria* at different ages, site indices and spacing: 4 × 4 m

Age (y)	Site index (m) 14	18	22	26	30	34	38	42
2	2.2500	4.1400	6.1000	7.9700	9.7100	11.2800	12.7100	13.9900
3	6.2300	11.4500	16.8700	22.0600	26.8600	31.2200	35.1600	38.7100
4	10.3600	19.0500	28.0600	36.6000	44.6800	51.9400	58.4900	64.3900
5	14.0600	25.8500	38.0900	49.8100	60.6400	70.4800	79.3700	87.3800
6	17.2300	31.6800	86.6800	61.0500	74.3300	86.3900	97.2900	107.1100
7	19.9300	36.6400	53.9900	70.6000	85.9600	99.9100	112.5200	123.8700
8	22.2300	40.8600	60.2100	78.7400	104.3500	111.4300	125.4800	1388.1500
9	24.1900	44.4800	65.5400	85.7100	111.6700	121.2900	136.5900	150.3700
10	25.8900	47.6000	70.1400	91.7300	118.0500	129.8000	146.1800	160.9300
11	27.3700	50.3200	74.1400	96.9600	123.6400	137.2100	154.5200	170.1200
12	28.6700	52.7000	77.6500	101.5500	128.5700	143.7100	161.8400	178.1700
13	29.8100	54.8100	80.7500	105.6100	132.9600	148.4500	168.3000	182.5900
14	30.8300	56.6800	83.5100	109.2100	132.9600	154.5500	174.0400	191.6100
15	31.7400	58.3500	85.9700	112.4300	112.4300	159.1100	179.1800	197.2600

With respect to age and site, there is continuous increase in yield as the site becomes better and the stand older. The decreasing increase in yield at older age for a given site tends to indicate convergence at maximum stocking. This behavior is true for all merchantable volume yields. Likewise, predicted values of the models indicate a higher yield in closer spacing for all merchantable limit.

Comparing the predicted yield from the models derived in a similar study conducted by Appleton (1980) in other provinces, there is generally a little difference in yield values derived for all merchantability limits, sites and spacings although the former shows a higher yield at younger age and poorer sites but quite conservative values in better sites and older age. For total merchantable volume yield at site index of 30 m and age at 10 years old, the predicted yield for a spacing of 4 5 4 m obtained by Appleton (1980) was 183 m^3 ha^{-1} while the model derived indicated a yield of 194 m^3 ha^{-1}.

Validation of yield models derived for *A. falcataria* was done using 30 temporary plots completely different from the sample data. Paired *t* - test was used to test the significance of deviation of the predicted values from the observed values. Results showed no significant difference. All yield prediction equations were found to provide acceptable yield estimates at different ages, spacings and site index as shown by the general trend of the predicted values and its conformity to the generally accepted principle of forest stand development.

Results also showed that at 18% interest, economic rotation for total merchant-able volume yield up to 10 cm dib is four years for all spacings and site classes except for spacings 2 × 2 m and 8 × 8 m at site index 14 m which is five years. For pulp timber, it is five years for site indices 30 to 42 m and six years for site indices below 30 m for all spacings although it is not economical in some site classes and spacings. A 6-year economic rotation was observed for sawntimber except for site index 14 m where it is not economical. The economic rotation obtained is acceptable although this may vary depending on the rate of interest used.

Conclusion and recommendations

A comprehensive study was conducted to determine volume, yield and economic rotation of *Albizia falcataria* in Mindanao, Philippines.

Some important observations gathered from the results are:

a. The major factors affecting tree volume are diameter at breast height and merchantable height (*MH*). *MH* for pulp timber is up to 15 cm top diameter while the values for sawntimber and total merchantable volume are 20 and 10 cm respectively.

b. The tree-site (*SI*) equation is:

$$\text{Log}_{10}\ (SI) = 0.492458 - 0.492458\ \text{Log}_{10}\ (A) + \text{Log}_{10}\ (TH)$$

The expected sigmoid shape was attained as shown in Figure 1.

c. The yield prediction functions developed showed that age, spacing and site index are variables significantly affecting yield. All yield prediction equations conform to the general accepted principle of forest development, thus providing acceptable yield estimates.

The generated equations necessitate further refinements as shown in the r^2. More variables like soil properties, physiographic and climatic factors need to be included to determine what factors really determine growth of *A. falcataria*. Jones

(1969) reported that differences in height growth and eventually volume growth were caused by the different combinations of site factors. This may be due to rapid juvenile growth and early growth deterioration on some sites. Also, genetic differences undoubtedly contribute to some degree.

Improved accuracy may be attained if data are analyzed by province or regional basis rather than for the whole of Mindanao.

Future studies on yield and economic rotation of *A. falcataria* as affected by cultural activities (thinning/cleaning) and fertilisation should be undertaken. Study on costs of plantation establishment at different accessibility classes must also be done. Soil microbial analysis in the rhizosphere of *A. falcataria* could be conducted to identify the beneficial organisms responsible for the growth of this species.

References

APPLETON, N. 1980. Yield prediction models and economic rotations of unthinned *Albizia falcataria* plantations with different planting spacings. MS thesis, University of Philippines, Los Banos.

JONES, J. R. 1969. *Review and Comparison of Site Evaluation Method.* USDA Forest Service Research Paper Rm-51. 27 pp.