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熱帯林情報No. 3

熱帯林の成長データ記録

（その２）

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情報「熱帯林の成長データ集録」の発刊にあたって

私ども国際緑化推進センターでは、我か国の国際森林・林業協力を総合的に支援するため、協力を担う人材の養成・確保、技術情報の収集・整備・提供、ＮＧＯ等の民間協力活動の支援、国際緑化の普及啓発、熱帯ての植林などの活動を行っております。

そして、情報活動の一つとして熱帯地域などでの森林造成に必要な情報について、これを「熱帯林情報」として発刊し、熱帯地域等て協力活動に従事する方々の参考に供しております。

今回、「熱帯林の成長テータ集録」と題して、熱帯地域での森林の成長と収穫に関するデータ集を発刊することになりました。

本書に掲載されたデータは、当センターが林野庁補助事業として行っている「カーボン・シンク・プロジェクト推進調査事業」の実施に当たり、熱帯林の収穫予測のために森林総合研究所の西川匡英林業経営部長か中心となって集めて頂いた資料に、同部長を始め森林総合研究所の関係者達がこれまてに収集していたデータも加えさせて頂いたもので、現在、我か国が集め得るかぎりのデータが集録されております。

地球環境の悪化が世界的に憂慮される中で、地球環境への熱帯林の果たす役割の重要性は益々増しております。とくに、地球温暖化に対する長期の炭素固定方策として熱帯地域での積極的な植林か注目される中で、熱帯林の成長に関するデータはなくてはならない資料だと思われます。

この度、西川匡英部長をはじめ関係の方々のご努力で、最新の熱帯林の成長データが整理出来ましたことは、今後の我か国の熱帯林問題への取組に大いに役立つことと信じております。

ここに、貴重な資料を収集・整理下さった森林総合研究所　西川匡英林業経営部長、高橋文敏資源計画科長、同研究所北海道支所　白石則彦天然林管理研究室長並びに秋田営林局鷹巣営林署岩野目森林事務所　増田義昭森林官の皆様に心から感謝申し上げるとともに、この情報「熱帯林の成長データ集録」が、今後、我が国の多くの協力関係者に活用され、我が国の国際森林・林業協力の推進に大きく貢献することを願っております。

１９９６年３月

㈶国際緑化推進センター
理事長　秋　山　智　英

熱帯林の成長データ集録

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1．はじめに

熱帯地域の森林の成長と収穫に関する情報は、先進国のものに比べるとまだ充分整備されていなくてその収集には困難をともなう。早生樹種については、D.Pandrey が Growth and yield of plantation species in the tropics (FAO 1983) において、熱帯林の成長と収穫をまとめている程度である。しかし、地球温暖化にともなう対応策として長期間炭素を固定する方法のひとつとして熱帯林を保全するとともに、積極的に植林していくことが近年注目されている。このため熱帯の早生樹種だけでなく、天然林についてもその成長特性を充分把握していく必要がある。

当初コンピュータによる文献検索を主体とした収集を考え、CAB, AGRICORA、AGRISなどで樹種別地域別に検索を試みたが、論文を主体としたものが多く、必ずしも有効な方法でないことがわかった。そこで前記の Pandreyのものを中心にして、多面的な方法で収集することにし、次のように個別に文献に当たることにした。

文献検索（CAB, AGRICORA, AGRIS）
ＦＡＯ（国連食糧農業機関）文献
森林総合研究所図書室、森林総合研究所海外研究情報室（ＯＤＣによる熱帯林情報収集）
海外専門家への依頼（マレーシア、タイ、インドネシア、パプア・ニューギニア、ＦＡＯなど）
単行本
その他

成長と収穫（Growth and Yield）に関しては、収穫表、成長モデルの形が一般的であるが、地位指数曲線、直径分布で表されたものもあり、天然林では定期平均成長量のみで表している場合が多い。これらの関係については項を設けて解説した。

集められた文献については、一定の様式（樹種、国、地域、データ採取地の立地環境、成長・収穫に関する表、図、式など、出典）で個表を作り整理することにした。本書はこの個表を印刷したものであるが、とくにデータ採取地の立地環境、成長・収穫に関する表、図式などは必要最小限にとどめているため、利用の際は出典に示した原文を参照することをお勧めする。また前記D.Pandrey の報告書では文中に多数の引用文献があり、これらの引用文献を含めて出典として示すことにした。なお今回は計測的な成長量を中心としたデータの収集であったが、バイオマス的な資料については、別途収集の機会を設けて行いたいと考えている。

なお樹種の学名については元森林総合研究所東北支所長の緒方健博士に校閲をお願いした。また筑波大学の松下　香、桧山千春嬢には個表の整理をお手伝いいただいた。ここに記して謝意を表する次第である。また、２－１、２－２を白石、２－３を西川、目次、索引を高橋、天然林人工林の個表作成を西川、高橋、白石、増田が担当した。

2．　本資料を利用する人のために

2－1　収穫表の概要

収穫表とは、ある樹種の森林に対して同一の取り扱いを施した場合の森林の統計量の標準的な値を、林齢の一定間隔ごとに表示した表てある。森林の統計量としては、平均胸高直径、平均樹高、単位面積当りの立木本数および胸高断面積合計、材積（総成長量）、成長量などかある。人工造林樹種では、年齢ごとに間伐される林木（副林木または間伐木）と残存する林木（主林木または残存木）とに分けて、それぞれの標準的な統計量を記していることも多い。

森林ては近接した林地に同一樹種か生育している場合を比較しても、土壌や地形、水分状態などの違いによって成長か大きく異なることがある。収穫表ては、地位(site)という立地の生産力の違いによって、同一樹種に対しても成長の異なる複数の表が作られるのが普通である。

森林の地位は、Ⅰ、Ⅱ、Ⅲ等のように等級区分することもあるが、地位指数によって数値で表現されることも多い。最も普通の地位指数は、基準となる林齢（基準林齢）を定めて、その林齢における優勢木または主林木の平均樹高の値そのものを指数とするものである。例えば日本においてはスギやヒノキの基準林齢は伐期を勘案して40年が慣用とされており、その林齢で到達する平均樹高が地位指数である。熱帯地方では早生樹種が造林されることも多いため、基準林齢は10年とか20年など非常に若齢のことが多い。

平均樹高が地位指数の表現に利用されるのは、樹高成長が林地固有の生産力をよく表わし、かつ森林の人為的取り扱いにほとんど依存しないと考えられているからである。これに対し、林齢の明確でない森林タイプの地位の判別には、１年当りの材積成長量がしばしば用いられる。

地位の判別目的はかりでなく、林齢に伴う材積の成長量の変化は森林の成長を扱う場合にきわめて重要である。材積成長量は、平均化する期間の取り方によって、次のように大別される。

平均成長量　　Mean Annual Increment (MAI)
連年成長量　　Current Annual Increment (CAI)
定期平均成長量　Periodic Annual Increment (PAI)

平均成長量は材積を林齢で割った１年当り平均の成長量で、全生育期間を均した成長量の平均値と考えられる。連年成長量はある林齢の前後１年間の成長量であり、２年以上の期間について成長量の年平均を取ったものは定期平均成長量と呼ばれている。林齢の変化に伴う平均成長量と連年成長量、総成長量の関係は下図に示されている。天然林のように林齢（ｔ）が明確でない森林の成長量は、連年（または定期平均）成長量が比較される場合が多く、それはまた地位の判別にも利用されている。

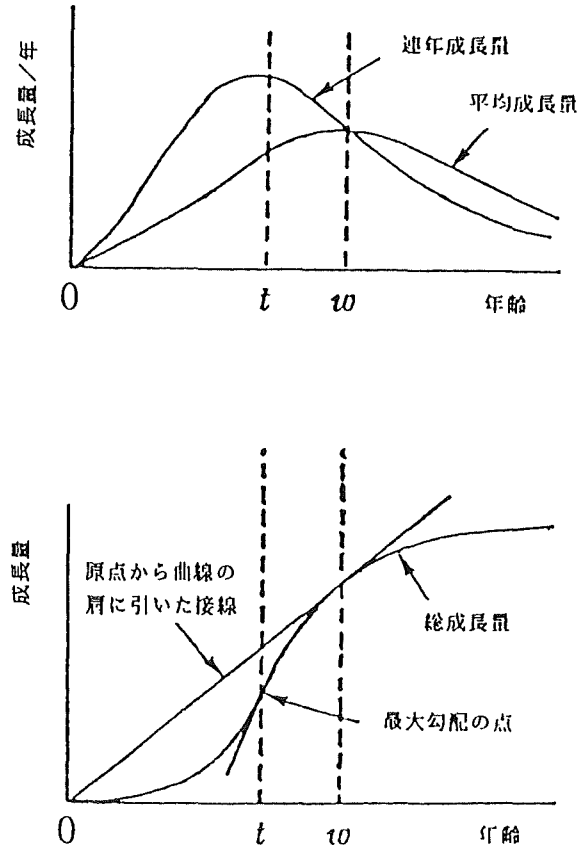

図２－１　平均成長量と連年成長量、総成長量の関係

平均成長量が最大となる林齢（w）において、その値は連年成長量と一致する。総成長量、平均成長量、連年成長量のいずれかがわかれば他の２者は計算可能である。

２－２　収穫表のタイプ分類

ここでは熱帯地方を中心に、さまざまな国や地域からさまざまな樹種についての成長量の資料を広く収集した。その中には収穫表と呼ぶにふさわしい体裁を備えた森林成長の資料もあるが、収穫表の要素（材積、直径、樹高、本数等）の一部分しか整っていなかったり、あるいは天然林で林齢が明確でないため林齢ごとの統計量という形式で表示されていない資料もある。

収集された成長資料にどのような種類の情報が載っているかを示すことは有益であり、そのためには資料をタイプによって分類しておく必要がある。そこでここでは基本的な要素の整った正常な収穫表の体裁を基本とし、それ以外の資料のタイプを以下のように分類した。

① 収穫表タイプ（林齢に対して材積はじめ各種統計量か示されている）

1． 完全な形の収穫表

2． 不完全な形の収穫表（成長量の資料は完備しているが、それ以外の立木本数、平均胸高直径、平均樹高等の情報が不完全なもの）

② 地位指数曲線タイプ（直接に成長量に結びつかないが、その基礎となりうる統計量が林齢に対する変化として示されている）

1． 樹高～林齢

2． その他（胸高直径、胸高断面積等）～林齢

③ 連年（または定期）成長量のみのタイプ（生育期間の一部についての成長量の資料）

1． 天然林等のＣＡＩ，ＰＡＩ

2 その他

④ その他のタイプ

1 直径階に対する直径成長量

2． 直径分布の変化

3． その他

2－3 収穫表に用いられる主な用語一覧（英・和）

今回収集された収穫表には専門的な用語がかなり用いられている。ここではこれらの用語をまとめ、日本語と解説を付し利用に供することにした。

英　　語	日　本　語	解　　説
average diameter	平均直径	普通胸高直径の平均を指す。表ではAv. diam. や$\bar{d}$と略記することがある。
age	林齢、樹齢	森林や樹木の年齢
accum. vol(yield)	累積収穫量	現材積にそれまでの間伐収穫量を累積した合計の収穫量
annual percent mortality	枯損率	mortality rateに同じ
annual mortality percent	枯損率	mortality rateに同じ
annual ingrowth percent	進階率	進階木の本数または材積の全林に対する割合
bark yield	樹皮量	樹皮量は、重量、面積、束などの単位で表す。
base age	基準林齢	地位指数を定める基準となる林齢
basal area	胸高断面積	地上1.2 または 1.3mの高さの木の幹の断面の面積
basal area growth	胸高断面積成長量	胸高断面積合計の年間成長量
d.b.h.(diameter at breast height)	胸高直径	地上1.2 または 1.3mの高さの木の幹の直径

英　　語	日　本　語	解　　説
diameter class	直径階	一定の直径の範囲をまとめた（括約した）階級。わが国では２ｃｍ括約、スイスでは、４ｃｍ括約、フランス、ドイツでは５ｃｍ括約が行われる。
diameter distribution	直径分布	森林内の木の直径（通常胸高直径）の頻度分布
diameter growth	直径成長（量）	胸高直径の定期成長（量）
d.o.b.	皮付き直径	樹皮付きの直径
bole	幹材、樹幹	stemに同じ。樹木の幹部
circumference(girth)	円周	樹木の円周を用いて直径の大きさを表す。
cohort	コーホート	ある特定の期間に出生した人口を表すが、動物一般では生命表作成を特定時期に出生したグループについて行ったときなどに用いられる。
coupe	クーペ	伐採の区画単位
codominant trees	準優勢木	樹冠の一般的なレベルには達しており、上方から充分の光を受けているが、側面からはほとんど受けていない樹木をさす。
CFI (continuous forest inventory)	森林継続調査法	観測点またはプロットをシステマティックに配置し、定期的に森林資源内容を観測する森林資源調査法。近年生態的な情報や環境情報をも測定する多目的な資源調査法が採用される傾向にある。
conversion factor	変換率	薪など層積から実積へ換算する場合の割合。針葉樹、広葉樹によってまた、径級の大きさによって異なる。
crop standing volume	立木蓄積	standing tree, またはstumpage volume ともいう。森林内の立木の材積
crop diameter	樹木直径	tree diameter　に同じ
crop height	樹高	tree height　　に同じ
culm	茎	節のある茎
cumulative thinnings	累積間伐木量	間伐木の本数または材積を加算したもの
de liocourt's quotients	リオクールの公比	異齢林の直径分布は逆Ｊ字型をなすが、隣接する直径階の本数比（ｑで表す）を等比級数の公比として用いれば、一番大きな直径階の本数をｎとすると、n, nq, nq^2, …… のように表される。

英　　語	日　本　語	解　　説
DBH	胸高直径	diameter at breast height の略で、胸高の部位（普通1.2 または 1.3m）の樹木の直径を指す。
diameter growth projection table	直径成長予測表	直径階毎の成長の推移を示したもので、stand table に同じ
dominant height	優勢木樹高 主林木樹高	優勢木または主林木の樹高
dry bark	乾燥樹皮量	樹皮を乾燥処理をしたもの
dry weight	乾（燥）重（量）	生物体重の計測て含水量の影響を除外したい時に用いる。普通 105℃で乾燥し、重量が安定した時を持って乾重とみなす。
dummy variables	ダミー変数	重回帰式の説明変量に用いられるもので、分類尺度の数量的な表現である。例えば、機械がA、B 2 台ある場合、説明変数 x ＝ 1，（機械Aがある時）、x ＝ 0，（機械Bがある時）というように、A，Bを分類するために任意の二つの実数を用いる。1、0が簡単であるためよく用いられる。
form factor	形数、幹形形数	樹幹のある位置における直径に等しい直径を底面とし、その樹高に等しい高さをもつ仮想的な円柱の体積とその幹材積との比を形数という。
fresh weight	生重（量）	乾燥処理を行わない生木の状態の重量
girth (class)	胴回り、樹幹周囲	樹木の直径で大きさを表す代わりに、周囲で表したもので、熱帯地域では、よくこの単位が用いられる。（例えば、半島マレーシアの利用材積表）。
green bark	樹皮生重	生木の状態の樹皮
gross volume	粗成長量	森林の全林木より生産された全材積
growth	成長（速度）	広義の成長全般を表わす。
growth rate	成長率	ある一定の時期からの樹木の成長を示し、普通１ｃｍ当たりの年輪数等で表すが、樹木または林分の材積、価値、あるいはその他の成長量で表すこともある。
growth prediction table	収穫予測表	収穫表に同じ
heavily thinned stands	強度の間伐を行った林分	被圧木、介在木、一部の準優勢木を除く間伐

英　　語	日　本　語	解　　説
height class	樹高級（階）	樹高をいくつかの階級に分けたもの。高さ階級
high forest	高林、喬林、高木林	熱帯では、サバンナ林、低林に対比して高木よりなるうっぺい林をいう。
increment	成長（量）	「増分」に相当する概念
ingrowth	進階成長量	測定されるように定められた最小直径階以下の木が成長して最小直径以上に達した木を進階木といい、その本数、または材積の量を進階成長量という。
inner bark	皮内	樹皮を除いた場合を表わす（樹皮なしの直径など）。
improvement felling (cutting)	整理伐、除伐保育伐	価値のある樹木を育成するため、価値のない樹木を除去することであるが、とくに混交異齢林において行う。
inside bark	皮内	inner barkに同じ
LAI	葉面積指数	leaf area index 単位土地面積上にある全葉面積。普通記号Ｆで表す。
LAR	比面積	葉面積比（SLA:specific leaf area）に同じ。葉面積（㎠）を葉乾重（ｇ）で割ったもの。葉の厚さに関係しており、同一樹種では上層の葉ほどSLAは小さい。
liberation thinning	上木伐採	幼齢木の成長を促すため上木または老齢木を伐採する。
linear regression weighted by the inverse of variance	重みつき線形回帰	分散の逆数を重みとした線形回帰
logistic function	ロジステック関数	Verhulst(1838)が提案し、Pearlらに再発見された動物・人間の増殖の数学的なモデル。個体の成長曲線も群落の現存量の増加曲線もロジスティック曲線で近似される場合が多い。
LWR	葉重比	leaf weight ratio 。葉重を全植物体重で割った値
low thinning	弱度の間伐	被圧木のみの間伐
main crop	主林木、主伐木	間伐されず残される木。主として英国で用いられる。
main stand	主林木、主伐木	間伐されず残される木。主として英国で用いられる。

英　　語	日　本　語	解　　説
mean diameter	平均（胸高）直径	地上1.2 または 1.3mの高さの直径の平均値
mean diameter by basal area method	平均断面積木	一定面積内のすべての林木の胸高断面積合計を林木本数で割ったものを平均断面積という。平均断面積木の直径は、常に算術平均直径より大きい。
mean height	平均樹高	森林全体の木の高さの平均
medium thinning	中庸度の間伐	すべての被圧木と介在木の一部を間伐する。
merchantable volume	利用（可能）材積	市場に適したサイズや品質の樹木または林分の材積
modified Malaysian uniform system	修正マレーシアユニフォームシステム	マレーシア・ユニフォームシステムは予備伐、下種伐を省略した、均等に（樹群単位ではない）択伐する前更作業すなわち傘伐作業の一種である。
mortality rate	枯損（死）率	火災、病虫害、風害等で枯損し、利用できなかった木の本数または材積の全林木に対する割合を表す。
NAR	純同化率	葉の光合成速度を示す。
No. of stems	立木本数	単位面積に生立している木の本数
number of stems(trees)	立木本数	単位面積に生立している木の本数
o.b.	皮付き	over bark の略
outer bark	皮付き	樹皮付直径など樹皮を付けたままの状態を表す。
outside bark	皮付き	樹皮付直径など樹皮を付けたままの状態を表す。
over bark	皮付き	樹皮付直径など樹皮を付けたままの状態を表す。
/ha, per ha	ha当り	材積など合計量を比較する単位面積。中国語の文献では毎公頃。1公頃は約16畝（ムー）
per rai	ライ	面積の単位で、1ライは0.16haに当たる。
poison treatment	巻きがらし	girdling, ringing ともいい、立木に材分に達する切り込みをめぐらし、立木のまま枯死させる。造林地にある利用価値のない立木で伐採整理すると経費が引き合わない場合などに行われる。
predominant height	準優勢木樹高	準優勢木の樹高
preliminary yield table	予備的な収穫表	サンプル数が少ない等の理由で、予備的に作成する収穫表

英　　語	日　本　語	解　　説
provisional normal yield table	地方的正常収穫表	正常収穫表は、充分の蓄積のある（fullystocked)林分の収穫表のことで、これを地域的に作成したもの。
q value	q値	樹木の直径分布において隣接する直径階の本数比で表す。択伐林の林型の指標になる。
RD		予側断面積に対する実断面積の比
RGR	相対成長率	relative growth rateの略で植物の乾量成長過程を複利的な成長とみなし、その利率に相当する値をいう。
recruitment	進階量	与えられた期間内に測定てきる（最小直径限界を越えた）大きさに達した樹木の本数または材積。ingrowthに同じ。
recruits group	進階木グループ	進階木のグループ
reference age	基準林齢	地位指数を定める基準となる林齢
remainings	残存木	間伐の後にも残存する樹木
remaining stands	残存林分 保残林分	間伐の後にも残存する林分
retained	残存する	間伐の後にも残存する
roundwood volume	丸太材積	丸太の材積のことで、スマリアン法、フーバー法、末口自乗法等で求める。
S	平均幹距	林木の平均的な樹幹距離を示す。
site class	地位級	地位をいくつかの等級に区分したもの
site index	地位指数	地位を表わす指数で、基準林齢における上層木、または優勢木の平均樹高が用いられる。
site index curves	地位指数曲線	各地位指数に対応する上層木または優勢木の平均樹高成長曲線を地位指数曲線という。
site quality	地位	林地の肥沃度、生産力
size class	サイズクラス	樹木の大きさを表わしたもので、樹高級と直径級などにより表わす。
Sr	相対幹距	平均幹距（ｓ）と林分の上層木の平均樹高（$\sqrt{H}$）との比を相対幹距または樹高一幹距比といい、次のように百分率で表す。 $Sr = S\sqrt{H} \times 100$（%） 林分密度の尺度の一つで、間伐の尺度になる。

英　　語	日　本　語	解　　説
stacked volume	層積	積み重ねた空間を含む容積をいう。薪など一定長の木材を一定の幅と高さに積み上げ、その体積を測るもので、実績(solid volume)に対して用いられる。
stand density	立木密度 林分密度	林分の密度は本数、断面積合計等1変数で表す場合と2変数の組み合わせ（相対幹距等）で表す場合がある。
stand table	林分表	直径階本数表の年次的な推移を表した表
stocking	立木度	最良の林分状態または管理された林分と比較して表した林分の状態
stump	伐根	木を伐倒したときの根株
suppressed (trees)	被圧木、劣勢木 下層木	被圧された木
survival percent	残存率	枯損等森林から除去された樹木を除いて残存する樹木の本数、または材積の全林木に対する割合
survival rate	残存率	survival percentに同じ
thick wood	成材材積	伐採点以下の材積を除いた木の皮付き直径7ｃｍ以上の部分の材積をいう。ドイツでは皮付き材積を指すが、東南アジア諸国では、樹皮なし材積を指す。
thinned	間伐された	間伐された（木または材積）
thinning	間伐	人為的に本数を減らすこと。間引き
thinnings	間伐木、副林木	間伐される木
tip end	末口	丸太で直径の小さい方の断面を末口、大きい方の断面を元口という。
top height	上層木樹高	上層樹冠を構成する優勢な木の樹高
total volume	主幹材積	木の主幹の材積、広葉樹によく見られるように主幹が明らかでないときは、枝下高までの材積をいう。主幹が（大枝を持たず）明らかなものは頂端までの材積をいう。
treated	処理をした	間伐など人の手を加えた状態を指す。
under bark (u.b.)	皮内直径	樹皮付きの状態の直径
unthinned stands	無間伐林	間伐が行われない林分で自然の推移にまかせている林分

英　　語	日　本　語	解　　説
untreated	無処理の	間伐など人の手の入らない、無処理の森林の状態を指し、間伐の施業比較試験地等では対照区となる。
upper height	上層高	林分内の上層木の平均樹高。林分から万遍なく上層木をとる必要があるため、例えば0.25ha内のプロットでは0.01haの２５個のプロットを設定し、それぞれのプロットの最高の樹高を有する木の平均樹高を求める。これはha当たり１００本に相当する。英国では top heightという。
volume	材積	材木の量
volume over bark (V.O.B.)	皮付き材積	樹皮付きの材積
volume thinned	間伐材積	間伐される木の材積
yield	収穫（量）	森林から除去されようがされまいが、年々または定期的に伐倒される林木の材積
yield table	収穫表	ある樹種に対し一定の作業法を採用した場合に、一定年度ごとの単位面積当たりの本数、材積およびこれに関係のある主な林分因子の値を時系列的に表示したもの。

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3）西沢正久：森林測定法、地球出版　1965

4）生態学辞典、築地書館　1983

目　　次

第１分冊（天然林及び針葉樹人工林）

天然林

目　　次

第２分冊（広葉樹人工林、多樹種及び竹類）

RUBIACEAE（アカネ科）

BORAGINACEAE（ムラサキ科）

VERBENACEAE（クマツヅラ科）

多樹種［単独樹種として分類しなかったもの］

索　引（地域・国別）

アジア

インドネシア

日本

マレーシア（マラヤ）

パキスタン

フィリピン

台湾

タイ

オセアニア

オーストラリア

フィジー

パプアニューギニア

アフリカ

コートジボアール（象牙海岸）

ガーナ

ケニア

マラウィ

モロッコ

ナイジェリア

南アフリカ

スーダン

タンザニア

ウガンダ

ザンビア

中 米

ジャマイカ

プエルトリコ

トリニダッドトバコ

南 米

コロンビア

ブラジル

スリナム

多 国 籍

ヨーロッパ

イタリア

(広葉樹人工林，多樹種及び竹類)

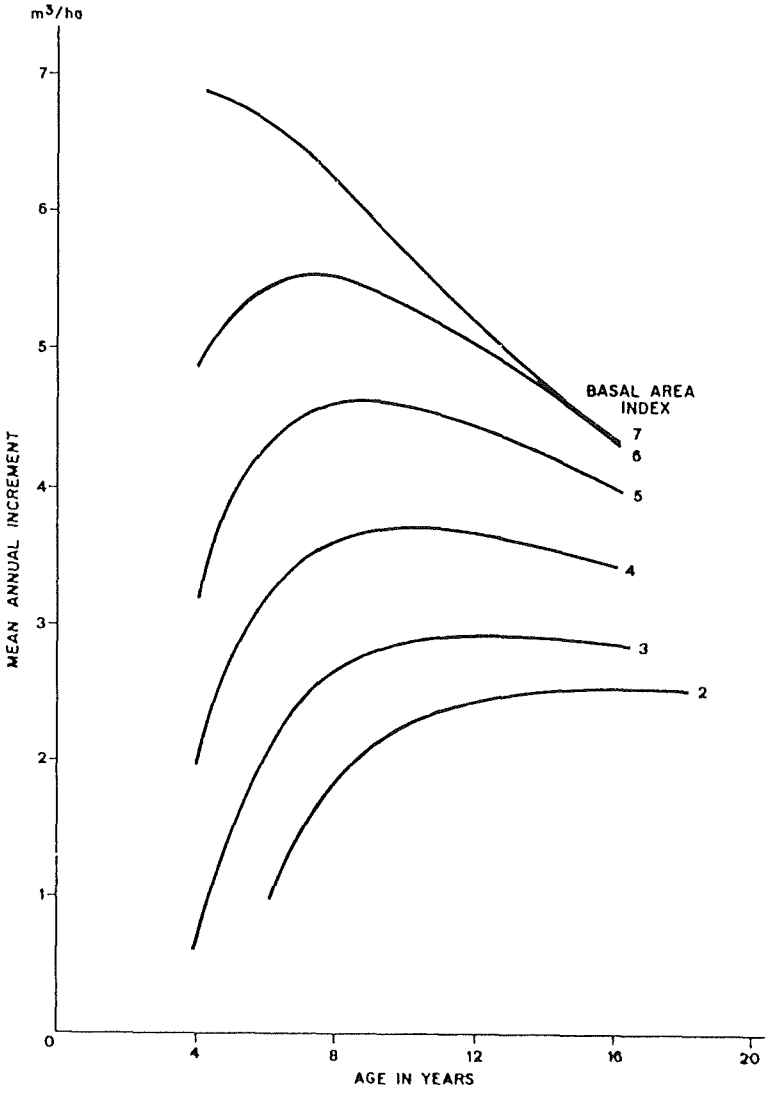
樹種：CASUARINACEAE（モクマオウ科）
Casuarina equisetifolia（トキワギョリュウ）
国：インド

データ採取地の立地環境

Locality:	Puri (Orissa)
Altitude:	sea level
Rainfall:	1 420 mm
Soil:	moderate to fine grained with little humus
Data source:	permanent sample plots
Number of plots:	54
Measurement specification:	Up to 5 cm top diameter over bark

成長・収穫に関する表，図，式など

Casuarina equisetifolia - India(4)
MAI - Basal area index curves



Yield equation

$V = -10.14678 + 0.46551\ A + 6.76636\ G \qquad (r^2 = 0.9635)$

where: V = timber volume in m^3 per ha above 5 cm diameter over bark
A = stand age
G = basal area in m^2/ha

(The equation is suitable for site index 18 - 21 at a reference age of 19 years.)

Based on the above relation, mean annual increment for volume production and age curve for each basal area index (stocking) has been drawn. Some values obtained from the curve are:

Age	Basal area index	MAI (m^3/ha)
5	7	6.85
7	6	5.57
8	5	4.69
10	4	3.81
12	3	2.96
16	2	2.60

Remarks: The initial planting spacing ranged between 2 x 2 m to 4 x 4 m but during the second decade of development mortality of trees was conspicuous.

5.7.4. Comments

It appears that with better stocking higher MAI is achieved at shorter age. On a better site, a stocked plantation 1 600 stems/ha yielded MAI of little more than 11.03 m³/ha in 12 to 15 years (3). As the main use of the species is fuelwood, plantation at close spacing with rotation age between 7 to 12 years appears to be desirable for maximizing the volume production.

出典

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(2) Rao, E.V. 1968 A study on Casuarina equisetifolia (unpublished).

(3) Ray, M.P. 1971 Plantation of Casuarina equisetifolia in Midnapore District. W.B. Indian Forester. Vol. 97 No. 8.

(4) Singh, S.P. 1978 Rotation as influenced by stand stocking. A study of Casuarina equisetifolia. Indian Forester. Vol. 104.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：SALICACEAE（ヤナギ科）
Populus deltaides
国　インド

データ採取地の立地環境

Materials and methods

The original stock of Populus deltoide Clone G-3 was received from M/s. Western India Match Company (WIMCO), Dhubn Assam. Cuttings were taken from the well adopted provenance of Jorhat to study the effect of seasons on sprouting and survival in four different seasons noted below:

Period		*Season*
March to May	—	I
June to August	—	II
September to November	—	III
December to February	—	IV

Cuttings of Poplar branches were inserted in the nursery beds during these seasons for 1982 and 1983. 100 cuttings of 35 cm length with a spacing of 30 × 40 cm were planted in nursery beds of 8 m^2 and replicated for 8 times.

In another experiment, three different parts of a branch were considered. While making the cuttings from each branch, leng h was measured and equally divided into three parts i.e bottom, middle and top Further, the individual part of the branch was divided into different cuttings measuring 35 cm each. 100 cuttings from each part were planted on 15th February 1985 in nursery beds, keeping 10 replications in each ones

20 cm of the respective cuttings were inserted into the well worked pulverised soil of nursery beds for both the experiments and the beds were kept moistured by spraying water as and when necessary.

Sprouting of cuttings was counted with the initiation of new leaves and survival percentage was determined, when the clones were ready for transplantation Well rotten cowdung @ 8 ton/ha was mixed in the nursery beds. Hand weeding was done three times in the nursery condition. The soil of the experimental plot is sandy loam and soil pH from 4.5 to 5 5

Growth characters were observed from a row plantation during 1980 to 1984. The clones were planted 1.5 m apart in a pit of 40 cm^3 filled with 5 kg of well decomposed cowdung. N, P and K fertilizers were applied around the established plant @ 120, 80 and 60 kg/ha/year.

Annual increment was determined as per the method described by Misra (1968) with a modification that in this case the weight of the ariel part alone was considered. Diameter and circumference (Girth) were measured at breast height Dry weight was determined by Oven dry method. Biomass of overground part was taken by felling the tree during July every year.

The general weather conditions of Jorhat, i e mean monthly percentage of rainfall, temperature, sunshine and relative humidity calculated on the basis of 61 years data provided by Tocklai Experimental Station, Jorhat is shown in Table 5.

Table 3

Mean growth parameters and biomass distribution of Poplar

Age of Poplar	Height (m)	DBH (cm)	Fresh weight (kg/plant)				Dry weight (kg/plant)			
			Bole	Branch + Twigs	Leaves	Total	Bole	Branch + Twigs	Leaves	Total
1 yr.	2.21	2.25	1.13	0.52	0.225	1.875	0.575	0.225	0.043	0.843
2 yrs.	3.50	4.75	2.87	0.87	0.61	4.35	1.51	0.415	0.102	2.027
3 yrs.	6.12	8.12	8.55	1.675	1.07	11.295	4.72	0.825	0.176	5.721
4 yrs.	10.50	15.00	44.00	13.00	17.00	74.00	26.326	6.730	2.625	35.681

Table 4

Annual increment of different growth parameters of Poplar

Parameters	Current Annual Increment				Mean Annual Increment of 4 years
	1 year	2 years	3 years	4 years	
Height (m)	2.21	1.29	2.62	4.381	2.625
DBH (cm)	2.25	2.50	3.37	6.88	3.75
Circumference (cm)	6.50	6.37	11.63	13.02	15.625
Fresh weight (kg)	1.875	1.30	8.05	45.888	18.50
Dry weight (kg)	0.843	0.638	3.82	20.987	8.92

出典

Sharma, T.C. and D.N. Bardoloi (1986). Observations on Propagation and Growth of Poplar (Populus deltoides Clone G-3). Indian For., 112 : 808-813.

樹種：SALICACEAE（ヤナギ科）
Populus Hibrid
国　：パキスタン

データ採取地の立地環境

Summary. *In an earlier study (2) mean annual increment (MAI) of hybrid poplar (P x E Cv I — 214) was estimated to be 235 cft for a crop of age 6 years with the assumption that 700 trees per acre of the species were available at the above age, that is, planting was done with a spacing of 10′ x 6′, no thinning was done upto the age of 6 years and only 26 trees were lost on account of mortality and other factors upto this age This plantation was however not maintained properly, no soil cultivation was done and irrigation was erratic*

Since hybrid poplar had been tried in different plantations with varying spacings since 1970, sample plots were laid out to assess its growth performance Data were available for different spacings in each locality, therefore, the data were considered separately for determination of growth parameters for each locality and for each spacing Under proper management 6 years old crop with 10′ x 10′ spacing gives MAI of 400 cft or more, with 15′ x 15′ and 18′ x 18′ MAI is 200 cft to 320 cft per acre

Basic data. 24 sample plots laid in different plantations of the Punjab in 1976 and onwards with their annual measurements constitute the basic data. Details of sample plots are given in Table 1.

Method and material Annual measurements of all the sample plots were converted on unit area basis Volume of standing and thinned crops were calculated separately (1, 3) Total volume for different ages was obtained by adding cumulative yield of thinnings for previous years to the standing volume.

As the sample plots were laid out in hybrid poplar plantations raised under different spacings viz 10′ x 10′, 15′ x 15′ and 18′ x 18′ the growth statistics for one spacing differed widely from others To get an idea about growth parameters the measurements were grouped according to spacings Data grouped as above gave the following information

S No	Locality	Spacing	No of measurements	Age range (years)
1	Daphar	10′ x 10′	20	2—6
2	Daphar	15′ x 15′	3	4—6
3	Daphar	18′ x 18′	23	3—7
4	Changa Manga	15′ x 15′	3	3—5
5	Changa Manga	18′ x 18′	18	2—10
6	Bhaghat	10′ x 10′	3	4—6
7	Bhaghat	18′ x 18′	3	5—7
8	Bela Piran Ghaib	10′ x 10′	3	6—8
9	Bela Piran Ghaib	15′ x 15′	6	8—10
10	Bela Piran Ghaib	18′ x 18′	3	7—9
			85	

Growth parameters were obtained for each spacing and each age group on unit area basis. Table 2 and table 3 show the parameters in British and metric units respectively.

成長・収穫に関する表，図，式など

Table 2

Growth and yield of hybrid poplar (P x E I-214) in British units

Age years	No of measure ment	No of trees	dbh in	Ht ft	B A ft^2	Vol ft^3	Total No including thinned trees	Vol ft^3	MAI ft^3
				SPACING 10′ x 10′					
				DAPHAR					
2	4	448	2 6	24	15 14	772 86	448	772.86	386 43
3	4	444	3 8	34	36 92	1197 69	448	1197 81	399.27
4	4	442	4 8	46	59 33	1546 81	448	1552 21	388 05
5	4	417	5 5	53	69 36	1796 13	448	1877 08	375 42
6	4	417	6 3	60	92 50	2318 96	448	2399 91	399 99
				BELA PIRAN GHAIB					
6	1	417	8 0	73	146 25	2589 20	417	2589 20	431 53
7	1	417	8 2	78	154 58	2785 00	417	2785 00	397 86
8	1	417	8 4	85	159 17	2874 10	417	2874 10	359 26
				BHAGAT					
4	1	419	6 2	55	87 89	2153 07	419	2153 07	538 27
5	1	419	6 6	57	98 93	2427 00	419	2427 00	485.40
6	1	415	7 2	63	117 85	2924 07	419	2948 33	491.39
				SPACING 15′ x 15′					
				DAPHAR					
4	1	194	5 7	42	35 36	509 24	194	509 24	127 31
5	1	194	6 5	45	39 00	726 21	194	726 21	145 24
6	1	194	7 5	56	61 03	1243 48	194	1243 48	207 25
				BELA PIRAN GHAIB					
8	2	200	9 9	70	107 40	2019 20	200	2019 20	252 40
9	2	198	10 3	75	117 26	2360 50	200	2370 62	263 40
10	2	189	10 8	78	117 53	2554 35	200	2643 97	264 40
				CHANGA MANGA					
3	1	191	6 8	51	47 94	1315 81	191	1315 81	438 60
4	1	191	7 9	59	65 25	1889 44	191	1889 44	472 36
5	1	175	8 8	63	73 59	2004 28	191	2158 75	431 75
				SPACING 18′ x 18′					
				DAPHAR					
3	4	130	5 2	34	19 46	488 87	130	488 87	162 96
4	4	130	6 9	44	33 98	843 84	130	843 84	210 96
5	5	130	7 5	49	40 66	982 37	130	982 37	196 47
6	5	129	8 2	54	48.02	1230 74	130	1230.82	205.14
7	5	128	9 1	62	59 09	1559 17	130	1561 99	223.14
				BELA PIRAN GHAIB					
7	1	129	10 6	71	80 31	1626 90	129	1626.90	232 41
8	1	127	11 3	75	87 73	1814.40	129	1818 57	227 32
9	1	127	12 0	79	97.71	2053 10	129	2057.27	228.59
				BHAGAT					
5	1	130	9 0	56	59 32	1613 00	130	1613 00	322 60
6	1	130	9 6	63	66 79	1662 53	130	1662 53	277 09
7	1	130	10 5	65	77 94	2195 79	130	2195 79	313.68
				CHANGA MANGA					
2	1	134	4 8	31	17 83	501 06	134	501 06	250 53
3	1	128	6.2	42	27 56	751 08	134	770 12	256.71
4	2	128	7 4	50	38 32	1044.07	133	1062 69	265 67
5	2	132	8 2	56	49.15	1430 20	132	1430 20	286 04
6	3	132	9 3	61	63 72	1924 40	132	1927.99	321 33
7	2	134	9 8	66	71 48	2263 53	134	2263 53	323 36
8	2	125	9 5	70	62 77	1991 24	125	1991 24	248 90
9	3	126	10 9	78	83 77	2745 07	126	2745 07	305 01
10	2	122	11 5	84	91.65	2912 38	122	2912 38	291 24

Table 3

Growth and yield of hybrid poplar (P x E Cv I-214) in metric units

Age years	No of measure-ment	No of trees	dbh cm	Ht. m	B.A. m^2	Vol. m^3	Total No. including thinned trees	Vol m^3	MAI m^3
				SPACING 3 x 3 m					
				DAPHAR					
2	4	1107	6.6	7 3	3.476	54.079	1107	54.079	27.040
3	4	1097	9 6	10.4	8 476	83.806	1107	83.814	27.938
4	4	1092	12 2	14 0	13 620	108.235	1107	108.613	27.153
5	4	1030	14 0	16 1	15.923	126.681	1107	131.345	26.269
6	4	1030	16 0	18 3	21 235	162.265	1107	167.929	27.988
				BELA PIRAN GHAIB					
6	1	1030	20.3	22.2	33.574	181.174	1030	181.174	30.195
7	1	1030	20.8	23.8	35.487	194.875	1030	194 875	27.839
8	1	1030	21.3	25.9	36.540	201.109	1030	201 109	25.138
				BHAGAT					
4	1	1035	15.7	16.8	20.177	150.657	1035	150.657	37.664
5	1	1035	16.8	17.4	22.711	169.824	1035	169.824	33.965
6	1	1025	18 3	19.2	27.055	204.606	1035	206.303	34.384
				SPACING 5m x 5m					
				DAPHAR					
4	1	479	14 5	12.8	8 118	35.633	479	35.633	8.908
5	1	479	16 5	13 7	8.953	50.815	479	50 815	10.163
6	1	479	19.0	17.1	14 011	87.010	479	87.010	14 502
				BELA PIRAN GHAIB					
8	2	494	25.1	21 3	24 656	141.289	494	141 289	17.661
9	2	489	26 2	22 9	26 919	165.171	494	165.879	18 431
10	2	467	27 4	23 8	26 981	178.735	494	185.006	18.501
				CHANGA MANGA					
3	1	472	17 3	15 5	11.005	92 071	472	92.071	30 690
4	1	472	20 1	18 0	14 979	132 210	472	132 210	33 052
5	1	432	22 3	19 2	16 894	140 245	472	151 054	30 211
				SPACING 6m x 6m					
				DAPHAR					
3	4	321	13 2	10.4	4.467	34 208	321	34.208	11.403
4	4	321	17.5	13 4	7 801	59.046	321	59.046	14 761
5	5	321	19 0	14 9	9 334	68 739	321	68.739	13 748
6	5	319	20.8	16 5	11 024	86 119	321	86 124	14 354
7	5	316	23 1	18 9	13.565	109.010	321	109 297	15 614
				BELA PIRAN GHAIB					
7	1	319	26 9	21 6	18 437	113.839	319	113 839	16 262
8	1	314	28 7	22 9	20.140	126 959	319	127.251	15 906
9	1	314	30 5	24.1	22 431	143.662	319	143.953	15 995
				BHAGAT					
5	1	321	22 9	17.1	13 618	112.866	321	112 866	22 573
6	1	321	24.4	19.2	15.333	116 332	321	116.332	19 389
7	1	321	26 7	19 8	17.892	153 646	321	153.646	21 949
				CHANGA MANGA					
2	1	331	12 2	9 4	4 093	35.061	331	35 061	17 530
3	1	316	15 7	12 8	6.327	52 555	331	53 888	17 963
4	2	316	18 8	15.2	8.797	73 057	329	74.360	18.590
5	2	326	20 8	17 1	11 283	100 075	326	100 075	20 015
6	3	326	23 6	18.6	14.628	134 656	326	134 907	22 484
7	2	331	24 9	20.1	16 409	158 386	331	158 386	22 626
8	2	309	24.1	21 3	14.410	139 333	309	139 333	17.416
9	3	311	27 7	23 8	19.231	192.081	311	192 081	21.342
10	2	301	29.2	25.6	21.040	203.788	301	203 788	20.379

FIG 1 MEAN ANNUAL INCREMENT (MAI) OF POPLAR (PXE CV/I-214) PLANTED AT 10'x10' (3M x 3M) SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB

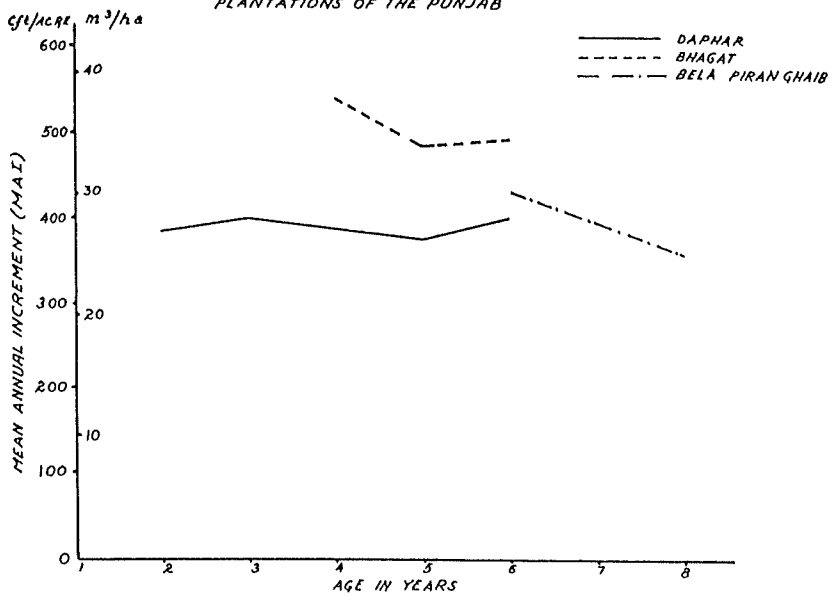


FIG 2 MEAN ANNUAL INCREMENT (MAI) OF POPLAR (PXE CV/I - 214) PLANTED AT 15'x15' (5M x 5M) SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB

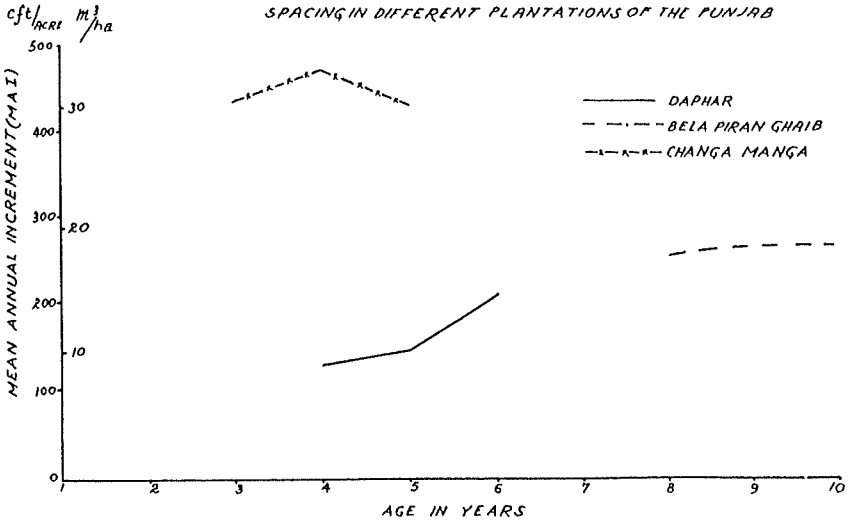


FIG 3 MEAN ANNUAL INCREMENT (MAI) OF POPLAR (PXE CV I-214) PLANTED AT 18'x18' (6M x 6M) SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB

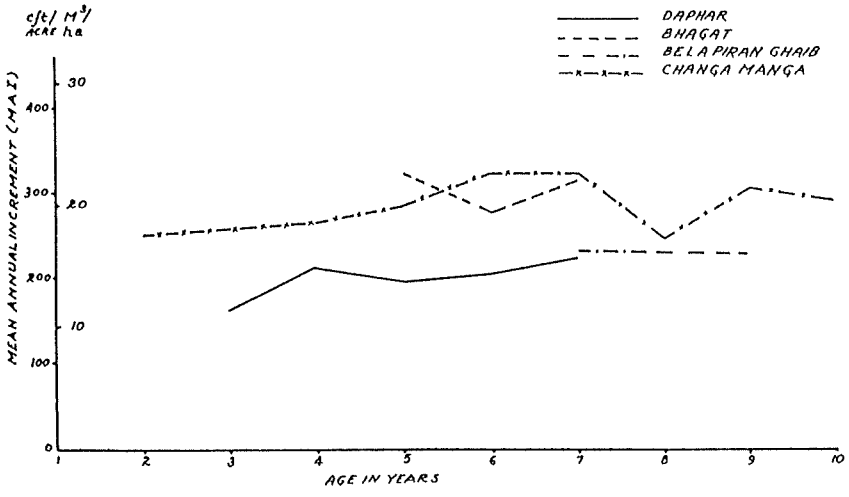


FIG. 4 DIAMETER BREAST HEIGHT (DBH) AGAINST AGE OF POPLAR (PxE CV/ I-214) PLANTED AT 10'x10' (3m x 3m) SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB

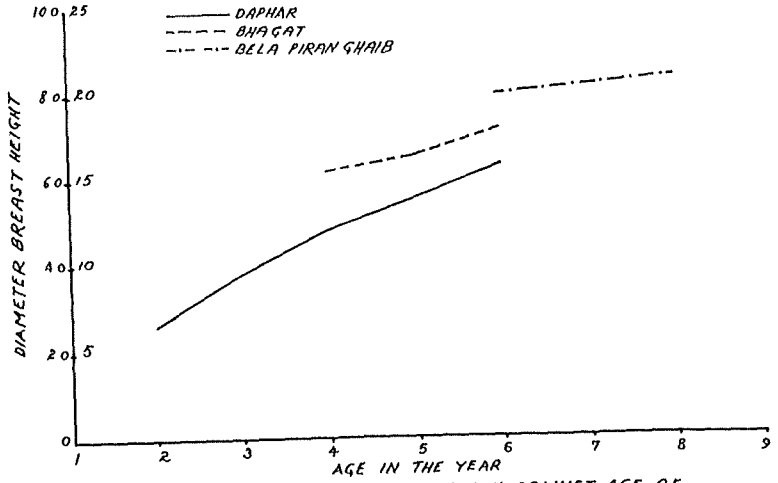


FIG. 5 DIAMETER BREAST HEIGHT (DBH) AGAINST AGE OF POPLAR (PxE CV/- I-214) PLANTED AT 15'x 15' (5m x 5m) SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB

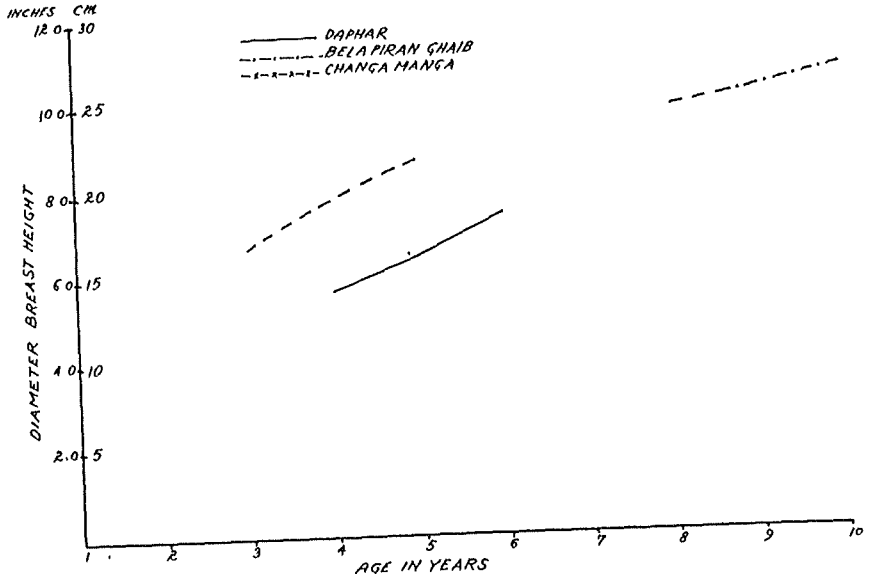


FIG 6. DIAMETER BREAST HEIGHT (DBH) AGAINST AGE OF POPLAR (PxE CV I-214) PLANTED AT 18'x 18' (6m x 6m.) SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB

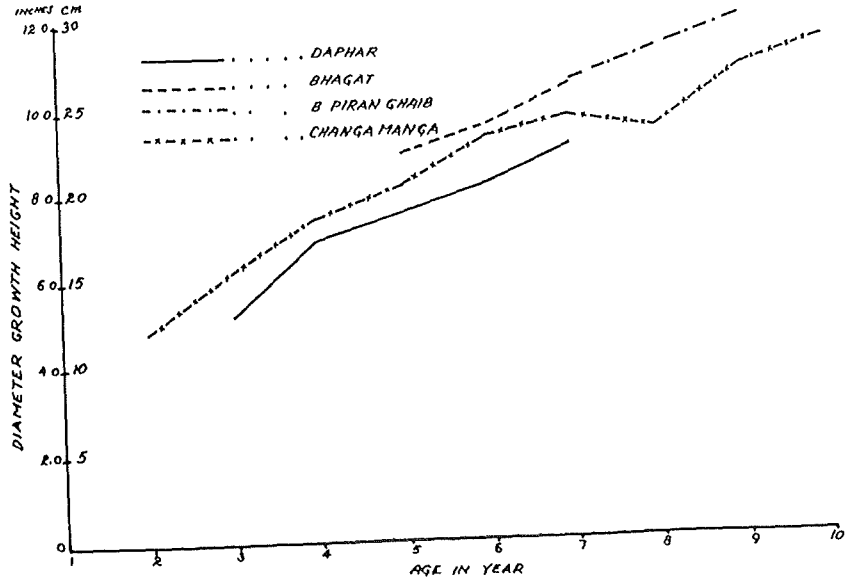


FIG 7- HEIGHT AGAINST AGE OF POPLAR (PxE CV I-214) PLANTED AT 10'x10' (3m x 3m) SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB

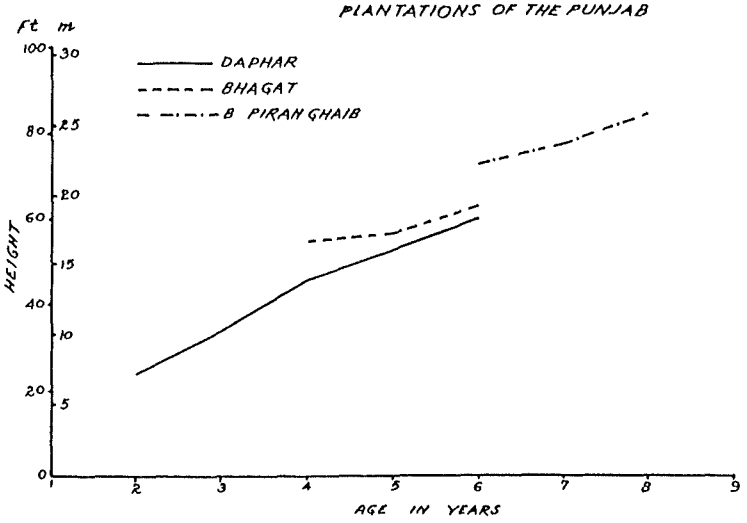


FIG 8 HEIGHT AGAINST AGE OF POPLAR (PxE CV I-214) PLANTED AT 15'x15' (5m x 5m) SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB

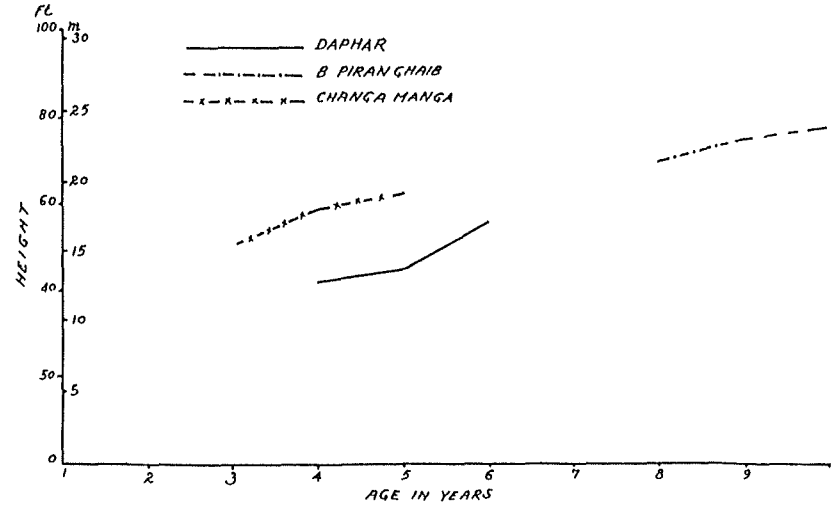
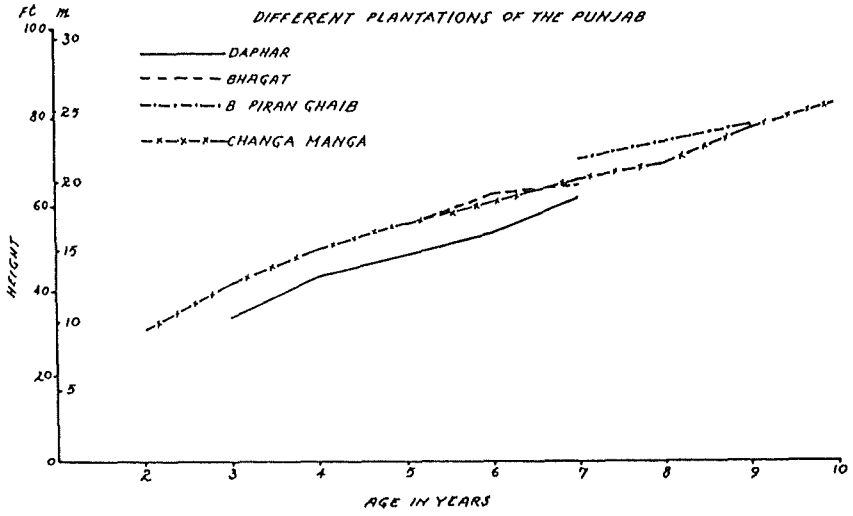


FIG 9 HEIGHT AGAINST AGE OF POPLAR (PxE CV I-214) PLANTED AT 18'x18' (6m x 6m) SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB



出典

Hussain, R W , Sheikh, M I (1981). Provisional Yield Table of Hyblid Poplars in Pakistan, The Pakistan of Forestry, October 1978, 165-184

樹種：PROTEACEAE（ヤマモガシ科）
Grevillea pteridifolia （Syn. *G. banksii* バンクスハゴロモノキ）
国　：インド

データ採取地の立地環境

Nursery technique

The seeds collected in April are sown in the nursery bed in the month of October. Before sowing, seeds are soaked in plain water for 24 hours The germination percentage is very high (70–80 per cent). Germination is completed in 25–30 days when two-leaved tiny plants, measuring about 2–3 cm appear in the bed. These plants are then pricked out and transplanted in the polythene bags (10 cm×23 cm) filled with potting mixture of soil, sand and cow-dung manure (4 : 2 : 1). These plants are ready for planting in the month of June-July when they have 10–15 cm height and 7–8 leaves.

Planting technique

So far, State Forest Research Institute has tried *Grevillea pteridifolia* on bauxite and coal mined out dumps and on the site having yellow clayey soil The planting technique in the case of bauxite mined out areas and coal-mine overburdens included digging of pits of 45 cm^3 size, filling these up with local soil (in the lower half of the pit) and mixture of humus rich sal (*Shorea robusta*) forest soil and 3 kg cow-dung manure, in the upper half of the pit Polypotted plants which are 7–8 months old are planted in these pits in the month of July.

成長・収穫に関する表，図，式など

Table 1
Growth parameters of Grevillea pteridifolia
(Year of plantation—1979)

Age (years)	Survival per cent of plants	Average Height (cm)	Average G B H. (cm)	M A I	
				Height (cm)	G B.H. (cm)
0	100	7	*	—	—
½	99	27	—	54	—
1½	98	162	—	103 3	—
2½	96	220	—	85 2	—
3½	96	419	—	117 7	—
4½	94	487	17 8	1(6 7	3.95
5½	94	501	—	89 8	Not measured
6½	94	571	19.8	86.8	3 05

* Diameter below 5 cm not recorded

出典

Prasad, Ram and S.K. Chadhar (1987). Grevillea pteridifolia (SYN. Grevillea banksii) A Successful Introduction to Mined Out Areas of Madhya Pradesh - I Botanical Characterristics. Indian For., 113 : 670 -674.

樹種：DIPTEROCARPACEAE（フタバガキ科）
Dipterocarpus baudii（タルインヅル）
国：マレーシア
Peninsular Malaysia

データ採取地の立地環境

STUDY AREA

The study area (Sample Plot No. 80), having an area of about 0.28 *ha* and an elevation of about 85 *m* a.s.l., is located within Field 12D of FRIM's compound. Planting ofraised seedlings of *D. baudii* was carried out in 1936 at a 2 x 2 *m* spacing and under light overhead canopy conditions. In 1954, the first measurement was made on all trees 10 *cm* dbh and above. Measurements of diameter, total height and clear bole height were made.

Weeding was carried out annually from 1936 - 1940 and in 1946. A thinning operation was carried out in 1956 where all trees 10 *cm* dbh and above other than *D. baudii* were removed.

成長・収穫に関する表，図，式など

Table 1. Frequency distribution by size class of all D. baudii trees of >10 cm dbh

Size Class, (cm dbh)	Age (Years) 18	22	26	28	31	52
	(number of trees/ha)					
10<15	43.5	33.4	33.4	33.4	33.4	13.5
15<20	50.2	40.1	40.1	33.4	30.1	20.1
20<25	63.5	46.8	33.4	36.8	20.1	20.1
25<30	50.2	63.5	50.2	30.1	16.7	13.4
30<35	36.8	26.7	36.8	56.8	30.1	10.0
35<40	10.0	40.1	43.5	23.4	36.8	10.0
40<45		13.4	20.1	40.1	30.1	46.8
45<50			20.1	16.7	13.4	20.1
50<55				6.7	23.4	10.0
55<60						20.1
60<65						20.1
65<70						3.3
Total	254.2	264.0	277.6	277.4	234.1	197.5
Diam. increment cm/y		0.69	0.83	0.53	1.21	0.24
Vol. (m^3 /tree)	0.32	0.50	0.68	0.72	0.96	1.91

Table 2. Volume distribution, (m^3/ha) by size class of trees of 20 cm dbh and larger

Size Class, cm DBH.	Age (Years) 18	22	26	28	31	52
	(volume, cu.m/ha)					
20<25	13.37	9.38	5.55	7.08	2.88	4.87
25<30	27.61	33.70	29.30	17.81	9.98	2.43
30<35	29.97	22.31	30.35	47.59	25.61	15.17
35<40	10.63	45.39	50.79	24.80	42.46	7.60
40<45		20.87	30.45	60.04	48.32	78.02
45<50			42.32	25.62	30.01	47.68
50<55				17.62	65.51	41.09
55<60						67.41
60<65						94.07
65<70						18.65
Total	81.58	131.65	188.76	200.56	224.77	376.99
Volume increment (m^3/ha/y)		12.52	14.28	5.90	8.07	7.25

出典

Mohamad, Borhan and Abdul Rahman Kassim (1989). Tree growth and yield of Dipterocarpus baudii under plantation in the Forest Research Institute Malaysia (FRIM), Peninsular Malaysia Growth and yield in tropical mixed/moist forests (1989) Kuala Lumpur, Malaysia.

樹種：DIPTEROCARPACEAE（フタバガキ科）
Shorea robusta（サール）
国：インド

データ採取地の立地環境

Artificial planting of *Shorea robusta (sal)* by *taungya* method is very old The oldest known *sal* platantion was raised in 1922 by this method in West Lehra Compartment Number 11 of Pharendra Range So far 64 6 per cent areas of *sal* forests in southern ranges and 27.6 per cent in northern ranges have been cultivated by this method Forests of northern ranges remain cut off during rains They are managed on longer rotation of 90 years to produce large sized timber, and hence rate of conversion into plantation is slow. Rotation in southern ranges is 75 years the object of management being production of fuelwood, poles and small sized timber

Sal in *taungya* origin crop forms almost pure stand with very little mixture of miscellaneous species like *asna, jamun* etc In *sal taungya* the practice has been to sow *jamun* along nalas and use teak shoots to beat up failures in *sal* lines and at abandoned dwelling places of cultivators prior to shifting to new planting areas The admixture of teak done in this way is visible in varying proportions generally not exceeding 10%.

A brief description of *taungya* technique adopted to raise *sal* plantations is as under—

After contractor has removed saleable produce and left the coupe, about the end of April, the land is distributed amongst *taungya* cultivators Each cultivator generally gets 0.1 ha each year with an overall total of 0 4 ha in different years of *sal taungya* A cattle proof fence consisting of 4 to 5 strands of barbed wire is usually erected round the coupe by forest department Free cultivation of agricultural crops is allowed for one year, comprising of *Kharif* and one *Rabi* crop *Kharif* crop usually consists of maize in southern ranges and paddy in the northern ranges, whereas *Rabi* crop consists of wheat and barley in the southern ranges and barley, *Lahi* and gram in northern ranges Soil preparation in lines is done during May It consists of digging trenches 3 m apart and 36 cm × 48 cm in cross section. The exavated soil is then spread for aeration. After a good premonsoon shower the trenches, are filled in with excavated soil in such a way that the level of the filled in trenches is at least 10 cm to 15 cm above ground level. *Sal* seed is sown, with one lines 6-8 cm deep and another line 2-2.5 cm deep, seeds being placed on their sides touching each others wings After the *sal* sowings, the cultivators sow their *kharif* crop Three weedings and cleanings are done in the monsoon, during which period casualties are also beaten up. After harvesting the *rabi* crop in the second year, trenches are again dug in any large failed gaps and *sal* is sown on the onset of monsoon in the same manner as in the first year. Small blanks are filled with other valuable species. Three weedings and cleanings are also done in the monsoon in the second and third year during which period casualties continue to be beaten up *Arhar* is sown in the fourth year of cultivation when the *sal* plants are in their third year This helps to protect the plants from frost, improves the soil, and is left to go on growing for a year more after the cultivators leave in order to keep down grass Cultivators leave the coupe after harvesting their fourth *rabi* crop when the sal plants are completing their third year of age.

成長・収穫に関する表，図，式など

Sal crops so raised are thinned at the age of 4, 7, 10, 15 20, 25, 30, 35, 40 years and thereafter at ten years interval. The space between lines 3 m apart takes about 10 to 15 years to get covered. The soil remains exposed to desiccation by sun. To mitigate this effect and to get some return planting of inter spaces in 5th year by leguminous tree species to be harvested at short rotation is advocated.

Stands which are 20 years old and above have closed canopy. The visual variation in growth in crops of different ages is not striking Number of trees retained per hectare differ widely within same age group.

Age (Years)	Mean number of trees/ha	Standard deviation
40	978	363
31-40	1228	612
21-30	1389	605
16-20	2142	954

The following gives an idea of variation in age and crop diameter of *sal taungya* crop—

	Mean	Standard deviation
Age (Years)	25 7	9 9
Crop diameter (cm)	13.11	4 71

At the time of revision of Working Plan of Gorakhpur Forest Division during 1972-74, a scheme of 5% sampling by lines with two random start was followed in *taungya* coupes so as to give two independent samples of enumerations of $2\frac{1}{2}$% intensity Growing stock was enumerated in 0-5 cm, 5-10 cm, 10-15 cm, 15-20 cm 20-30 cm 30-40 cm, 40-50 cm and 50-60 cm diameter classes Thus for each coupe crop diameter, basal area and number of trees/ha is known with reasonable accuracy Further measurement of crop diameter and crop height in regenerated *sal* coupes by *taungya* method showed the following relationship—

Average diameter (Basal area method (cm)	Average height (m)
5.0	4 6
10.0	10 8
15.0	18 0
20.0	23 0
25 0	26 5

These measurements from the basis of growth and yield study of *sal taungya* plantation, because sample plots for repeated measurements to study growth do not exist. Measurement of 221 coupes are utilised They do not include coupes where thinning fellings were in progress. Plantation having proportion of *sal* less than 70% have also been ignored and in calculating per hectare values, plantation area is reduced according to % of density.

Age of coupes	Number of coupes (plantation)
40	6
31-35	44
26-30	36
21-25	33
16-20	16
15	51
	221

The following two regressions were developed—

(1) $\text{Log}\frac{PN}{100} = \frac{1.98019}{\log (T+10)} - .16295$

$R^2 = 230$ Where PN is number of trees/ha

$F = 65.25$ T = Age of the stand

A low value of Determination Coefficient was expected on account of marked variation in number of trees/ha for same age. It implies that thinning intensity has been variable probably being governed by the discretion of marking officer rather than any fixed norms for thinnings.

The regression however, provides a trend of relative reduction in number of trees per hactare with the passage of time.

Table showing number of trees per hectare for curve trends yielding 600, 1000, and 1400 trees/ha at 40 years of age is prepared with the help of common slope model, for which basic equation becomes

$$\text{Log}\frac{PN}{100} = \frac{1.98019}{\text{Log}\,(T+10)} - a_1$$

$$\text{Where } a_1 = \frac{1.98019}{\text{Log}\,(40+10)} - \text{Log}\frac{N'}{100} \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

N′ being number of trees/ha at 40 years of age

Table

Number of trees/ha (common slope model)

Level of stocking at 40 years (No. of trees)		Age in years							
		10	15	20	25	30	35	40	50
600	No. of trees/ha	1363	1069	914	785	706	646	600	532
1000	No. of trees/ha	2272	1782	1524	1309	1176	1077	1000	887
1400	No of trees/ha	3181	2495	2134	1832	1647	1508	1400	1242

Curve trends are parallel to each other, thus the reduction in number of tree in time may be taken corresponding to different intensity of thinnings.

(2) An estimate of crop diameter (D) is obtained by

$$\text{In } D = 16.04784 - \frac{18.37607}{T^{0.1}} - 2.97191 \text{ In}\left(\frac{PN}{100}\right) + 4.31303 \text{ In}\frac{\left(\frac{PN}{100}\right)}{T^{0.1}} - .11934 \text{ In}\frac{\left(\frac{PN2}{100}\right)}{T^{0.1}}$$

T—value for regression coefficients 7.703 5.103 4.744 3.390

R^2 (for In D regression) = 821

$$\text{Mean of residual } \% \left(\frac{D-\hat{D}}{\hat{D}} \times 100\right) / N = 1.29$$

Standard deviation of residual % = 15.33 Where $\hat{D}$ is estimate of D

In all a number of independent variables were used, but the above were found to contribute significantly. The index value of age (T) was determined by iterative method. Crop diameter is influenced by fluctuations in thinning intensity over growth period. Further single point data collected at the time of working plan preparation and not successive measurements information forms the basis of this study, which has inherent limitations Considering these aspects, the values of mean and standard deviation of residual % are reasonably good. The following table gives the movement of crop diameter for different stocking levels.

Table

Crop diameter in cm

Level of stocking at 40 years (No. of trees) per/ha	Age in years							
	10	15	20	25	30	35	40	50
600	7 32	9 71	12.10	14.57	17.06	19.56	22 09	27.20
1000	6.99	8 95	10 86	12 86	14.78	16.74	18 68	22 57
1400	6.60	8.26	9.80	11 55	13.15	14.76	16.35	19 47

It would be seen that crop diameter, with increase in stocking, shows a decrease, which is a natural trend

To obtain growing stock of forests and thinning yields, additional knowledge of crop form factor and (ii) ratios between number of trees/ha after and before thinnings to volume/ha after and before thinnings at various ages is required. The growth of young *sal taungya* crops of Gorakhpur corresponds to II quality *sal* yield tables prepared by Griffith & Sant Ram for natural forests Thus above two growth informations have been taken from these tables for computation of growth and yield of *sal taungyas* The growth inforrmation may not be very precise but definitely would indicate the relative growth trends under different level of stocking.

Table

Form factor and number—volume ratio table

	Age in years							
	10	15	20	25	30	35	40	50
From factor for crop volume upto 5 cm bole diameter limit (i.e. total stem volume)	.451	.480	.460	.446	.442	.436	430	414
Number-volume ratio increase $T = \left(\frac{N'/N}{V'/V} - N'/N\right)$	.045	055	088	1.6	125	.140	.152	.164

Where N′ and N are number of trees and V′ and V are volume/ha after and before thinnings respectively.

The value of T helps in evaluating crop volume/ha after thinnings

$$V' = \frac{V}{T\ \frac{N}{N'} + 1}$$

Crop volume/ha after thinnings was then utilised to estimate, total yield and M A I. for different stocking levels (See Annexure I, II, & III).

Annexure I

Growth and yields information

Level of stocking at 40 years-600 trees/ha

Age (Yrs)	Crop diameter (cms)	Crop height (m)	No. of trees/ha	Crop standing volume/ha before thinning (m^3)	Thinnings (m^3)	Cumulative thinnings (m^3)	Total yield/ha (m^3)	M A I. (m^3)
10	7 32	7.4	1383	19.15	1 04	1 04	19 15	1.915
15	9.71	10.6	1069	40 29	2 43	3 47	41.33	2 55
20	12.10	14.3	914	69.16	3.43	9 90	72 63	3 632
25	14 57	17 4	785	101 61	11 61	21 51	111 51	4 460
30	17 06	20 2	706	144.05	17 32	38 83	165 66	5 522
35	19 56	22 5	646	190.50	24 95	63 78	229.33	6 552
40	22 09	24 6	600	243.34	35 61	99 39	367.12	7 678
50	27 20	26.3	532	336.72	—	—	436.11	8 722

Annexure II

Growth and yields information

Level of stocking at 40 years-1000 trees/ha

Age (Yrs)	Crop diameter (cms)	Crop height (m)	No. of trees/ha	Crop standing volume/ha before thinning (m^3)	Thinnings (m^3)	Cumulative thinnings (m^3)	Total yield/ha (m^3)	M A I. (m^3)
10	6.99	7 1	2272	27 93	1.52	1 52	27.93	2 793
15	8 95	9 5	1782	51.14	3.09	4 61	52.66	3 511
20	10.86	12.3	1524	79.90	7.43	12 04	84.51	4.226
25	12 86	15 3	1309	116 07	13 27	25 31	128 11	5 124
30	14 78	17 6	1176	157.02	18.87	44 18	182 33	6 078
35	16.74	19 9	1076	295.55	26.90	71.08	249.73	7 135
40	18 68	21.7	1000	255.83	37 43	108 51	326 91	8.173
50	22.57	25.0	887	367.44	—	—	475 95	9 514

Annexure III

Growth and yields information

Level of stocking at 40 years-1400 trees/ha

Age (Yrs.)	Crop diameter (cms)	Crop height (m)	No. of trees/ha	Crop standing volume/ha before thinning (m^3)	Thinnings (m^3)	Cumulative thinnings (m^3)	Total yield/ha (m^3)	M A.I. (m^3)
10	6.60	6·5	3181	31.92	1.73	1.73	31 92	3 192
15	8.26	8.6	2495	55.21	3.34	5.07	56 94	3 796
20	9.80	10.7	2134	79.26	7 37	12 44	84.33	4 217
25	11.55	13.3	1832	113.90	13.01	25.45	126 34	5 054
30	13.15	15.5	1647	153.31	18.41	43.86	178.76	5.959
35	14.76	17.6	1508	198.08	25.96	69.82	241.94	6 913
40	16.35	19 4	1400	245.30	35 89	105.71	315.12	7.878
50	19.47	22.4	1242	343 06	—	—	448.77	8 975

出典

Singh, S.P (1980). Growth and yield of (*Shorea robusta*) Sal in taungya plantations of Gorakhpur Forest Division. Indian For., 106 : 474-481.

樹種：DIPTEROCARPACEAE（フタバガキ科）
Shorea spp.（メランチ）
国　：マレーシア
Sarawak, Malaysia

データ採取地の立地環境

Materials and methods

The Engkabang plots were established in Semengoh Plantation forest within the confines of Semengoh Forest Reserve, 19 km south of Kuching. The plantation was established by the Sarawak Forest Department during the period 1927 - 1940. These plots were measured at frequent intervals (Table 1). Maintenance in the form of removing overtopping or competing trees by felling or girdling (with or without poison), thinning and clearing of weed species and climber cutting at ground level were applied to these plots. The site of all the plots is in the riverine pan of Sungai Semengoh with alluvial soil. Sample Plots 4B and 4C, both planted with Engkabang bintang (*Shorea splendida*), have already been described in the second paper of this series for plots treated with Improvement Felling (Primack *et al.*, 1987).

One of the problems faced during the analysis of these old plots is that we could only gather the available data kept by the Sarawak Forest Department. Unfortunately, some of the record books were lost. For example, there was missing information to explain why Sample Plots 4B and 8C, which were Improvement Felling plots, were later converted to plantations plots with different code numbers. Also, the measurement record for Sample Plot 10 could not be located, and Sample plot 8C only has measurement records for the juvenile stage (0 to 19 years old).

The records describing these plantation plots are fragmentary. Often there is no explanation as to why the plots were established. Details of plot maintenance are usually not given. For example, the terms "Improvement Felling", "removal of overtopping trees" and "thinning" were used in the record book to describe the types of maintenance/treatments given to the plantation. These terms are in most cases very ambiguous; "Improvement Felling" may mean "removal of overtopping trees" of other species or of the planted trees, in which case, "thinning" is more approprite. "Improvement Felling" should therefore be restricted to primary forest only and not to plantations in order to avoid confusion. In this report, the authors have changed the term "Improvement Felling" to "removal of overtopping/competing trees" or "thinning" where appropriate.

Growth rates for the various plots are evaluated based on the available records of measurement as tabulated below:

成長・収穫に関する表，図，式など

Sample Plot	Available growth measurement (year)
4B	1969, 1972, 1973, 1974
4C	1969, 1972, 1973, 1974
5C	1969, 1972, 1973, 1974
7C	1969, 1974
9	1972, 1973
12	1969, 1972, 1973, 1974
13	1969, 1972, 1973, 1974
14	1969, 1972, 1973, 1974

All work on the Sample Plots ceased during the war years from 1942 — 45, and all the plots were totally neglected during this period.

The results are all presented as mean annual diameter increments (cm/year). The girth of trees (gbh) was taken at breaset height (1.3 m) during the first measurement and on the same point for subsequent measurements. In some cases measurements were taken at a higher point if the tree had buttresses. Girth is assumed to be zero during establishment to enable calculation of growth figures. All results are presented as diameter increase per year (cm/year). Analysis of variance was conducted to find out if there are any significant differences among the growth rates of various plots (Snedecor and Cochran, 1973). T-tests were used to determine which plots are different from the others if the former test proved significant.

Table 1. Summary of plantation data on *Shorea* species growing at Semengoh Plantation Reserve.

Plot and Species	No. of Stems per ha.	Deci. yr. of Estab.	Deci. yr. last Assessm.	Deci. age last Assessm.	Sample Size	MADI (cm)	Average Dimeter (cm) Establishment to last Assessment			Basal Area (m^2/ha)
							Overall	5 largest	5 smallest	
4B *S. splendida*	272.7	1926.15	1974.97	48.62	30	0.72	34.86	45.54	25.24	26.03
9 *S. splendida*	88.8	1936.88	1973.88	37.00	120	0.86	31.62	51.60	19.60	6.97
13 *S. splendida*	137.0	1940.50	1974.86	34.36	111	1.10	34.75	50.42	21.17	12.99
4C *S. hemsleyana*	40.2	1935.50	1974.87	39.37	85	0.83	32.71	50.42	21.17	12.99
5C *S. pinanga*	119.8	1935.50	1974.87	39.37	96	0.80	31.35	48.99	19.21	9.25
7C *S. macrophylla*	74.1	1936.29	1974.29	37.86	120	1.22	46.10	74.82	21.79	12.37
12 *S. palembanica*	76.5	1940.50	1974.86	34.36	60	0.95	32.56	48.44	38.62	6.37
14 *S. stenoptera*	139.2	1940.50	1974.87	34.37	132	0.87	29.78	40.47	19.67	9.70

Note: Listed are plot, number and species, number of stems per hectare, decimal year of plot establishment, decimal year of last assessment, decimal age of last assessment, sample size (number of trees measured), mean annual diameter increment (MADI) from establishment to last assessment, average diameter at last assessment for all of the trees, the five largest trees and the five smallest trees, and the basal are of trees (m^2/ha) at the date of last assessment. The average growth rate for each size category of trees can be obtained by dividing average diameter by their decimal age.

Table 2. Mean annual diameter increments (MADI) for Shorea trees growing at Semengoh Plantation Reserve.

Plot and species	Establ. to 1969	1969 to 1972	1972 to 1973	1973 to 1974	1969 to 1974
4B *S. splendida*	0.73 (0.15)	0.56 (0.26)	0.36 (0.33)	0.78 (0.42	0.56 (0.27)
9 *S. splendida*	—	0.86* (0.21)	0.61 (0.49)	—	—
13 *S. splendida*	1.04 (0.22)	0.82 (0.30)	0.63 (0.47)	1.28 (0.57)	0.87 (0.32)
4C *S. hemsleyana*	0 84 (0.14)	.0.91 (0.28)	0.84 (0.38)	0.38 (0.23)	0.79 (0.25)
5C *S. pinanga*	0.79 (0.19)	0.93 (0.32)	0.48 (0.37)	0.84 (0.54)	0.82 (0.29)
7C *S. macrophylla*	1.29 (0.41)	—	—	—	0 84 (0.59)
12 *S. palembanica*	0.93 (0.21)	1.01 (0.48)	0.73 (0.43)	1.48 (0.67)	1.04 (0.43)
14 *S. stenoptera*	0.83 (0.15)	1.08 (0.41)	1.02 (0.42)	1.17 (0.43)	1.09 (0.31)

* MADI based on growth period between establishment and 1972

Note: Listed for each plot number and species are MADI for successive measurement intervals. Standard deviations are in parentheses. Sample sizes and plot data are in Table 1.

Figure 1. Frequency distribution of mean annual diameter increments for 120 trees of Shorea macrophylla (Plot 7C) from 1969-1974.

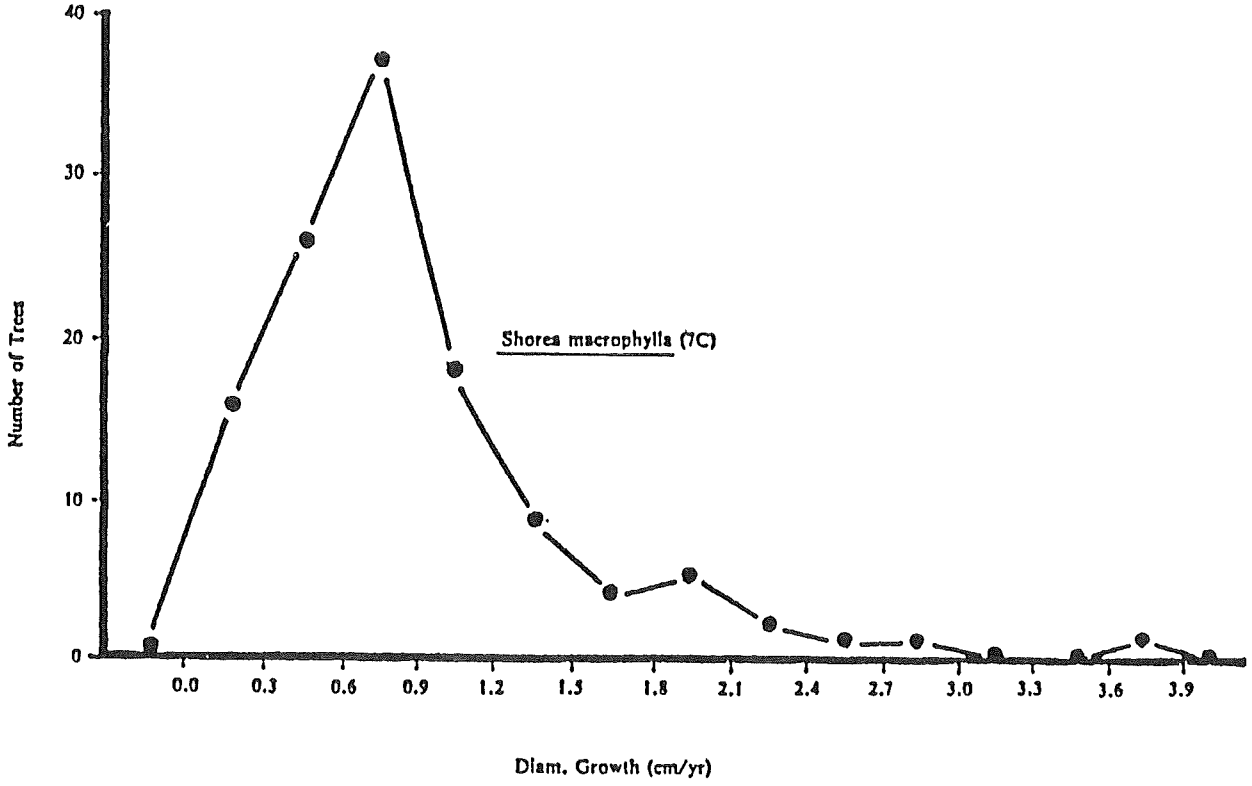


Figure 2. Frequency distribution of mean annual diameter increments for 96 trees of S. pinanga (Plot 5C, triangles), 111 trees of S. splendida (Plot 13, boxes) and 132 trees of S. stenoptera (Plot 14, circles) from 1969-1974.

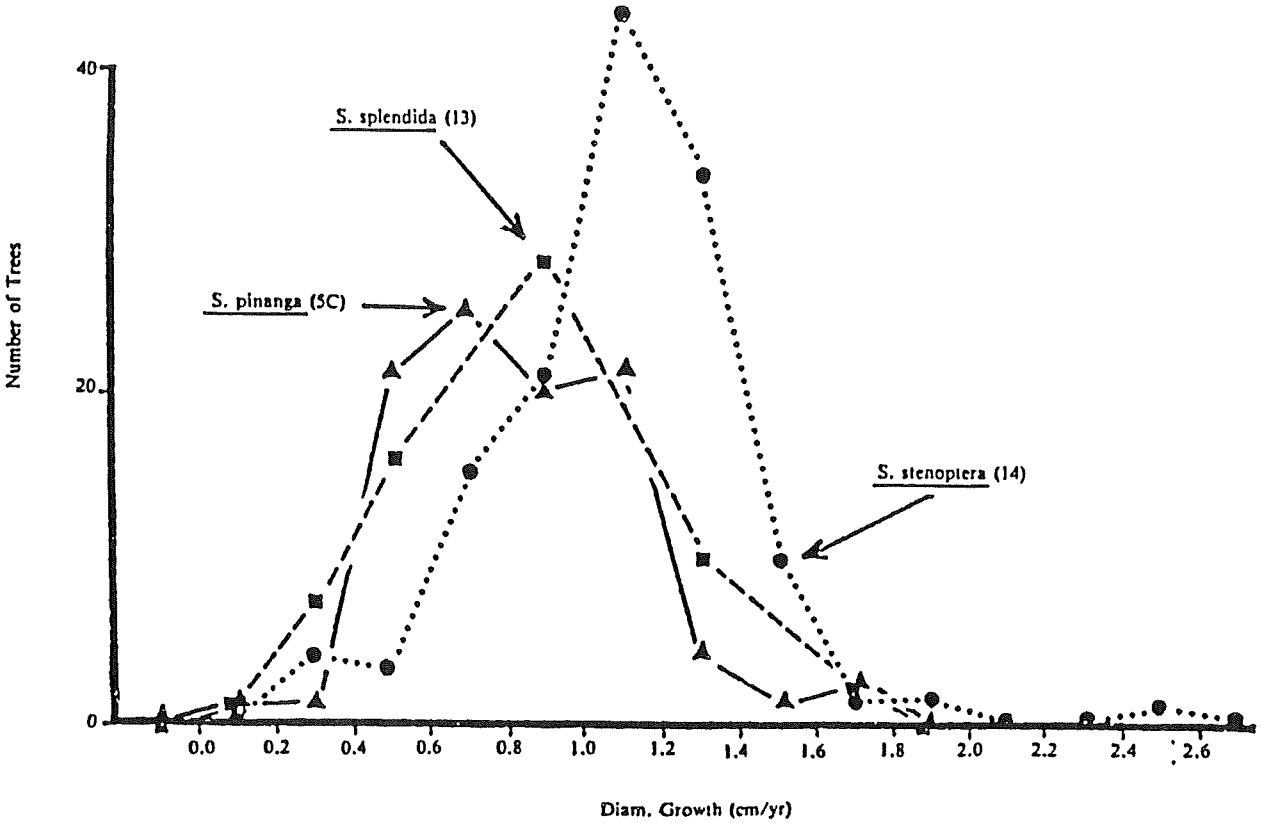


Table 3. The mean annual diameter increment for the minimal, maximal and median growth rates (cm/year) of Shorea species for primary forests*, Improvement Feeling primary forests+ and plantations.

Mean annual diameter increment (cm/year)	Primary Forest (spp. beneath)	Improvement Felling Primary Forest (spp. beneath)	Plantation (spp. beneath)
Minimum	0.13 *S cuspidata*	0.16 *S. scrobiculata*	0.80 *S. pinanga*
Maximum	0.82 *S. hopeifolia*	0.93 *S. splendida*	1.22 *S. macrophylla*
Median	0.30 *S. ovata*	0.43 *S. parvifolia*	0.86 *S. splendida*

* Data from Primack *et al.*, (1987a).
\+ Data from Primack *et al.*, (1987b).

Table 4. Mean annual diameter increments (cm/year) of the five fastest-growing Shorea trees from primary forest, Improvement Felling primary forest, and plantation.

	Primary Forest	Improvement Felling	Plantation
	0.39	0.63	0.94
	0.55	1.51	1.40
	0.56	0.97	1.46
	0.47	0.76	1.16
		0.28	1.25
		0.34	1.98
			1.41
			1.18
$\bar{x}$	0.49	0.75	1.35

Note: Each value represents the mean value for a species.

出典

Tan, S.S., Primack, R.B., Chai, E.O.K. and Lee, H.S. (1987). The silviculture of dipterocarp trees in Sarawak, Malaysia. Ⅲ. Plantation forest Malaysian Forester, Vol. 50, No. 2 · 148-161.

樹種：HAMAMELIDACEAE（マンサク科）
Altingia excelsa（ラサマラ）
国：インドネシア

データ採取地の立地環境

2. Altingia ~~ex~~c elsa Noronhae
(RASAMALA)

Data.

Lokasi	Jumlah petak coba/ ukur	Jumlah pemeriksaan	Tinggi dari muka laut	Keadaan lapangan/tanah
Bandung Utara	10	20	1500	Rata dan sedikit miring
Bandung Selatan	6	6	1350	
Garut	3	15	1300	
Priangan Tengah	5	10	1500	
Priangan Barat	45	178	700-1000	
Jumlah:	69	229		

成長・収穫に関する表，図，式など

Umur (Age) (Tahun/Year)	Peninggi (Upper-height) (m)	TEGAKAN TETAP (MAIN STAND) (T.T.) Jumlah pohon/ha (Number of trees/ha) (N)	S %	Rata-rata tinggi (Average height) (m)	Rata-rata diameter (Average diameter) (cm)	Bidang dasar/ha (Basal area/ha) (m^2)	V.kayu tebal/ha (Thick-wood/ha (m3)	Tegakan penjarangan (T P) (Thinnings) V.kayu tebal/ha (Thick-wood/ha (m3)	Vkt kumulatip/ha (ΣVt /ha) (m3)	jumlah volume (Total volume) (Vol.T.T + ΣT.P.) (m3/ha)	Riap rata-rata tahunan (Mean annual) increment (m3/ha)	Riap tahunan berjalan (Current annual increment) (m3/ha)	Umur (Age) (Tahun/Year)
Altingia ~~ex~~c elsa Noronhae (Rasamala)													
BONITA I (SITE CLASS I)													
5	6,0	2225	38,0	3,8	5,5	6,0	2	-	-	2	0,4	0,4	5
10	10,7	1140	29,7	9,0	9,7	8,4	23	6	6	29	2,9	5,4	10
15	14,9	730	26,7	13,4	13,6	10,6	58	16	22	80	5,3	10,2	15
20	18,2	570	24,7	16,5	16,6	12,3	86	27	49	135	6,7	11,0	20
25	20,3	490	23,9	18,8	18,7	13,5	108	34	83	191	7,6	11,2	25
30	22,2	440	23,1	20,6	20,4	14,4	126	35	118	244	8,1	10,6	30
35	23,5	405	22,7	22,1	21,9	15,2	140	34	152	292	8,3	9,6	35
40	24,7	380	22,3	23,2	23,0	15,8	150	32	184	334	8,3	8,4	40
45	25,5	360	22,2	24,2	23,9	16,2	158	29	213	371	8,2	7,4	45
50	26,2	350	21,9	24,8	24,4	16,4	163	27	240	403	8,1	6,4	50
55	26,7	343	21,7	25,4	24,9	16,7	168	26	266	434	7,9	6,2	55
60	26,9	335	21,8	25,5	25,2	16,8	172	25	291	463	7,7	5,8	60
BONITA II (SITE CLASS II)													
5	7,1	1930	34,5	5,0	5,5	6,6	6	2	2	8	1,6	1,6	5
10	12,9	910	27,6	11,2	11,2	9,6	38	11	13	51	5,1	9,6	10
15	17,7	605	24,7	16,1	16,1	12,1	81	25	38	119	7,9	13,6	15
20	21,1	485	23,1	19,5	19,5	13,8	114	34	72	186	9,3	13,4	20
25	23,5	410	22,6	22,0	22,0	15,2	139	34	106	245	9,8	11,8	25
30	25,4	360	22,3	24,0	24,0	16,2	157	30	136	293	9,8	9,6	30
35	27,0	330	21,9	25,6	25,6	16,8	172	25	161	333	9,5	8,0	35
40	28,2	300	22,0	26,8	26,8	17,4	182	23	184	366	9,2	6,6	40
45	29,0	280	22,1	27,8	27,8	17,9	190	21	205	395	8,8	5,8	45
50	29,8	265	22,1	28,5	28,5	18,2	197	28	225	422	8,4	5,4	50
55	30,4	250	22,4	29,1	29,1	18,5	203	19	244	447	8,1	5,0	55
60	30,8	240	22,5	29,4	29,4	18,7	208	18	262	470	7,8	4,6	60

BONITA III (SITE CLASS III)

5	8,6	1650	30,8	6,3	7,5	7,4	13	3	3	16	3,2	3,2	5
10	15,2	730	25,0	13,6	13,7	10,8	60	17	20	80	8,0	12,8	10
15	20,3	500	26,7	18,8	18,5	13,5	109	34	54	163	10,9	16,6	15
20	24,2	400	22,2	22,8	22,2	15,4	142	33	87	229	11,4	13,2	20
25	26,5	340	22,0	25,4	25,1	16,8	168	27	114	282	11,3	10,6	25
30	28,6	290	22,1	27,4	27,9	17,8	187	22	136	323	10,8	8,2	30
35	30,2	260	22,1	29,0	30,2	18,6	203	19	155	358	10,2	7,0	35
40	31,4	230	22,5	30,2	32,6	19,2	215	17	172	387	9,7	5,8	40
45	32,7	210	22,7	31,4	34,6	19,8	224	15	187	411	9,1	4,8	45
50	33,5	190	23,3	32,2	36,8	20,2	232	14	201	433	8,7	4,4	50
55	34,2	170	24,1	32,2	39,2	20,5	239	13	214	453	8,2	4,0	55
60	34,7	150	25,3	33,3	41,7	20,8	246	12	226	472	7,9	3,8	60

BONITA IV (SITE CLASS IV)

5	10,2	1250	29,8	7,6	9,1	8,2	16	5	5	21	4,2	4,2	5
10	18,0	600	24,4	16,1	15,9	12,0	84	25	30	114	11,4	18,6	10
15	23,0	420	22,8	21,7	21,3	14,9	136	35	65	201	13,4	17,4	15
20	27,2	325	21,9	25,8	25,8	17,0	174	30	95	265	13,2	12,8	20
25	30,2	255	22,3	28,9	30,3	18,4	202	20	115	317	12,7	10,4	25
30	32,3	210	23,0	31,0	34,1	19,6	222	15	130	352	11,7	7,0	30
35	33,9	185	23,3	32,4	37,5	20,4	237	14	144	381	10,9	5,8	35
40	35,1	160	24,2	33,8	40,9	21,0	250	12	156	406	10,2	5,0	40
45	36,2	140	25,1	34,9	44,3	21,6	259	11	167	426	9,5	4,0	45
50	37,0	120	26,5	35,8	48,3	22,0	267	10	177	444	8,9	3,6	50
55	37,8	110	27,2	36,6	50,8	22,3	274	9	186	460	8,4	2,8	55
60	38,4	100	27,9	35,1	53,6	22,6	280	8	194	474	7,9	2,8	60

BONITA V (SITE CLASS V)

5	11,7	1045	28,4	9,1	10,5	9,0	27	8	8	35	7,0	7,0	5
10	20,4	495	23,7	11,9	18,5	13,4	110	33	41	151	15,1	23,2	10
15	25,9	350	22,2	24,6	24,3	16,2	160	30	71	231	15,4	16,0	15
20	29,8	260	22,3	28,5	29,9	18,2	198	20	91	289	14,4	11,6	20
25	32,8	200	23,2	31,5	35,5	19,8	227	15	106	333	13,3	8,8	25
30	35,2	150	24,9	33,9	42,3	21,0	250	11	117	367	12,2	6,8	30
35	37,1	120	26,4	35,8	48,3	22,0	268	9	126	394	11,2	5,4	35
40	38,6	100	28,0	37,4	53,8	22,7	282	7	133	415	10,4	4,2	40
45	39,8	80	30,1	38,5	60,9	23,3	292	6	139	431	9,6	3,2	45
50	40,7	60	34,2	39,5	71,1	23,8	300	5	144	444	8,9	2,6	50
55	41,5	50	36,6	40,3	78,5	24,2	306	5	149	455	8,3	2,2	55
60	42,0	40	40,5	40,8	88,5	24,6	312	4	153	465	7,8	2,0	60

出典

Suharlan, A., Sumerna, K, and Sudiono, Y (1975) Yield table of ten industrial wood specoes Lembaga Penelitian Hutan

樹種：LEGUMINOSAE（マメ科）
Acacia auriculiformis（オマバアカシア）
国　：インド

データ採取地の立地環境

Study site and plantation details

These studies were undertaken in plantations of *Eucalyptus* hybrid and *Acacia auriculaeformis* raised in Singhbhum Afforestation and Dalbhum Forest Divisions of Bihar (between 20°15′ to 22°45′ N and 80° 25′ to 86° 50′ E) at altitude 92 m. The area receives an average annual rainfall of about 1500 mm, mostly from mid June to mid October and is almost flat and consists of good quality sandy loam soil upto the depth 1 m to 2 m. Originally these areas were covered with sal forests which degraded in course of time due to heavy illicit fellings and subsequently there monocultures were raised in these areas.

Four plantations of *Acacia auriculaeformis* and three plantations of *Eucalyptus* (one from Social Forestry Division) were selected for the present study. The details of these plantations are presented in Table 1 and 1 A.

Material and Method

Field studies were conducted during May, June 1985 using the tree harvesting method of stratified tree technique (Art & Mark 1971) for estimation of Biomass. One temporary plot, depending upon the area of the plantation, was laid out in each plantation and the diameter of all the standing trees on the plot were recorded, the whole diameter range was divided into three diameter classes and designated as A, B and C for convenience of further reference. Thus in all 21 trees were harvested, twelve from *Acacia auriculaeformis* and nine from *Eucalyptus* plantations. Fresh weight of all the tree components of the sample trees harvested were recorded in the field. Representative samples of each component were collected to estimate their biomass and nutrient content. For the estimation of root biomass seven root systems, one from each plantation were extracted, (roots of B class trees as its diameter was very close to the mean diameter of the crop) and their fresh weight recorded. Representative samples of roots were also collected for further estimation

成長・収穫に関する表，図，式など

Table 1

Details of Plantations

Species - *Eucalyptus hybrid*

Age (years)	3	5	7
Area of plantation (ha)	36	20	3
Area of enumeration plot (ha)	0.36	0.20	0 09
No. of trees on the enumeration plot			
Class A	113	24	24
Class B	226	123	53
Class C	64	57	13
Total	403	204	90
No. of trees/ha			
Class A	314	120	267
Class B	628	615	589
Class C	178	285	144
Total	1120	1020	1000
Mean Diameter of the crop (cm)	4 3	8.2	7.5
Class A	2 9 (2.0 to 3 0)	4 3 (2.0 to 5 0)	5 1 (4 0 to 6 0)
Class B	4 4 (4 0 to 5 0)	7.8 (6 0 to 9 0)	7 9 (7 0 to 9.0)
Class C	6 3 (6.0 to 7 0)	10.8 (13.3 to 13 0)	10 3 (10 0 to 12 0)
Mean height of the crop (m)	5.3	8 5	8 7
Class A	4.5	5.8	7.0
Class B	5.3	8 5	8.7
Class C	6.6	10.6	9.4

Table 1-A

Details of Plantations

Species *Acacia auriculaeformis*

Age (years)	3	5	7	9
Area of plantation (ha)	8	8	6	40
Area of enumeration plot (ha)	0.09	0.09	0.09	0.4
No of trees on the enumeration plot				
Class A	22	47	37	90
Class B	82	46	35	228
Class C	18	6	13	97
Total	122	99	85	415
No of trees/ha				
Class A	244	522	411	225
Class B	911	511	389	570
Class C	200	67	144	243
Total	1355	1100	944	1038
Mean Diameter of the crop (cm)	3.4	4 8	7.0	9.1
Class A	2 0 (1.0 to 2.0)	4.0 (3.0 to 4.0)	6.0 (5.0 to 6.0)	6.4 (5.0 to 7 0)
Class B	3 5 (3.0 to 4 0)	5 3 (5 0 to 6.0)	7.4 (7 0 to 8 0)	9 0 (8 0 to 10 0)
Class C	5.1 (5.0 to 6.0)	7.2 (7 0 to 8.0)	9 5 (9 0 to 10.0)	11.7 (11.0 to 13 0)
Mean height of th crop (m)	3.7	6 0	7.1	7.9
Class A	3 6	5.5	6.9	8 0
Class B	3.7	6.0	7.1	7.9
Class C	6.6	7.6	9.0	9.14

出典

Pande, M.C., V.N. Tandon and Mridula Negi (1986). Biomass Production and its Distribution in an Age Series Plantations of Eucalyptus Hybrid and Acacia auriculaeforimis in Bihar. Indian For., 112 : 975-985.

樹種：LEGUMINOSAE（マメ科）
Acacia auriculiformis（オオバアカシア）
国　：フィリピン

データ採取地の立地環境

成長・収穫に関する表，図，式など

(2) A. auriculiformis

当林分はルソン島北部のパンタバンガン森林造成技術協会プロジェクト内の草生地に1980年に植林された林分で，海抜高は約 200mである。

1984年2月に間伐率が断面積合計で約11%，20%，44%の間伐試験地を設定し，各調査区（200㎡）内の全ての立木の胸高直径，樹高を毎年1月，2月，3月のいずれかに1986年まで測定した。また各間伐区では1985年3月にも断面積間伐率が各々26%，22%，34%の間伐をおこなった。そして毎年，調査区外でサンプル木を1984年には6本，1985年には8本，1986年には5本伐採し，サンプル木の相対生長関係を用いて各々の年の葉，枝，幹の現存量を推定した。

表2　*Acacia auriculiformis* の林分概況と現存量

p-1

調査年 (年)	立木密度 (no/ha)	主軸密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量 葉量 (ton/ha)	枝量 (ton/ha)	幹量 (ton/ha)	合計 (ton/ha)	葉面積 (m^2/m^2)	材積 (m^3/ha)
1984	2600	4550	3 6	4	2 7	3 6	8 5	15 1	2	14 7
1985	2550	4500	5 1	5 7	4 6	6 9	23 3	33 1	3 8	38 8
1986	2550	4350	6 2	6 3	4 5	7 6	30 4	43 6	4 1	51 3

p-2

調査年 (年)	立木密度 (no/ha)	主軸密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量 幹量 (ton/ha) 間伐前	幹量 (ton/ha) 間伐前	材積 (m^3/ha) 間伐前	材積 (m^3/ha) 間伐前	間伐率 (断面積) (%)
1984	2150	3350	3 6	4 1	6 7	6	11 7	10 5	11
1985	1700	2400	6 5	7 2	21	15 4	34 5	25 3	26
1986	1000	1600	8 1	8 2	20 9	—	36 5	—	

p-3

調査年 (年)	立木密度 (no/ha)	主軸密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量 幹量 (ton/ha) 間伐前	幹量 (ton/ha) 間伐前	材積 (m^3/ha) 間伐前	材積 (m^3/ha) 間伐前	間伐率 (断面積) (%)
1984	2550	3900	3 4	4 2	6 9	5 5	11 9	9 5	20
1985	2200	2550	6 1	7	19 5	15	32 2	24 7	22
1986	1500	1800	7 8	8 1	21 1	—	36 6	—	

p-4

調査年 (年)	立木密度 (no/ha)	主軸密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量 幹量 (ton/ha) 間伐前	幹量 (ton/ha) 間伐前	材積 (m^3/ha) 間伐前	材積 (m^3/ha) 間伐前	間伐率 (断面積) (%)
1984	2250	3900	3 8	4 6	8 7	4 9	15 1	8 5	44
1985	1250	1500	7 3	8	16 8	11 3	27 5	18 5	34
1986	750	1000	8 8	8 4	14 5	—	25 5	—	

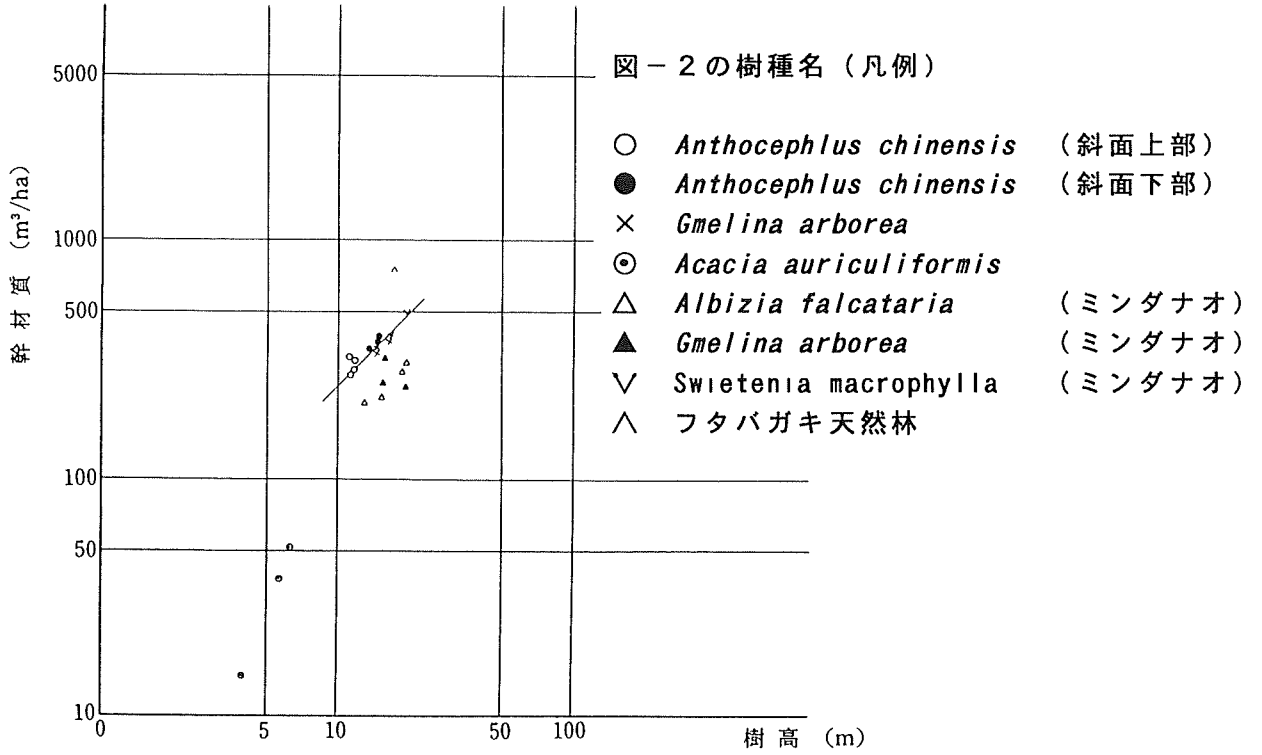


図2　幹材積と樹高との関係

表3　各早生樹種の生長量

Acacia auriculiformis (p-1)

期間（年）	年生長量		年平均生長量	
	幹現存量 (ton/ha·year)	幹材積 (m³/ha·year)	林齢 (年)	幹材積 (m³/ha·year)
1984－1985	14 8	24 1	4	3 7
1985－1986	7 1	12 5	5	7 8
			6	8 6

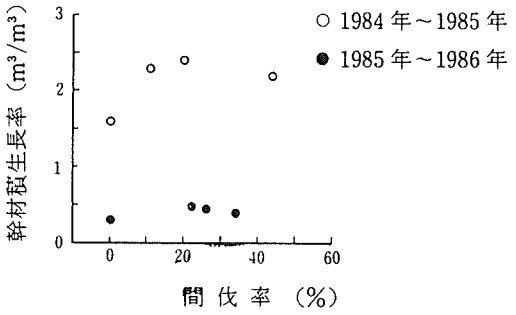


図3　*Acacia auriculiformis* 林の幹材積生長率と間伐率との関係

出典

加茂皓一、石塚森吉、大住克博：早生樹種林とマツ林の生長解析、熱帯農業集報　No. 65、65～79．(1989)

樹種：LEGUMINOSAE（マメ科）
Acacia auriculiformis（オオバアカシア）
国：フィリピン

データ採取地の立地環境

Project area : Pantabangan and Carranglan, Province of Nueva Ecija
121° to 121° 12' East longitude and 15° 50' and 16° 02' North latitude

average annual temperature : 27C°

annual rainfall : 1,850 mm severe dry season from November to May

soil : red podzolic high acidity and infertility

Vegetation : cogon(Imperata cylindrica), samon(Themedia triandra) and talahib(Saccharum spontaneum)

1. 資料

収穫予想表作成のための野外調査は、1988年 8月より、チームリーダー宮崎宣光氏の設計、指導のもとで行なわれた。アカシアの林齢４年生以上の林分の中から、標高、方位、傾斜、林齢等のさまざまな箇所を空中写真によって吟味し、調査候補地を120点あまり選定した。そして実際に現地へ行き該当箇所を捜し、ある程度まとまりのある林木集団を含むように暫定プロットを設定した。プロットの形状および大きさは原則として20m×20m（斜距離）の方形としたが、地形等の制約がある場合には適宜15m×25m、15m×20m、10m×30mなども採用した。

プロット内の林木は、胸高直径２cm以上を対象とし毎木調査した。胸高直径は輪尺を用いて一方向のみを測定し、樹高は測竿を用いた。そのほか土壌の物理性、化学性を調べるため表土および中層土を採取した。こうしたプロットを、今回の収穫予想表作成のため、92ヶ所設定することができた（実際には100ヶ所測定したが、資料不備のため無効なものが８ヶ所あった）。

成長・収穫に関する表，図，式など

3. 収穫予想表の作成

Acacia auriculiformis収穫予想表を作成する基本方針を以下に示す

基本方針

1. 各地位に対し、Mitscherlich曲線を用いて樹高生長曲線を与える。
（上：SI＝１７，中：SI＝１２，下：SI＝７）
2. 樹高から直径を推定するため、図－４に$D = a h^b$を地位別にあてはめて関係式を求める。その結果、林齢から樹高を介して胸高直径が推定で

きることになる。この場合、

$$h(t) = M \{ 1 - Lexp(-kt) \}$$

$$d(t) = ah(t)^b$$

が同時に満たされることから、直径の生長は

$$d(t) = aM^b \{ 1 - Lexp(-kt) \}^b$$

で表されることになる。この関数は、Richards関数と呼ばれ、測樹学の分野で広く用いられている生長関数である。

3. 地位ごとに $v = ad^b$ を当てはめるか、もしくは3つの地位をまとめて $v = ad^bh^c$ の重回帰モデルを適用して平均幹材積を推定する。このうち精度の良い方を採用する。ただしいずれの場合も、vの生長（vと林齢の関係）は平均直径とはパラメータは異なるが、やはりRichards関数となる。

4. 立木本数の変化は林齢から与える。その際は図－8を参考にする。当地のアカシア林分の場合、立木本数と平均幹材積のあいだにはほとんど全く関係はなく、従って立木本数は独立な変数として外から与えることができる。ただし林齢に対し立木本数が増加し続けると、樹高の生長と合わせて林分密度が非常に高まる可能性もある。その場合は相対幹距比を一定とするよう本数を調整する。

Growth Prediction Table for Acacia auriculiformis Stands on Good Site

A	H	D	N	B	V	TV	MI	CI
1	2.2							
2	5.2	3.3	1001.	1.0	2.3	0.0	1.14	2.17
3	7.6	5.2	1186.	2.9	9.1	0.0	3.03	6.79
4	9.5	6.7	1346.	5.5	21.1	0.0	5.28	12.03
5	11.0	8.0	1485.	8.5	37.5	0.0	7.49	16.37
6	12.3	9.0	1604.	11.6	56.6	0.0	9.44	19.16
7	13.3	10.1	1422	12.8	67.3	5.1	10.34	15.72
8	14.1	11.1	1266.	13.7	75.8	11.1	10.87	14.56
9	14.7	11.9	1160.	14.4	83.2	16.7	11.10	13.01
10	15.2	12.6	1083.	15.0	89.6	21.7	11.13	11.33
11	15.6	13.2	1028.	15.5	95.0	26.0	10.99	9.68
12	15.9	13.7	986.	15.9	99.5	29.6	10.76	8.15
13	16.2	14.1	955.	16.3	103.2	32.6	10.45	6.79
14	16.4	14.4	931.	16.5	106.3	35.2	10.11	5.61
15	16.6	14.6	912.	16.8	108.8	37.2	9.74	4.60
16	16.7	14.8	898.	17.0	110.9	38.9	9.36	3.75
17	16.8	15.0	886.	17.1	112.6	40.3	8.99	3.05
18	16.9	15.2	878	17.2	113.9	41.4	8.63	2.47
19	16.9	15.3	870.	17.3	115.0	42.3	8.28	2.00
20	17.0	15.3	865	17.4	115.9	43.0	7.95	1.61

A : stand age(yrs)　H : mean height of dominant trees(m)
D : mean diameter(cm)　N : number of stems(/ha)
B : basal area(m^2/ha)　V : volume of stocking(m^3/ha)
TV : volume of thinnings(m^3/ha)
MI : mean annual increment of total volume(m^3/ha)
CI : current annual increment of total volume(m^3/ha)

* These items are common to the following tables

Growth Prediction Table for Acacia auriculiformis Stands on Medium Site

A	H	D	N	B	V	TV	MI	CI
1	1.5							
2	3.6	2.3	1000.	0.5	0.8	0.0	0 41	0.78
3	5.3	3.6	1149.	1.4	3.2	0.0	1.06	2.35
4	6.7	4.7	1280.	2.6	7 3	0.0	1.81	4 08
5	7.8	5.6	1397.	4.0	12.7	0.0	2.55	5.49
6	8.7	6.3	1499.	5.5	19.1	0.0	3.19	6.39
7	9.4	6.9	1590.	6.9	25.9	0.0	3.70	6.79
8	9.9	7.4	1670.	8.2	32.7	0.0	4.09	6.78
9	10.4	7.8	1741.	9.4	39.2	0.0	4.35	6.49
10	10.7	8.1	1803.	10.5	45.2	0.0	4.52	6.01
11	11.0	8.3	1859.	11.5	50.6	0.0	4.60	5.44
12	11.2	8.6	1796.	11.8	52.9	1.1	4.50	3 41
13	11.4	8.8	1739.	12.0	54.6	2.3	4.38	2.84
14	11.6	9.0	1695.	12.2	56.0	3.2	4.23	2.35
15	11.7	9.1	1661.	12.3	57.2	4.0	4.08	1.93
16	11.8	9.2	1634.	12.4	58.1	4.6	3.92	1.57
17	11.9	9.3	1614.	12.5	58.9	5.2	3.77	1.28
18	11.9	9.4	1597.	12.6	59.5	5.6	3.61	1.04
19	12.0	9.5	1585.	12.6	60.0	5.9	3.47	0.84
20	12.0	9.5	1574.	12.7	60.3	6.2	3.33	0.68

Growth Prediction Table for Acacia auriculiformis Stands on Poor Site

A	H	D	N	B	V	TV	MI	CI
1	0.9							
2	2.1	1.4	999.	0.2	0.2	0.0	0.09	0.16
3	3.1	2.1	1084.	0.5	0.6	0.0	0.21	0.45
4	3.9	2.7	1162.	0.8	1.4	0.0	0.34	0.75
5	4.5	3.2	1233	1.2	2.3	0.0	0.47	0 97
6	5.1	3.7	1298.	1.6	3.5	0.0	0.58	1.11
7	5.5	4.0	1357.	2.0	4.6	0.0	0.66	1.16
8	5.8	4.3	1411.	2.4	5.8	0.0	0.72	1.15
9	6.0	4.5	1460.	2.7	6.9	0.0	0.76	1.09
10	6.3	4.7	1505	3.0	7.9	0.0	0.79	1.01
11	6.4	4.8	1546.	3.3	8.8	0.0	0.80	0 92
12	6.6	4.9	1584.	3.6	9.6	0.0	0.80	0 82
13	6.7	5.0	1618.	3.8	10.3	0.0	0.79	0 72
14	6.7	5.1	1650.	4.0	11.0	0.0	0.78	0.63
15	6.8	5.2	1678	4.1	11 5	0 0	0.77	0 55
16	6.9	5.2	1704	4.3	12.0	0.0	0.75	0 48
17	6 9	5.2	1728	4.4	12.4	0.0	0.73	0 42
18	7.0	5 3	1750	4 5	12.8	0.0	0 71	0 36
19	7.0	5.3	1770.	4.6	13.1	0.0	0.69	0.31
20	7.0	5 3	1788	4.7	13 4	0.0	0.67	0 27

この収穫予想表について、若干の説明を加える。

・地位上では７年生で相対幹距比が20％になり、本数調整が必要な林分密度に達した。地位中ではその林齢が12年であり、地位下では20年生までにそうした林分密度に達しなかった。

・主副合計の幹材積平均生長量が最大となる林齢は、上、中、下それぞれ10年、11年、12年であった。地位が良いほど早期に現われる点は収穫表の一般的な傾向と一致する。

・副林木が毎年計上されているが、これは間伐を毎年行なうことを意図するものではない。実際の間伐にあたっては、上層木平均樹高、本数を測定し、相対幹距比が22～23％となるような残存木本数を決定する。

・表に示したよりも高密度の相対幹距比を維持した場合、表の値よりも立木蓄積および間伐木収穫が増大する。それはもとになっている生長モデルに密度効果が組み込まれていないため、間伐木はなるべく高齢まで保持してから収穫した方が総収穫量が増えるからである。しかし枯損を生じるような高密度の範囲は、この生長モデルは扱うことができないため、いたづらに密度を高めることは誤りてある。

・バンタバンガン地域のAcacia auriculiformis林分は、この収穫予想表に基づいて判断すれば、地位指数１２ないし１４以上の林分以外は間伐収穫等を期待することは困難であろう。

出典

白石則彦　ｱｶｼｱ ｱｳﾘｶﾘﾌｫﾙﾐｽの幹材積表および収穫予想表の作成，ﾊﾟﾝﾀﾊﾝｶﾝ地域林業開発ﾌﾟﾛｼｪｸﾄﾌｪｰｽII 森林立地（森林統計解析）報告書

樹種：LEGUMINOSAE（マメ科）
Acacia auriculiformis（オーリキュリフォルミス）
国　：多国籍［インドネシア，インド，マレーシア］

データ採取地の立地環境

成長・収穫に関する表，図，式など

Details \ Countries	Indonesia			India	Malaysia
Reference	(3)	(4)	(4)	(1)	(2)
Locality	Java	Java	Java	West Bengal	Sabah
Altitude in m	0–600	0–200	0–500	0–500	0–500
Rainfall in mm		2200–2700	2000	1000–1400	2000>
Soil	good soil	good soil	eroded lat. soil	red shallow lateritic	Red brown tropical
Data source	-	-	-	-	-
Measurement specification	4 cm	4 cm	4 cm	5 cm (ob)	7.2 cm (ub)
MAI (m^3/ha)	20.0 (10–12)	15–20 (10–12)	8–12 (10–12)2/	5.0 (15)2/	16.8 (11–12) 2/
MAI (A1)1/	- 2/	18.2 (4)2/	7.9 (4)	-	-
(A2)	14.0 (5)	19.2 (5)2/	-	-	-
(A3)	18.0 (6)	-	-	-	-
(A4)	20.7 (7)	-	9.5 (7)	3.80 (7)	-
(A5)	21.4 (8)	15.0 (8)	-	-	-
(A6)	21.3 (9)	-	-	-	-
(A7)	21.0 (10)	-	-	1.98 (10)	-
(A8)	19.7 (12)	-	-	5.13 (12)	-
(A9)	-	17.4 (13)	11.7 (13)	-	-
Net above ground biomass productivity in tons/ha	-	26.4 (3–4 years)	-	-	-

1/ A1, A2, A3, etc., refer to age in years.

2/ Figures in brackets indicate age in years.

Remarks: No fertilizer has been used in achieving the growth in the above table, but use of fertilizers stimulates initial growth, which has been reflected in Indonesia (3) and India (1).

出典

(1) Banerjee, A.K. 1973 Plantation of Acacia auriculiformis (Benth) A. cunn. in West Bengal. Indian Forester 99(9).

(2) Nicholson, D.I. 1965 A note on Acacia auriculiformis A. cunn. ex Benth in Sabah. The Malayan Forester 28(3).

(3) Sastromidjojo, J.S. 1964 Acacia auriculiformis. Communication No. 84

(4) Wiersum, K.F. and Ramlan, A. 1982 Cultivation of Acacia auriculiformis on Java, Indonesia. Commonwealth Forestry Review 61(2).

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO　1983　所収

樹種：LEGUMINOSAE（マメ科）
Acacia catechu（アセンヤクノキ）
国　インド
India

データ採取地の立地環境

成長・収穫に関する表，図，式など

Methodology

Various parameters used in the text are as under :

Parameter	Denoted in text by	Unit
Age	A	year
Dominant height	H	metre
Basal area/ha before thinning	BA	m^2/ha
Basal area ratio	BA/BA_{Max}	—
Height ratio	H/H_{Max}	—
Minimum diameter	d_1	cm

Step I. Points for two graphs between (1) age and dominant height (2) dominant height and basal area/ha were plotted Free hand curves were then drawn to cover the maximum observed values (BA_{Max} & H_{Max}). Suitable functions to fit points taken from hand drawn curves were found. This procedure yielded the following relationships :

$$BA_{Max} = 17.0065\ (1-e^{-.19063H})^{3.57643}$$

$$Log_e\ H_{Max} = 3.82797 - 3.18984A^{-.41427}$$

Common intercept model was used to generate a family of site index curves and reference age of 30 years was taken.

Dominant height corresponds to the height of a tree of dominant diameter, where dominant diameter is mean diameter of 125 thickest trees/ha.

Step II : The diameter measurements of a year in permanent sample plot after arranging in ascending order were grouped into ten diameter classes and mean diameter (d) of each group was determined In the first stage a sigmoid relationship between cumulative probability (p) (in the present case 05, .15, .25,....., .95) and mean diameters was developed for each measurement of all the sample plots (i e 53 observations) by the following simple regression :

$$\phi = \frac{d - d_1}{a + bd}$$

where $\phi = Log_{10}[200\ p/Log_{10}\ (100-10p)]$ d_1, corresponds to $p_1 = 05$ and 'a' and 'b' are the intercept and the slope d_1 is the first value of diameter class vector (d_1, d_2 . d_{10}) corresponding to p_1 of cumulative probability or probability vector (p_1, $p_2 \cdots p_{10}$) The variation of d_1, a and b was studied with reference to various independent variables like dominant height, age of the crop, height ratio H/H_{Max} and basal area ratio 'q' which is an index of competition.

$$q = \frac{BA}{BA_{Max}}$$

The choice finally rested on the

following extended model which takes into account these variables and produce statistically significant effect on the behaviour of the model.

(a) $\text{Log}_{10} d_1 = 32473 \log_{10} (H/H_{Max} .A) + 69172$

$R = .574$

T value for regression coefficient = 15.252. Variation in minimum class diameter is explained poorly in view of what has been stated earlier about basic data.

(b) $(d-d_1)/\phi = 45806\, d - 45942\, d_1 + 01313A\, (BA/BA_{Max}\ (H/H_{Max}) + .55329$

$R = 994$

T—value for regression coefficients are 183.779, 89 254 and 9 596 respectively.

Step III : At first instance logarithmic relationship between tree height (h) and diameter at breast height (d) was developed. These height and diameters of representative trees in sample plot are measured at the time of each measurement to develop height/diameter relationship.

$$\text{Log}_{10} h = a' + b' \log_{10} d$$

Variation in "intercept a' " is explained more than "slope b' " by independent variables and hence variation in intercept is retained in regression in generating family of height/diameter curves for different site qualities. The following regression for intercept was obtained.

$a' = .14406\ (H/H_{Max})^2 .\text{Log}_{10} A + .82501\ (H/H_{Max})\ (BA/BA_{Max}) - 00952\ (BA/BA_{Max})^2 . A + .00795A - .07782$

$R = .562$

T—value for regression coefficient are 2 473, 5.474, 4.408 and 3.992 respectively

Step IV : Heartwood volume (V) estimation is taken from tables published about Uttar Pradesh—*Chais* working given on page 14 of 'Growth and yield statistics of common Indian timber species' Vol. II, publication of F.R I & Colleges, Dehradun. These figures are estimated fairly by the regression.

$$V = — 05430 + .16156\ D^2 h$$

where D = diameter in metres.

The yield tables for three site quality classes have been calculated with the help of regressions (Annexure I) Two constraints were imposed in generating tables These are that number of trees in lower quality cannot be less than the number for the same age in superior quality and secondly, that the preceeding age class cannot have less trees than the succeeding one.

In calculating thinning yields from low (ordinary) thinnings the distribution has been assumed to follow the following curves

$$p_i^* = p_i \left(\frac{I}{L} - 1\right) \cdots \cdots \cdots \text{(vi)}$$

Where p_i^* is i^{th} term of probability of vector p^* which relates to stem in the stand that will be left after thinning.

$$\overset{*}{p} = (\overset{*}{p_1}, \overset{*}{p_2} \cdots\cdots\cdots \overset{*}{p_n})$$

L is the ratio of the stocking after thinning to the stocking before thinning.

Yield Table

Good Sites (Before thinning statistics upto Col. 7)

Age (yrs)	Dominant		Mean diameter by basal area method (cm)	Number of trees/ha	Basal area/ha (m^2)	Total volume/ ha (m^3)	Volume thinned (m^3)	M.A I. (m^3)
	Height (m)	Diameter (cm)						
10	13.5	23.0	17.1	557	12.78	9 65	0.31	0 965
15	16.3	25.3	19.2	499	14.43	20 89	0.62	1.413
20	18 3	27.0	21.0	440	15 22	31.31	1.18	1 612
25	19.9	28 5	22.6	390	15.66	40 09	1 60	1 688
30	21.1	29 7	24.1	349	15 94	47.53	1 93	1.708
35	22.1	30.8	25 5	315	16 13	53.85	2.12	1.700
40	23 0	31.8	26.9	287	16 26	59 38	2.35	1.679
45	23 8	32 6	28 2	262	16 36	64.01	2.25	1.647
50	24 5	33.4	29.4	242	16 44	68 48	2 38	1.617
55	25.1	34 0	30 6	224	16.50	72 40	2.44	1.584
60	25 6	34 6	31 8	208	16 55	75 93	—	1.552
Moderate sites								
10	10 6	21.1	15.8	557	10 97	3 23	0 01	0.323
15	13.3	23 5	17 9	504	12.64	9 96	0.14	0 665
20	15 3	25.4	19 6	460	13.92	18.00	0 39	0.907
25	16 8	26 9	21.2	416	14.67	26 00	0.72	1 061
30	18.1	28 3	22 6	376	15.15	33 34	1.07	1.153
35	19.2	29 4	24 0	341	15 49	39.64	1 27	1.199
40	20.1	30 5	25 3	312	15.72	45.47	1 54	1.227
45	20 9	31.4	26.6	286	15.90	50 52	1 65	1 237
50	21 6	32 2	27 8	264	16 04	55 12	1 82	1.238
55	22 3	32.9	29.0	244	16 15	59 15	1 84	1.232
60	22.8	33.5	30.1	227	16.24	62.97	—	1.224
Poor sites								
10	8 0	18 8	14.6	557	9 33	0 57	0.14	0.057
15	10.4	21.5	16 5	504	10 78	3 57	0 28	0.247
20	12 3	23 5	18 2	460	11 93	8 22	0 11	0.432
25	13 8	25.1	19.7	429	13 04	13.94	0.21	0.579
30	15.1	26 5	21.1	396	13 83	19 89	0.39	0 688
35	16 2	27.7	22 4	365	14 38	25 76	0 64	0.768
40	17 1	28 8	23.6	336	14 79	31 30	0.79	0.827
45	17 9	29 8	24 8	311	15 10	36 34	0 99	0 864
50	18 7	30 7	26 0	288	15.34	40 96	1.11	0.890
55	19.3	31 5	27 1	268	15 53	45.29	1 25	0 908
60	19 9	32 2	28 2	250	15 69	49 25	—	0 919

出典

S.P. Singh and R.C. Jain (1987). Yield of Heartwood in Acacia catechu (khair) for use in Hatha Manufacture. Indian For., 113 : 404-408.

樹種：LEGUMINOSAE（マメ科）

Acacia confusa（ソウシジュ）

国：台湾

データ採取地の立地環境

台湾中南部

使用プロット数　172

1968 6

成長・収穫に関する表，図，式など

第20表　臺灣中南部相思樹人工林林分收穫表　地位級 I

林齢	地位指数		胸高直径 (cm)		林分高 (m)		每公頃 立木林数		胸高断面積 (m²)		立木材積 (m³)			
(年)	平均	範囲	平均	範囲	平均	範囲	平均	範囲	平均	範囲	平均	範囲	連年生長量	平均生長量
4	6 28	5 63～6 93	3 96	3 72～4 18	4 06	3 84～4 30	5519	5607～5453	6 98	6 50～7.47	14 755	14 271～15 239	3 689	3 038
6	8 71	7 90～9 51	5 65	5 34～5 96	5 57	5 29～5 90	5013	5089～4956	11 66	11 04～12 26	32 365	30 184～34 547	8 805	3 435
8	10.75	9 82～11 69	7 23	6 85～7 62	7 01	6 66～7 41	4361	4429～4309	15 27	14 56～15 99	55 817	51 180～60 455	11 726	3 854
10	12 57	11 52～13 61	8 71	8 25～9.16	8 36	7 95～8 82	3489	3549～3444	18 01	17 20～18 82	82.551	75 564～89 841	13 368	4 328
12	14.25	13 09～15 40	10 07	9 56～10 57	9 61	9 15～10 13	2737	2791～2696	20 16	19 26～21 06	110 922	101.066～120 782	14 186	4 817
14	15 71	14 46～16 96	11.42	10 84～12 00	10 77	10 26～11 35	2149	2198～2112	21 92	20 99～22 85	139 735	127 512～151 963	14 407	5 276
16	17 16	15.82～18 49	12 65	12.01～13 29	11 85	11 29～12.49	1701	1746～1667	23 26	22 20～24 32	168 282	153 925～182 644	14 274	5 682
18	18 39	16 96～19 81	13 83	13.14～14 52	12 84	12 23～13.53	1359	1401～1327	24 41	23 28～25 54	196 097	179 832～212 369	13.908	6 025
20	19 50	18 00～21 00	14 95	14 20～15 70	13 75	13.10～14 50	1100	1140～1070	25 40	24 20～26.60	223 498	205.499～241 504	13.701	6 325

地位級・II

林齢	地位指数		胸高直徑 (cm)		林分高 (m)		每公頃 立木株數		胸高斷面積 (m²)		立木材積 (m³)			
(年)	平均	範圍	平均	範圍	平均	範圍	平均	範圍	平均	範圍	平均	範圍	連年生長量	平均生長量
4	4.55	3 89～5.19	3.32	3.11～3 54	3 49	3 25～3 71	5859	6134～5695	5 69	5 20～6 17	13 446	12 955～13 922	3 362	3 362
6	6 55	5 75～7.36	4 80	4 51～5.09	4.81	4 50～5 11	5309	5547～5165	10 03	9 41～10 64	26 458	24 247～28 609	6 507	4 410
8	8 26	7 33～9.20	6 18	5 82～6 54	6 08	5 71～6 45	4628	4843～4498	13.36	12 64～14 08	43 259	38 559～47 831	8 401	5.408
10	9 77	8.72～10 82	7 47	7 05～7 89	7.27	6 83～7.70	3728	3911～3610	15 84	15 03～16 66	62 816	55.428～70 002	9 779	6 282
12	11 18	10 03～12 33	8 69	8 22～9 16	8 37	7 88～8 87	2947	3116～2845	17 76	16.86～18 66	84 228	74 236～93 947	10 707	7 015
14	12 39	11 14～13 63	9 84	9 30～10 38	9 40	8 85～9 94	2341	2495～2248	19 25	18 27～20 33	106 631	94.239～118 685	11 202	7 617
16	13 59	12 25～14 93	10 91	10 32～11 50	10 34	9 74～10 94	1878	2021～1792	20 43	19 37～21 49	129 397	114 842～143 556	11 383	8.088
18	14 60	13 17～16 02	11 94	11 28～12 58	11 21	10 55～11 85	1524	1657～1444	21 44	20 26～22 52	152 044	135 554～168.084	11.324	8.447
20	15 50	14 00～17 00	12 90	12 20～13 60	12 00	11 30～12 70	1255	1380～1180	22 20	21 00～23 40	174 750	156 502～192 500	11 353	8.738

地位級・III

林齢	地位指数		胸高直徑 (cm)		林分高 (m)		每公頃 立木株數		胸高斷面積 (m²)		立木材積 (m³)			
(年)	平均	範圍	平均	範圍	平均	範圍	平均	範圍	平均	範圍	平均	範圍	連年生長量	平均生長量
4	2 81	2 16～3 46	2 70	2.46～2 95	2 90	2 66～3 09	6980	7759～6398	4 39	3 91～4 88	12 149	11 638～12 646	3 038	3.689
6	4 40	3 59～5 21	3 95	3 64～4 30	4 02	3 71～4 28	6282	6958～5776	8 40	7 79～9 01	20 611	18 309～22 853	4 231	5 394
8	5 77	4 84～6 71	5.13	4.75～5 57	5 12	4 75～5 44	5506	6117～5050	11 50	10.73～12 16	30 830	25 935～35 596	5 110	6 977
10	6 98	5.93～8 02	6 23	5 78～6 75	6 13	5 72～6 52	4493	5028～4092	13 68	12 87～14 49	43 281	35 589～50 772	6 226	8 255
12	8 11	6 96～9 26	7 31	6 80～7 88	7 11	6 62～7 53	3637	4118～3278	15 36	14 46～16 26	57 805	47.401～67 937	7.262	9 244
14	9.06	7 81～10 30	8 26	7.68～8 91	7 99	7 44～8 46	2971	3409～2643	16 63	15 64～17 61	73 864	60 961～86 428	8 030	9 981
16	10 03	8 69～11 36	9 17	8 53～9 89	8 80	8 19～9 31	2460	2865～2158	17 61	16 54～18.66	90 909	75.754～105 667	8 523	10.518
18	10 81	9 38～12 23	10 03	9 34～10 82	9 53	8 87～10 08	2067	2445～1785	18 38	17 24～19 51	108 430	91.269～125 159	8 765	10 895
20	11.50	10 00～13 00	10 85	10 10～11 70	10.20	9 50～10 80	1765	2120～1500	19 00	17 80～20 20	126 498	107 498～115 000	9.030	11 175

出典

劉慎孝・林子玉(1968)．台湾中南部相思樹林分収穫表及材積表．台湾省立中興大学・台湾省林務局合作研究報告、台湾省立中興大学農学院森林学系．

樹種：LEGUMINOSAE（マメ科）
Acacia decurrens（ミモザアカシア）
国　：インドネシア

データ採取地の立地環境

7. Acacia decurrens Willd
(AKASIA)

Data.

Lokasi	Jumlah petak coba/ ukur	Jumlah pemeriksaan	Tinggk dari muka laut	Keadaan lapangan/tanah
Bandung Utara	59	148	600 s/d 2100	Rata dan agak miring
Kedu	7	7	600 s/d 2100	Agak rata/ agak miring
Pekalongan	10	10		
Jumlah:	17	17		
Malang Utara	39	103	600 s/d 2100	Agak rata/ agak miring
Pasuruan	2	2		
Brantas Timur	30	68		
Jumlah:	71	173		
Jumlah semua:	147	338		

成長・収穫に関する表，図，式など

Umur (Age) (Tahun/Year)	Peninggi (Upper-height) (m)	TEGAKAN TETAP (MAIN STAND) (TT) Jumlah pohon/ha (Number of trees/ha) (N)	%	Rata-rata tinggi (Average height) (m)	Rata-rata diameter (Average diameter) (cm)	Bidang dasar/ha (Basal area/ha) (m^2)	Kayu tebal/ha (Thick-wood/ha (m3)	Tegakan penjarangan (TP) (Thinnings) Kayu tebal/ha (Thick-wood/ha (m3)	Kkt kumulatip/ha (Vtw /ha) (m3)	Jumlah volume (Total volume) (Vol.T.T. + T.P.) (m3/ha)	Riap rata-rata tahunan (Mean annual increment) (m3/ha)	Riap tahunan berjalan (Current annual increment) (m3/ha)	Umur (Age) (Tahun/Year)
Acacia decurrens Willd (Akasia)													
BONITA I (SITE CLASS I)													
2	5,1	1830	49,2	4,9	4,3	2,7	1	-	-	1,0	0,5	-	2
3	9,0	1110	35,9	7,7	7,4	4,8	10	0,5	0,5	10,5	3,5	9,5	3
4	12,0	825	31,2	10,6	9,6	6,0	21	6,0	6,5	27,5	6,9	17,0	4
5	14,3	670	29,0	12,8	11,5	6,9	31	13,0	19,5	50,5	10,1	23,0	5
6	16,0	575	28,0	14,5	13,0	7,6	41	18,0	37,5	78,5	13,1	28,0	6
7	17,2	520	27,4	15,8	14,1	8,1	49	22,0	59,5	108,5	15,5	30,0	7
8	18,1	480	27,1	16,7	15,2	8,7	56	23,0	82,5	138,5	17,3	30,0	8
9	18,7	450	27,1	17,4	16,0	9,1	61	23,0	105,5	166,5	18,5	28,0	9
10	19,2	430	27,0	17,8	16,8	9,5	65	22,5	128,0	193,0	19,3	26,5	10
11	19,5	415	27,1	18,1	17,3	9,8	68	22,0	150,0	218,8	19,8	25,0	11
12	19,8	400	26,8	18,2	17,6	10,0	71	22,0	172,0	243,0	20,2	25,0	12

BONITA II (SITE CLASS II)

2	6,9	1400	41,6	5,6	5,9	3,8	4	-	-	4,0	2,0	-	2
3	10,9	920	32,5	9,5	8,8	5,6	16	3,0	3,0	19,0	6,3	15,0	3
4	14,0	650	29,3	12,6	11,2	6,8	30	12,5	15,5	45,5	11,4	26,5	4
5	16,4	555	27,8	15,0	13,4	7,8	43	20,0	35,5	78,5	15,7	33,0	5
6	18,2	475	27,1	16,8	15,2	8,7	56	23,0	54,5	114,5	19,1	36,0	6
7	19,4	420	27,1	18,0	17,2	9,7	67	22,5	81,0	148,0	21,1	33,5	7
8	20,4	380	27,0	18,9	18,7	10,5	76	21,5	102,5	178,5	22,3	30,5	8
9	21,0	360	27,0	19,5	19,7	11,0	83	20,5	123,0	206,0	22,9	27,5	9
10	21,5	340	27,1	20,0	20,7	11,4	87	20,0	143,0	230,0	23,0	24,0	10
11	21,8	330	27,2	20,3	21,3	11,8	90	19,0	162,0	252,0	22,9	22,0	11
12	22,0	325	27,1	20,5	21,6	11,9	93	19,0	181,0	274,0	22,8	22,0	12

BONITA III (SITE CLASS III)

2	8,8	1195	35,3	6,8	7,1	4,7	9	1,0	1,0	10,0	5,0	-	2
3	12,8	770	30,2	11,5	10,3	6,4	24	13,0	14,0	38,0	12,7	28,0	3
4	16,0	570	28,1	14,6	13,0	7,6	41	18,0	32,0	73,0	18,2	35,0	4
5	18,4	460	27,3	17,0	15,7	8,9	58	23,0	55,0	113,0	22,6	40,0	5
6	20,2	390	26,9	18,7	18,4	10,3	74	22,0	77,0	151,0	25,2	38,0	6
7	21,6	340	27,0	20,1	20,8	11,5	88	18,5	95,5	183,5	26,2	32,5	7
8	22,6	310	27,0	21,0	22,6	12,4	99	17,5	113,0	212,0	26,5	28,5	8
9	23,3	280	27,6	21,7	24,5	13,2	107	16,0	129,0	239,7	26,6	27,7	9
10	23,7	270	27,6	22,2	25,3	13,6	112	15,5	144,5	256,5	25,6	16,8	10
11	23,9	260	27,9	22,4	26,1	13,9	116	15,0	159,5	275,5	25,0	19,0	11
12	24,2	255	27,8	22,6	26,4	14,0	117	14,5	174,0	291.0	24,2	15,5	12

BONITA IV (SITE CLASS IV)

2	10,5	955	33,1	9,3	8,6	5,5	15	3,0	3,0	18,0	9,0	-	2
3	14,7	650	28,6	13,2	11,7	7,0	33	15,0	18,0	51,0	17,0	33,0	3
4	17,9	480	27,4	16,4	15,1	8,6	54	23,0	41,0	95,0	23,7	44,0	4
5	20,4	380	27,0	18,8	18,7	10,5	76	22,0	63,0	139,0	27,8	44,0	5
6	22,2	320	27,1	20,7	21,9	12,1	94	18,5	81,5	175,5	29,2	36,5	6
7	23,6	275	27,4	22,1	25,0	13,5	110	15,5	97,0	207,0	29,6	31,5	7
8	24,7	240	28,1	23,1	27,7	14,5	123	13,5	110,5	233,5	29,2	26,5	8
9	25,4	220	28,5	23,8	29,7	15,3	131	12,5	123,0	254,0	28,2	20,5	9
10	25,9	210	28,2	24,3	30,8	15,7	138	11,5	134,5	272,5	27,2	18,5	10
11	26,2	200	29,0	24,6	32,0	16,1	142	11,0	145,5	287,5	26,1	15,0	11
12	26,4	195	29,2	24,8	32,6	16,3	144	10,5	156,0	300,0	25,0	12,5	12

BONITA V (SITE CLASS V)

2	12,3	805	30,8	10,8	9,9	6,2	24	6,5	6,5	30,5	15,2	-	2
3	16,5	545	27,9	15,0	13,9	7,8	44	20,5	27,0	71,0	23,7	40,5	3
4	19,5	400	27,1	18,2	17,8	10,0	72	23,0	50,0	122,0	30,5	51,0	4
5	22,4	315	27,0	20,9	22,2	12,2	97	18,0	68,0	165,0	33,0	43,0	5
6	24,2	255	27,8	22,8	26,5	14,1	119	14,5	82,5	201,5	33,6	36,5	6
7	25,8	215	28,4	24,2	30,4	15,6	137	12,0	94,5	231,5	33,1	30,0	7
8	26,9	185	29,4	25,3	34,0	16,8	150	10,0	104,5	254,5	31,8	23,0	8
9	27,6	160	30,8	26,1	37,3	17,5	160	9,0	113,5	273,5	30,4	19,0	9
10	28,2	150	31,1	26,6	39,1	18,0	165	9,0	122,5	287,5	28,8	14,0	10
11	28,4	140	32,0	26,8	40,8	18,3	169	7,5	130,0	299,0	27,2	11,5	11
12	28,6	140	31,7	27,0	41,0	18,5	171	7,0	137,0	308,0	25,7	9,0	12

出典

Suharlan, A , Sumerna, K, and Sudiono, Y (1975). Yield table of ten industrial wood specoes Lembaga Penelitian Hutan

樹種：LEGUMINOSAE（マメ科）
Acacia mangium（アカシア　マンギューム）
国　：ブルネイ

データ採取地の立地環境

1. はじめに

ブルネイの位置，気候，土壌及び *Acacia mangium* の実験植林についてはすでにその概要を報告した（本誌　旧 No. 68, 1983，新 No 3, 1985)。今回は，その3用地のうち，Bt. Kukub（海抜 100 m の丘陵地，軽度焼畑跡地）と Bt Perumpong（海抜 20～30 m の丘陵地，重度焼畑跡地）の成長状態を各々の土壌条件と比較して報告し，また，*A mangium* の急成長か，植え込み後何年くらいて鈍化するか，ということも報告したい。

3. 土壌条件

Bt Kukub と Bt Perumpong の土壌については，前報（本誌　新 No. 3, 1985）てくわしく報告しているか，化学的性質については大きな差はない。

Bt Kukub は海抜約 100 m の小高い丘の頂上て，黒褐色の表土を 20 cm ほと剝くと黄赤色の砂質土壌か出て来る。土壌硬度は極めて低く，深さ 100 cm のところまてほとんと 10 以下てある。Bt Kukub は Case A（図-5）に含まれる。

Bt Perumpong の用地は，海抜 20～30 m の丘てあって，かなり重度の焼畑か行われた形跡かある。土壌表面付近はかなり硬く，30 cm くらいから軟らかく 60 cm から再ひ硬くなり（この附近まて木の根か存在する）85 cm のところから灰色の粘土の混った土壌となり，硬度も 23～24 と上昇する。Bt Perumpong は Case B（図-5）に含まれる。

成長・収穫に関する表，図，式など

6. 土壌条件による成長の違い

胸高直径の成長には，Bt. Kukub, Bt Perumpong の 2 地点において，はっきりした差は認められないか，樹高の成長においてははっきりした差か認められた。これは焼畑の使用程度と関係する土壌の肥沃度・硬度・深度の差異に因るものと推測される。（図-1, 2, 3, 4）

7. *A. mangium* の急成長はいつ止まるか

図-5と図-6 は表-1 の樹高と胸高直径をクラフに描いたものてある。図-6 の樹高成長のクラフては，立地条件により樹高のハラツキか大きいので，Case A と Case B に分けた。Case A の立地は軽度の焼畑跡地あるいは択伐跡地で，土壌が物理的化学的に重度に破壊されていないことを意味する。Case B の立地は，強度の焼畑跡地あるいは，強度の放牧地で，土壌か物理的化学的に重度に破壊されていることを意味する。

図-5 を見ると，樹高成長は 1～6 年生て急成長を示し，7～8 年で成長速度は鈍り，9 年生て低成長に入る。すなわち，*A mangium* の樹高急成長は，6 年生前後まて

てあると云える。フルネイの場合，5年生の立木蓄積を試算してみると，Case A て 346 m^3/ha，Case B て 214 m^3/ha を示した。樹高は各々 19 48 m，14 51 m，また胸高直径は各々 18 8 cm，18 7 cm であった。従って *A mangium* をチップ用材，あるいは薪炭用材として使用するならは，6年生伐期は一案かもしれない。図-6を見ると直径成長は，樹高成長ほと立地条件によるハラツキは著しくない。しかし，樹高成長と同様，5年生前後までの直径成長は大きく，以後は漸減する傾向にある。

A mangium は，クイーンスラント州北部，パプアニューギニア南部，モルッカ諸島，インドネシアのイリアンジャヤに天然分布する。そこては成熟木の樹高は 25～30 m，直径は 60 cm に達する。1986年9月下旬，クイーンスラントの Kennedy 近く，Meunga Logging Area の雑木林て，樹高 40 m 以上（目測），胸高直径 53 cm（実測）の *A mangium* を見た。また，その近くの小川沿いて，樹齢約 20 年，樹高約 40 m，直径 40 cm，44 cm のものも見た。しかしサバやフルネイては，こく一部の例外地区を除いては，一般的な気候・立地条件から，樹高 25 m 前後か最高てはないかと推測される。同時に，直径成長は，樹高成長と密接な関係にあると見なされるので 40 cm 前後か最大てはないかと推測される。実際，フルネイの Case A に該当する5年生て，樹高 20 m 前後の立木に梢か枯れたり，樹冠の葉か黄色くなったりして die-back の特徴か出始めている。またサバの Ulu Kukut の樹齢 17 年 6 か月のものも 1984 年 10 月初旬見学した時，一部梢枝は die-back を起していた。

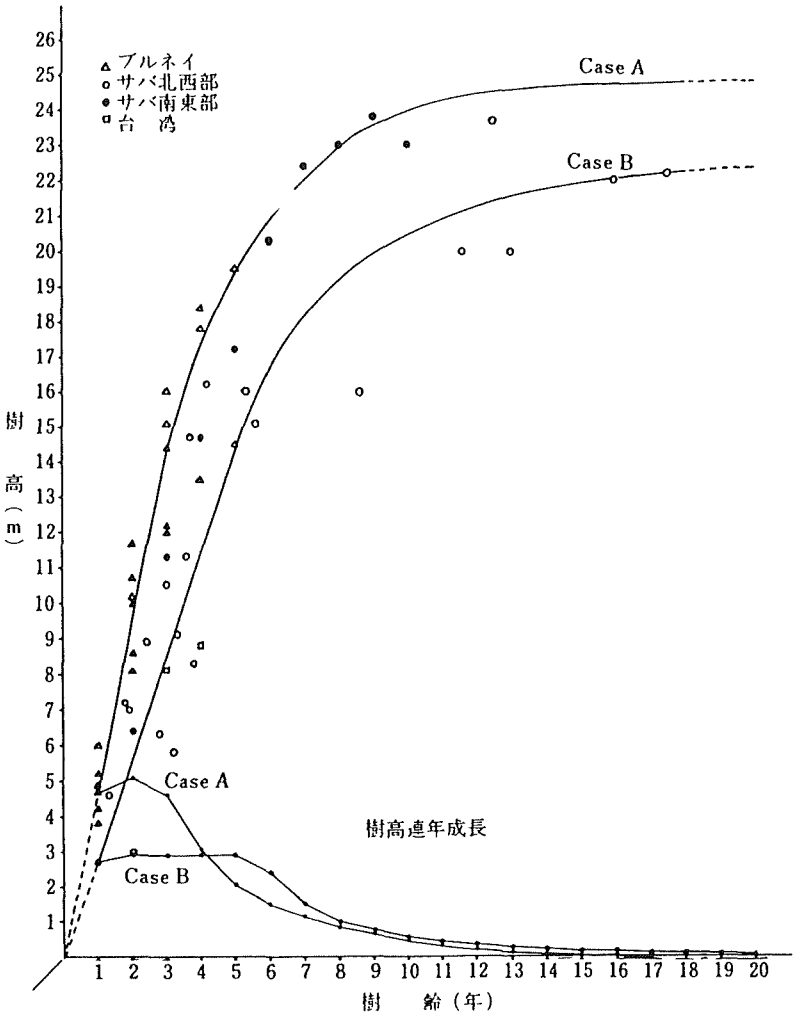


図-5 *A mangium* の樹高成長

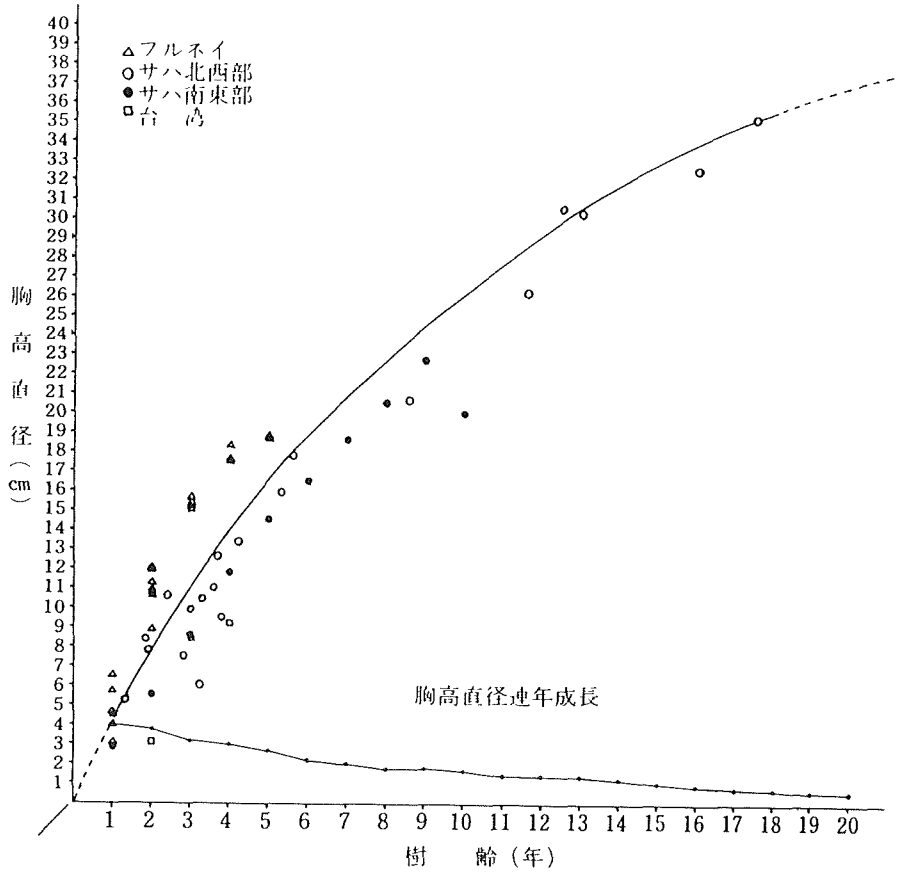


図-6　*A mangium* の肥大成長

8. 結　論

1)　*A mangium* を土壌条件の異なる2か所て試験植栽した結果は，肥大成長については顕著な差はみられなかったか，伸長成長についてはかなりの差かみられた。サバの Forest Research Centre て改良されたものの種子を使った試験植栽木の幹の分岐率は，20% 前後てあったか，他は 50% 前後てあった。

2)　種子による成長の差は，オーストラリア原産とサバにおける選抜育種を経たものに関して，平均値においては，オーストラリア産の方か優れているか，分散分析の結果，有意差は認められなかった。

3)　*A mangium* はその自生地であるオーストラリア北部においては，樹高 40 m，胸高直径 50 cm に達するものも認められるか，サバ，フルネイにおいては，樹高 25 m 前後，直径 40 cm 前後か，一般的成長の限界てはないかと推測される。

4)　*A mangium* をパルプ用，チップホート用に使用する場合，土地の生産力を最大に生かすには，5〜7年伐期か1つの目安となる（図-5，6)。

出典

熱帯林業　No 12（1988），海外林業コンサルタンツ協会

樹種：LEGUMINOSAE（マメ科）

Acacia mangium（アカシア マンギューム）

国　：マレーシア

データ採取地の立地環境

固定試験地データ及び暫定試験地データ　計２５０プロットより作成

成長・収穫に関する表，図，式など

TABLE 4

SITE I

AGE	MEAN D	H	N	HA V	G	Vcai	Vmai	PV
1	5.26	5.43	1100	6.98	2.39		6.98	
2	9.87	10.65	1000	38.73	7.66	31.76	19.37	81.99
3	13.21	14.10	879	76.08	12.05	37.35	25.36	49.09
4	16.07	16.76	736	107.55	14.94	31.47	26.89	29.26
5	18.70	18.95	641	138.91	17.64	31.36	27.78	22.57
6	21.14	20.78	574	169.60	20.17	30.69	28.27	18.10
7	23.41	22.33	524	199.16	22.55	29.56	28.45	14.84
8	25.49	23.65	485	227.09	24.76	27.93	28.39	12.30
9	27.40	24.76	454	253.04	26.80	25.95	28.12	10.25
10	29.14	25.71	429	277.13	28.67	24.11	27.71	8.70
11	30.70	26.51	410	298.53	30.36	21.79	27.18	7 29
12	32.09	27.19	393	318.50	31.87	19.56	26.54	6.14
13	33.34	27.78	380	336.15	33.23	17.65	25.86	5.25
14	34.42	28 26	369	351.52	34.41	15.37	25.11	4.37
15	35.38	28.68	360	365.16	35.46	13.64	24.34	3.73

TABLE 5

SITE II

AGE	MEAN D	H	N	HA V	G	Vcai	Vmai	PV
1	4.03	4.07	1100	3.22	1 40		3.22	
2	7.26	7.71	1010	16.27	4.18	13.05	8.14	80.19
3	9.95	10.74	940	37.25	7.32	20.98	12.42	56.31
4	12.37	13.28	880	63.81	10.59	26.56	15.95	41.62
5	14.60	15.43	770	87.25	12.90	23.44	17.45	26.86
6	16.65	17.25	693	110.96	15.09	23.71	18.49	21.37
7	18.53	18.81	635	134.27	17.14	23.30	19.18	17 35
8	20.24	20.12	592	156 53	19.04	22 27	19.57	14.22
9	21.78	21.23	557	177 38	20 79	20.85	19.71	11 75
10	23 18	22 18	530	196.86	22 39	19.48	19 69	9 90
11	24.42	22.99	508	214.54	23.83	17.67	19.50	8 24
12	25 52	23 67	490	230.46	25.12	15 92	19.20	6.91
13	26.50	24.25	476	244.85	26.27	14.40	18 83	5.88
14	27.35	24.73	464	257.41	27.28	12 56	18.39	4 88
15	28.09	25.15	454	268.56	28.16	11.15	17 90	4 15

TABLE 6

SITE III

AGE	MEAN D	H	N	HA V	G	Vcai	Vmai	PV
1	2.65	2.71	1100	1.01	0.60		1.01	
2	4.68	4.77	1050	4.73	1.80	3.72	2.37	78.66
3	6.96	7.37	1010	14.41	3.84	9.67	4.80	67.14
4	9.10	9.79	980	30.13	6.37	15.72	7.53	52.17
5	11.06	11.92	964	51.25	9.26	21.13	10.25	41.22
6	12 85	13.75	854	68.61	11.08	17.36	11.44	25.30
7	14.44	15.28	777	85.47	12.73	16.86	12.21	19.72
8	15.88	16.59	719	101.94	14.27	16.47	12.74	16.15
9	17.18	17.70	675	117.40	15.66	15.47	13.04	13.17
10	18.34	18.66	641	131.88	16.93	14.48	13.19	10.98
11	19.36	19.46	613	145.02	18.07	13.14	13.18	9.06
12	20.26	20.14	591	156.85	19.07	11.83	13.07	7.54
13	21 06	20.72	573	167.54	19.97	10.69	12.89	6.38
14	21.74	21.20	558	176.86	20.75	9.32	12.63	5.27
15	22 34	21.62	546	185.13	21.43	8.27	12.34	4.47

出典

猪瀬　光雄(1991)．ＪＩＣＡサバ州造林技術開発訓練計画　森林管理分野短期専門家報告書．国際協力事業団．

樹種：LEGUMINOSAE（マメ科）
Acacia nilotica （Syn. *A. arabica* アラビアゴムモドキ）
国　：インド

データ採取地の立地環境

Study area and Data collection

This study was undertaken in 5, 7, 11, 13 and 17 years old plantations raised on road sides in Kurukshatra, Hissar and Sonipat Forest Division. The details of these plantations are given in Table 1.

The field data was collected, using the stratified tree technique (Art & Marks, 1971) of harvesting of sample trees. One temporary study plot, measuring 0.03 ha to 0.06 ha was laid out in each plantation. The D.B.H. of all the standing trees within the plot was recorded. The entire diameter range was divided into three diameter clases and designated as A, B and C for simplicity of reference. Three sample trees, one from each diameter class (close to the mean d.b.h. of that class) were harvested in each plantation, to obtain the above ground biomass, except in 11 and 17 yeats old plantations, where one mean tree was sampled, as there was not much variation in the diameter range. Fresh weight of all the tree components was taken in the field immediately after felling of sample trees. Representative samples of all the tree components were collected.

成長・収穫に関する表，図，式など

Table 1

Details of plantations

Species—Acacia nilotica

Age (Years)	5	7	11	13	17
Area of sample plot (ha)	0 06	0 05	0 05	0 05	0 03
No. of trees on the sample plot					
Class A	38	10	—	10	—
Class B	31	16	23	16	24
Class C	20	11	—	11	—
Total	89	37	23	37	24
No of tree/ha					
Class A	633	200	—	200	—
Class B	517	320	460	320	800
Class C	333	220	—	220	—
Total	1483	740	460	740	800
Mean diameter of the crop (cm)	7 6	13.4	16.9	14.4	26.04
Class A	4 3 (3—6)	8 5 (6—10)	—	9 4 (7—11)	—
Class B	8 4 (7—10)	13.4 (11—15)	16 9 (14—20)	14.4 (12—16)	26 04 (22—28)
Class C	12.6 (11—14)	17.3 (16—20)	—	18 9 (17—22)	—
Mean height of the crop (m)	8 6	8 6	12 2	12.65	15 0
Class A	7 3	7.9	—	8 65	—
Class B	8 6	8.6	12 2	12 65	15.0
Class C	10 0	9.5	—	13.10	—

Note .—Figure in brackets indicate the range of D.B.H. of each class.

出典

Tandon, V.N., M.C. Pande, Lajpat Rai and H.S. Rawat (1988). Biomass Production and its Distribution by Acacia nilotica Plantations at Five Different Ages in Haryana. Indian For., 114 : 770-775.

樹種：LEGUMINOSAE（マメ科）
Acacia nilotica（Syn. *A. arabica* アラビアゴムモドキ）
国　：インド

データ採取地の立地環境

Locality: southern and northern Doab of Uttar Pradesh and Udaipur in Rajasthan

Data source: permanent sample plots

Size of plots: not indicated

Number of plots: 11

Measurement specification: 5 cm diameter over bark. Tree model has been developed to simulate growth and yield based on 26 observations on the sample plot.

成長・収穫に関する表，図，式など

Yield table

Age (years) \ Site class	I		II		III	
	No. of stems/ha	MAI (m^3/ha)	No. of stems/ha	MAI (m^3/ha)	No. of stems/ha	MAI (m^3/ha)
5	1 196	7.33	1 473	4.17	1 487	1.84
10	691	9.56	872	5.96	1 059	2.99
15	514	9.36	660	5.90	855	3.05
20	417	8.87	541	5.58	726	2.90
25	354	8.47	462	5.24	634	2.71

Site class is based on dominant height which corresponds to the height of a tree of dominant diameter, where dominant diameter is mean diameter of 125 thickest tree/ha.

5.3.4 Single tree volume equations

INDIA (1)

Regression equations were based on more than 400 tree measurements.

$V = 0.00208 + 0.411526\ D^2 H$ $(r^2 = 0.9685)$

where: V = volume of single tree over bark in m^3 measured up to 50 cm diameter over bark
D = diameter at breast height in cm
H = total height in m.

出典

(1) Sharma, R.P. and Jain 1977 General standard volume table for Babul (Acacia nilotica). Indian Forest Record (N.S.)

(2) Singh, S.P. 1982 Growth studies of Acacia nilotica. Indian Forester Vol. 108, No. 4.

ダイジェストデータ Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：LEGUMINOSAE（マメ科）
Acacia nilotica （Syn. *A. arabica* アラビアゴムモドキ）
国　：スーダン

成長・収穫に関する表，図，式など

SUDAN (3)

Regression equation

$V = 0.07785184 + 0.00003866\ D^2 H \qquad (r^2 = 0.9968)$

Symbols have the same meaning as above. This equation has been derived from the volume table data, based on measurement of 1 260 trees in eight different localities. Percentages of the branch wood and stem wood of an average tree have also been worked out and are as follows:

Stem wood (measured up to 24 cm diameter o.b.)	= 61.9 %
Branch wood	= 38.1 %
Total volume of the wood in a single tree	= 100 %

出典

(3) Waheed Khan, M.A. 1965 Single tree growth statistics for Acacia nilotica. U.N. Special Fund Forestry Research and Education Project Pamphlet No. 6. Sudan.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：LEGUMINOSAE（マメ科）

Acacia mearnsii （Syn. *A. mollissima* モリシマアカシア）

国　：多国籍（インドネシア、ケニア、ブラジル、インド）

データ採取地の立地環境

INDONESIA (6)

Locality:	Bandung Uttara, Malang Uttara, Brantas Trimureti
Altitude:	1 000 to 2 000 m
Rainfall:	700 to 3 000 mm
Soil:	well-drained volcanic soil of high fertility
Data source:	temporary sample plots
Number of plots:	147

成長・収穫に関する表，図，式など

Provisional normal yield table

(total volume in m^3 ob/ha)

Age in years	Site class I		Site class II		Site class III		Site class IV	
	No. of stems/ha	MAI (m^3/ha)	No. of stems/ha	MAI (m^3/ha)	No. of stems/ha	MAI (m^3/ha)	No. of stems/ha	MAI (m^3/ha)
2	805	15.2	955	9.0	1 195	5.0	1 400	2.0
3	545	23.7	650	17.0	770	12.7	920	6.3
4	400	30.5	480	23.7	570	18.2	650	11.4
5	315	33.0	380	27.8	460	22.6	555	15.7
6	255	33.6	320	29.2	390	25.2	475	19.1
7	215	33.1	275	29.6	340	26.2	420	21.1
8	185	31.8	240	29.2	310	26.5	380	22.3
9	160	30.4	220	28.2	280	26.6	360	22.9
10	140	28.8	210	27.2	270	25.6	340	23.0
11	140	27.2	200	26.1	260	25.0	330	22.9
12	140	25.7	195	25.0	255	24.2	325	22.8

Remarks: The crop is heavily thinned from the third year onward and MAI includes thinning yield.

Bark yield at 8 years of age

(7.5 years in case of Brazil)

Details \ Countries	India (3)	Brazil (1)	Kenya (2)	Indonesia (2)
No. of tree per ha	620	1 666	1 500	275
Dry bark in kg/ha	14 330.0	15 525.0	7 500–12 500	7 337.5

1/ Converted to dry bark from green bark using 42.5 percent weight loss in dryness. Brazil yield seems to be on higher side.

Average percentage of green bark in the diameter range 6 to 21.5 cm is 13.65 percent (1).

Site index and diameter growth

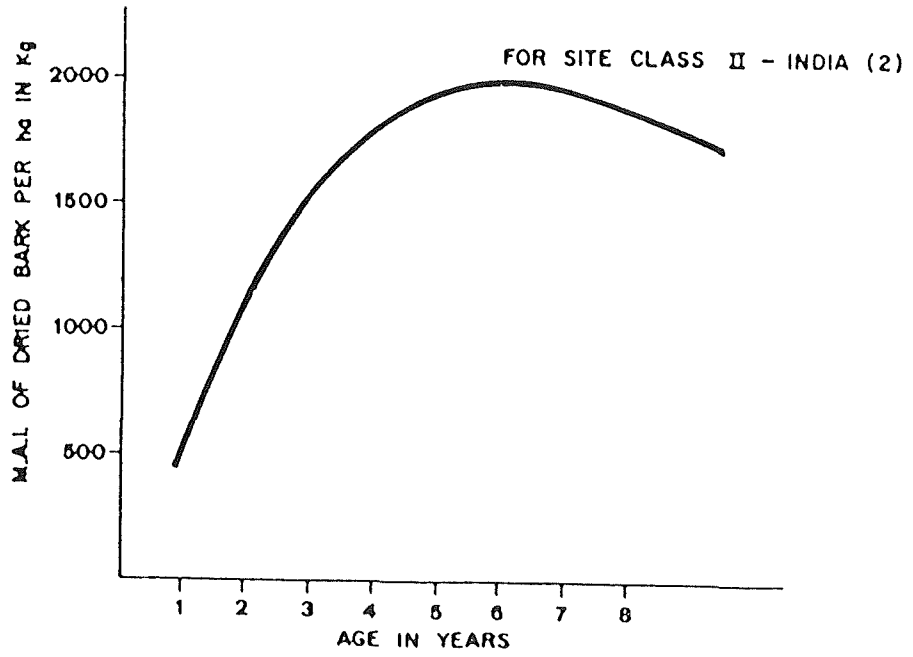
Details \ Countries	Kenya	Brazil
(a) Reference	(5)	(4)
(b) Locality	western plateau	Rio Grande do Sul
(c) Altitude	2000 - 2800 m	0 - 100
(d) Rainfall	1050 - 1320 mm	1 500 mm
(e) Data source	permanent sample plots	temporary sample plot
(f) No. of plots	20	150
(g) Size of plots	500 m^2	400 m^2
(h) Site index equation where: A = stand age Hm = mean height of 200 stems/ha Ho = dominant height	$\log SI = \log Hm + 1.2325 \times \left[\frac{1}{A} - \frac{1}{10}\right]$ SI = site index	$Ho = \frac{A^2}{b_o + b_1 A + b_2 A^2}$ $b_o = 0.09310$ $b_1 = 0.16690$ $b_2 = 0.03247$ ($r^2 = 0.91$
(i) Diameter growth equation where: D = mean dbh in cm N = No. of stems/ha A = stand age	$D^2 = 477.6728 (\log A) + 324.1794 \times \log N + 5.5844 (SI) + 0.4249 (SI)^2 - 300.0517 (\log A \times \log N/100) + 6.6020 (\log A \times SI) - 14.2133 \log \frac{N}{100} SI - 369.7141$	
Remark	Diameter growth equation can be applied to A. mearnsii outside Kenya also	

Diameter/total wood/green bark relation for single tree in Brazil (1)

Diameter class in cm	Total wood volume u.b. per tree in m^3	Green bark in kg/tree
6.0 - 9.5	0.0273	9.03
10.0 - 13.5	0.0685	12.05
14.0 - 17.5	0.1299	18.14
18.0 - 21.5	0.2457	25.86

Remarks: Calculation of total wood and green bark per tree is based on 30 trees of a 7.5 year old plantation, measured in each diameter class.

MAI of dried bark over age curve



The MAI for timber seems to culminate between 6 to 8 years (6) whereas MAI for bark may culminate earlier (3). But the rotation age followed in almost all the plantations ranges between 8 to 10 years, which may be due to the tannin content in bark on maturity, or relative market demand and price of these two products. The MAI of wood ranges between 25 to 35 m^3/ha whereas dried bark yield ranges between 7 000 to 14 000 kg/ha at eight years of age, depending upon site and density of plantations.

出典

(1) Bernardo Reoh et al. 1980 Factors de conversao para calculo de volume de Acacia mearnsii. Instituto de Pesquisas e Estudos Florestais, Circular Technica No. 120. Nov.

(2) Sherry, S.P. 1971 The black wattle, Pietermasitzburg. University of Natal Press.

(3) Raghavan, M.S. 1954-64 Tentative yield table of Acacia mollissima. Working Plan of Nilgiri. India.

(4) Schneider, P.R., et al. 1980 Site index for black wattle, Acacia mearnsii de Wild. Brazil Florestal qno.10 No. 42.

(5) Schonau, A.P.G. 1975 Effect of site quality and initial stocking density on average diameter on black wattle plantation in Kenya. Forest Science, Vol. 21 No. 1.

(6) Indonesian Department of Agriculture, Forest Research Institute. 1975 Yield table of ten industrial species.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：LEGUMINOSAE（マメ科）
Albizia falcataria（モルッカネム）
国　：インド
North Bengal, India

データ採取地の立地環境

Nursery

The seeds obtained from the Phillipines averaged 50 numbers per grammo in weight and the germination started within 4 to 5 days, being complete within 15 to 30 days, the actual period varying somewhat with the time of sowing Experiments indicate that sowing in April appears to be the best. About 28 per cent germination was obtained both in the case of direct sowing in beds as well as sowings in polypots. No pre-treatment for breaking the dormancy of the seeds was, however, carried out in the North Bengal experiments though 70 to 85 per cent germination has been reported from Hawaii with the aid of mechanical scarification or treatment with sulphuric acid. The seedlings obtained were outplanted at an age varying from 10 to 12 months.

Site factors

In Hawaii, *Albizia falcataria* has been found most suitable for areas where the rainfall varies between 2000 mm—5000 mm (80"—200") and where the altitude is less than 900 m (2000 ft) The most suitable soils have been found to be deep, moist but free-draining, including free draining, clays Dry, sterile and sandy or compacted soils have been found unsuitable for the species. Against these requirements, the site factors of the experimental plantations of *Albizia falcataria* raised in the Buxa Forest Division are given in Table 2.

Table 2

Albizia falcataria Site factors of experimental plantations

Year of Plantation	Location	Annual rainfall (mm)	Altitude (m)	Soil type
1974	Silvicultural Garden, South Rajabhatkhawa Block, Buxa Forest Division	3800	120	Sandy loam
1975	Poro Block, Buxa Forest Division.	3800	95	Clayey loam
1976	South Rajabhatkhawa Block. Buxa Forest Division	3800	120	Sandy loam

成長・収穫に関する表，図，式など

Table 3

Albizia falcataria Growth data of experimental plantations

Location	Year of creation	Age at the time of measurement (Yrs)	Survival percentage	M.A I height (m)	M A I diameter (cms)	M A.I. volume (m^3/tree)	M.A.I. volume per ha (m^3)
Silvicultural Garden, South Rajabhatkhawa Block Buxa Forest Division.	1974	5 00	7 6%	4.28	5 73	0.088	16.72
Poro Block, Buxa Forest Division.	1975	3.75	50 0%	3.06	3 44	0 030	37 50
South Rajabhatkhawa Block, Buxa Forest Division.	1976	3.50	34 7%	3.84	3 26	0 032	27 76

Table 4

Albizia falcataria Figures for M.A I. per ha on an assumed 5% retention at the end of 5 years (Initial Planting at 2 m × 2 m)

Location	Year of creation	Age at the time of measurement (years)	M.A I volume (m^3/tree)	M.A I volume per ha (m^3)
Silvicultural Garden, South Rajabhatkhawa Block, Buxa Forest Division	1974	5 00	.085	1.0 00
Poro Block, Buxa Forest Division	1975	3.75	0 030	37 50
South Rajabhatkhawa Block, Buxa Forest Division	1976	3 50	0 032	40 00

Table 5

Growth data of Albizia falcataria grown in other Countries along with some other tropical fast growing species tried in North Bengal

Name of species	Location	Early height growth per year (m)	Early diameter growth per year (cms)	M A I volume per ha (m^3)
Albizia falcataria	British Solomon Island and Sabah	3.0 – 3.7	4 5 – 5 5	7 – 14
Albizia procera	North Bengal.	1 52	—	—
Anthocephalus chinensis	North Bengal, Cooch Bihar Forest Division	1 8 – 3 0	1 – 1.40	9.8 –11 2
Gmelina arborea	North Bengal, Buxa Forest Division.	1 94	1.94	—
Lagerstroemia speciosa	North Bengal, Buxa Forest Division.	1 22	1 21	—

出典

Palit, S (1980). Trials of *Albizia falcataria* (L) Fosberg and *Leucaena leucocephala* (Lam.) De Wit in North Bengal. Indian For., 106 : 456-465.

樹種：LEGUMINOSAE（マメ科）
Albizia falcata（モルッカネム）
樹　：インドネシア

データ採取地の立地環境

8. Albizia falcata Backer
(JEUNGJING)

Data.

Lokasi	Jumlah petak coba/ukur	Jumlah pemeriksaan	Tinggi dari muka laut	Keadaan lapangan/tanah
Jasinga	17	85	50 s/d 160	rata
Kebun Raya Bogor	1	1	250	
Jumlah:	18	86		
Pekalongan	1	3	400	
Kalang Utara	2	8	400 s/d 600	
Kediri	28	126		
Jumlah:	31	137		
Jumlah semua:	49	223		

成長・収穫に関する表，図，式など

Umur (Age) (Tahun/Year)	Peninggi (Upper-height) (m)	TEGAKAN TETAP (MAIN STAND) (T.T.) Jumlah pohon/ha (Number of trees/ha) (N)	S %	Rata-rata tinggi (Average height) (m)	Rata-rata diameter (Average diameter) (cm	Bidang dasar/ha (Basal area/ha) (m^2)	V.kayu tebal/ha (Thick-wood/ha (m3)	Tegakan penjarangan (T P.) (Thinnings) V.kayu tebal/ha (Thick-wood/ha (m3)	Vkt kumulatip/ha (Vtw /ha) (m3)	Jumlah volume (Total volume) (Vol.T.T. + ΣT.P.) (m3/ha)	Riap rata-rata tahunan (Mean annual increment) (m3/ha)	Riap tahunan berjalan (Current annual increment) (m3/ha)	Umur (Age) (Tahun/Year)
Albiz ia falcata Backer (Jeungjing)													
BONITA I (SITE CLASS I)													
2	4,5	1240	67,8	2,4	5,3	2,7	5	-	-	5	2,5	-	2
3	8,6	995	39,6	6,7	8,1	5,2	20	2	2	22	7,3	17,0	3
4	12,4	790	30,8	10,8	10,7	7,3	38	8	10	48	12,0	26,0	4
5	15,8	610	27,5	14,4	13,8	9,1	60	15	25	85	17,0	37,0	5
6	19,3	465	25,8	17,8	16,9	10,4	82	24	49	131	21,8	46,0	6
7	22,1	360	25,6	20,8	19,9	11,2	102	36	85	187	26,7	56,0	7
8	24,3	280	26,4	23,2	23,1	11,7	119	46	131	250	31,2	63,0	8
9	26,0	230	27,2	25,0	25,8	12,0	132	50	181	313	34,8	63,0	9
10	27,3	190	28,6	26,6	28,7	12,3	144	53	234	378	37,8	65,0	10
11	28,4	170	29,0	27,8	30,9	12,8	152	54	288	440	40,0	62,0	11
12	29,4	160	28,9	28,6	32,5	13,3	161	53	341	502	41,8	62,0	12
BONITA II (SITE CLASS II)													
2	7,2	1075	45,6	5,2	7,2	4,4	14	-	-	14	7,0	-	2
3	12,2	800	31,1	10,4	10,6	7,0	38	7	7	45	15,0	31,0	3
4	16,4	595	26,9	14,8	14,0	9,2	63	16	23	86	21,5	41,0	4
5	20,0	440	25,6	18,7	17,5	10,6	87	28	51	138	27,6	52,0	5
6	23,0	330	25,7	22,0	20,9	11,4	109	40	91	200	33,3	62,0	6
7	25,5	240	26,7	24,5	24,7	12,0	128	50	141	269	38,4	69,0	7
8	27,1	200	27,0	26,4	28,1	12,4	142	54	195	337	42,1	68,0	8
9	28,5	170	27,9	7,8	31,0	12,8	154	54	249	403	44,8	66,0	9
10	29,8	150	28,4	29,0	33,6	13,3	164	53	302	466	46,6	63,0	10
11	30,7	140	28,6	30,0	35,3	13,7	172	51	353	525	47,7	59,0	11
12	31,5	130	28,9	30,9	36,9	13,9	180	50	403	583	48,5	58,0	12

BONITA III (SITE CLASS III)

2	10,0	915	35,5	8,2	9,1	6,0	26	4	4	30	15,0	-	2
3	15,4	645	27,5	14,1	13,2	8,8	57	14	18	75	25,0	45,0	3
4	20,4	425	25,5	19,3	17,9	10,7	90	29	47	137	34,2	62,0	4
5	24,6	275	26,3	23,6	23,4	11,8	122	46	93	215	43,0	78,0	5
6	27,6	195	27,9	26,7	28,6	12,5	146	54	147	293	48,8	78,0	6
7	29,3	160	29,0	28,6	32,1	13,0	160	54	201	361	51,6	68,0	7
8	30,5	140	29,8	29,9	35,0	13,5	170	52	253	423	52,9	62,0	8
9	31,2	125	30,8	30,8	37,5	13,8	178	50	303	481	53,4	58,0	9
10	31,9	115	31,4	31,5	39,5	14,1	182	48	351	533	53,3	52,0	10
11	32,4	110	31,8	32,0	40,5	14,2	186	47	398	584	53,1	51,0	11
12	32,9	110	31,3	32,4	41,1	14,6	192	45	443	635	52,9	51,0	12

BONITA IV (SITE CLASS IV)

2	12,7	775	30,4	11,1	11,0	7,4	41	6	6	47	23,5	-	2
3	19,3	465	25,8	18,0	16,6	10,0	83	25	31	114	38,0	67,0	3
4	24,4	280	26,3	23,4	23,0	11,6	120	46	77	197	49,2	83,0	4
5	28,1	180	28,5	27,5	30,1	12,8	150	54	131	281	56,2	84,0	5
6	30,6	135	30,2	30,0	35,8	13,6	172	52	183	355	59,2	74,0	6
7	32,2	120	30,5	31,6	39,1	14,4	186	47	230	416	59,4	61,0	7
8	33,4	110	30,8	32,8	41,5	14,9	196	43	273	469	58,6	53,0	8
9	34,0	100	31,8	33,6	44,0	15,2	202	41	314	516	57,3	47,0	9
10	34,5	100	31,3	34,2	44,4	15,5	206	39	353	559	55,9	43,0	10
11	34,8	100	31,0	34,6	44,6	15,6	209	37	390	599	54,4	40,0	11
12	35,3	95	31,2	34,8	46,0	15,8	212	36	426	630	52,5	31,0	12

出典

Suharlan, A , Sumerna, K, and Sudiono, Y. (1975) Yield table of ten industrial wood specoes Lembaga Penelitian Hutan.

樹種：LEGUMINOSAE（マメ科）
Albizia falcataria（モルッカネム）
国　：インドネシア

データ採取地の立地環境

Locality:	Kediri, Jasinga, Malangá, etc.
Altitude:	50 - 600 m
Data source:	temporary sample plots
Number of plots:	49
Measurement specification:	not indicated

Published provisional normal yield table
(total vol. in m^3/ha ob)

成長・収穫に関する表，図，式など

Age (years)	Site class I		Site class II		Site class III		Site class IV	
	No. of stems/ha	MAI (m^3/ha)	No. of stems/ha	MAI (m^3/ha)	No. of stems/ha	MAI (m^3/ha)	No. of stems/ha	MAI (m^3/ha)
2	775	28.5	915	15.0	1 075	7.0	1 240	2.5
3	465	38.0	645	25.0	800	15.0	995	7.3
4	280	49.2	425	34.2	595	21.0	790	12.0
5	180	56.2	275	43.0	440	27.6	610	17.0
6	135	59.2	195	48.8	330	33.3	465	21.8
7	120	59.4	160	51.6	250	38.4	360	26.7
8	110	58.6	140	52.9	200	42.1	280	31.2
9	100	57.3	125	53.4	170	44.8	230	34.8
10	100	55.9	115	53.3	150	46.6	190	37.8
11	100	54.4	110	53.1	140	47.7	170	40.0
12	95	52.5	110	52.9	130	48.5	160	41.8

出典

(5) Indonesian Department of Agriculture Forest Research Institute.
1975 Yield tables for ten industrial species.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：LEGUMINOSAE（マメ科）
Albizia falcataria（モルッカネム）
国名：フィリピン

データ採取地の立地環境

成長・収穫に関する表，図，式など

PHILIPPINES (3)

Locality: Nasipit

Other factors: not indicated

Data source: temporary sample plots

Site index equation based on a ten year reference age:

$$\log H = 1.04550 + 0.41834 \log A \qquad (r^2 = 0.72)$$

where: H = mean total height in metres of at least five dominant and co-dominant trees
A = stand age in years

Yield equations

$$\log Y_{20} = -2.34183 + 1.31168 \log A + 2.07938 \log S + 0.06460 \log (AS) \qquad (r^2 = 0.66)$$

$$\log Y_{10} = -1.53657 + 0.20085 \log A + 1.46447 \log S + 0.63247 \log (AS) \qquad (r^2 = 0.81)$$

where: Y_{20} = yield in m^3/ha for measurement up to 20 cm top dib.(for sawn timber)
Y_{10} = yield in m^3/ha for measurement up to 10 cm top dib. (for pulpwood)
A = stand age
S = site index

It has been assumed that stand density in a particular age site class is not highly variable and this assumption holds good in Y_{10} equation.

出典

(1) Chinte, F.O. 1971 Silvicultural study of the four pulpwood species. The Philippine Lumberman.

(3) Revilla Jr., R.J. 1974 Yield predictions in the forest plantations. Philippine Forest Research Society. Proceedings of the Forest Research Symposium on Industrial Forest Plantations, Manila.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：LEGUMINOSAE（マメ科）
Albizia falcataria（モルッカネム）
備　考：多国籍（フィリピン，マレーシア）

データ採取地の立地環境

成長・収穫に関する表，図，式など

Details \ Countries	Philippines	Malaysia		
Reference	(1)	(4)	(2)	
Locality	Bislig, Surigao del Sur		Central lowland	
Altitude	-	-	600 m	600 m
Rainfall	-	-	2000 - 2500 mm	
Soil	-	-	poor sandy	average
Data source	T.S.P.	T.S.P.	T.S.P.	T.S.P.
No. of plots	6	-	1	1
Size of plots	-	-	400 m^2	700 m^2
Measurement specification	-	7.5 cm (ob)	7.5 cm (ob)	7.5 cm (ob)
MAI (m^3/ha)				
(A1)	39.0 (2) 1/	13.4 (2.5) 1/	1.5 (2.6) 1/	5.5 (2.5) 1/
(A2)	47.0 (2.6)	38.7 (4.5)	5.5 (4.1)	15.4 (4.5)
(A3)	-	37.6 (5.8)	8.0 (6.1)	15.4 (6.0)
(A4)	49.0 (7.5)	37.8 (6)	8.5 (7.0)	14.5 (7.0)

1/ Figures in brackets indicate age in years.
A1, A2, etc. indicate age in years.

出典

(2) Mitchel, B.A. Possibilities for forest plantations. Malayan Forester. 1965

(4) Streets, R.J. Exotic forest trees in Commonwealth. Clarendon Press. 1962 Oxford.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：LEGUMINOSAE（マメ科）

Albizia falcataria（*Malacca albizia* モルッカネム）

国　台湾

データ採取地の立地環境

適応範囲　　台湾北　部　標高400m以下

中南部　標高800m以下

サンプルプロット数　145

成長・収穫に関する表，図，式など

表15 馬六甲合歓人工林林分收穫表

Table 15 Yield table of Malacca Albizzia in Taiwan

地位級	林齢（年）	地位指数 平均	地位指数 範囲	林分平均胸高直径（cm） 平均	林分平均胸高直径（cm） 範囲	林分高（m） 平均	林分高（m） 範囲	每公頃胸高断面積（m^2） 平均	每公頃胸高断面積（m^2） 範囲	每公頃立木材積（m^3） 平均	每公頃立木材積（m^3） 範囲	每公頃立木株数 平均	每公頃立木株数 範囲	每公頃立木材積連年生長量（m^3）	林齢（年）
	2	8 27	~ 19 ~ 9 35	5 15	4 48 ~ 5 97	5 17	4 75 ~ 5 63	6 03	5 47 ~ 6 63	16 38	13 65 ~ 19 41	9001	10716 ~ 7287	11 20	2
	3	10 69	9 30 ~ 12 09	8 37	~ 28 ~ 9 70	7 94	7 29 ~ 8 65	8 75	7 94 ~ 9 62	32 13	26 79 ~ 38 10	2067	2461 ~ 1673	15 76	3
	4	12 84	11 1.~ 14 52	11 24	9 78 ~ 13 04	10 25	9 40 ~ 11 16	11 39	10 33 ~ 12 53	51 84	43 21 ~ 61 46	1300	1548 ~ 1053	19 71	4
	5	14 80	12 87 ~ 16 71	13 75	11 96 ~ 15 95	12 15	11 15 ~ 13 23	13 98	12 68 ~ 15 38	75 13	62 65 ~ 89 07	1029	1226 ~ 833	21 29	5
	6	16 62	14 45 ~ 18 79	15 91	13 84 ~ 18 46	13 73	12 59 ~ 14 94	16 52	14 99 ~ 18 17	101 73	84 83 ~ 120 62	893	1063 ~ 723	26 60	6
I	7	18 33	15 94 ~ 20 71	17 79	15 47 ~ 20 61	15 04	13 81 ~ 16 38	19 03	17 26 ~ 20 93	131 45	109 61 ~ 155 85	812	967 ~ 657	29 73	7
	8	19 96	17 36 ~ 22 56	19 42	16 89 ~ 22 52	16 17	14 83 ~ 17 60	21 51	19 51 ~ 23 66	164 13	136 86 ~ 194 60	757	902 ~ 613	32 68	8
	9	21 51	18 70 ~ 24 32	20 85	18 14 ~ 24 18	17 12	15 72 ~ 18 65	23 97	21 74 ~ 26 36	199 64	166 47 ~ 236 70	720	857 ~ 583	35 51	9
	10	23 00	20 00 ~ 26 00	22 11	19 31 ~ 25 69	18 00	16 50 ~ 19 50	26 40	24 00 ~ 29 00	237 80	198 00 ~ 282 75	690	820 ~ 560	38 17	10
	11	24 44	21 25 ~ 27 63	23 23	20 21 ~ 26 94	18 68	17 15 ~ 20 34	28 81	26 13 ~ 31 69	278 70	232 40 ~ 330 44	668	796 ~ 541	40 90	11
	12	25 83	22 46 ~ 29 20	24 23	21 08 ~ 28 10	19 32	17 73 ~ 21 04	31 20	28 30 ~ 34 32	322 08	268 57 ~ 381 08	650	775 ~ 527	43 38	12
	13	27 18	23 63 ~ 30 72	25 13	21 85 ~ 29 14	19 89	18 25 ~ 21 66	33 58	30 46 ~ 36 93	367 93	306 81 ~ 436 24	636	758 ~ 515	45 85	13
	14	28 49	24 77 ~ 32 20	25 93	22 56 ~ 30 08	20 39	18 72 ~ 22 21	35 94	32 60 ~ 39 53	416 18	347 04 ~ 493 44	624	743 ~ 505	48 25	14
	15	29 76	25 88 ~ 33 65	26 66	23 19 ~ 30 93	20 85	19 13 ~ 22 70	38 29	34 73 ~ 42 11	466 77	389 22 ~ 553 42	615	732 ~ 498	50 59	15
	2	5 39	4 31 ~ 6 47	3 64	3 18 ~ 4 13	4 00	3 54 ~ 4 46	4 51	3 92 ~ 5 08	9 44	7 25 ~ 11 84	13416	15088 ~ 11745	6 46	2
	3	6 98	5 58 ~ 8 37	5 91	5 16 ~ 6 72	6 15	5 43 ~ 6 85	6 53	5 69 ~ 7 37	18 52	14 23 ~ 23 23	3081	3465 ~ 2697	9 08	3
	4	8 38	6 70 ~ 10 05	7 95	6 94 ~ 9 03	7 93	7 02 ~ 8 84	8 51	7 40 ~ 9 60	29 89	22 96 ~ 37 49	1938	2180 ~ 1697	11 37	4
	5	9 65	7 72 ~ 11 58	9 71	8 48 ~ 11 04	9 40	8 32 ~ 10 48	10 43	9 09 ~ 11 78	43 31	33 28 ~ 54 33	1535	1726 ~ 1343	13 41	5
	6	10 84	8 67 ~ 13 01	11 24	9 82 ~ 12 78	10 62	9 40 ~ 11 84	12 33	10 74 ~ 13 93	58 65	45 07 ~ 73 56	1331	1497 ~ 1165	15 34	6
	7	11 96	9 57 ~ 14 35	12 56	10 98 ~ 14 28	11 64	10 30 ~ 12 98	14 21	12 37 ~ 16 04	75 79	58 23 ~ 95 05	1211	1362 ~ 1060	17 14	7
II	8	13 02	10 41 ~ 15 62	13 72	11 98 ~ 15 59	12 51	11 07 ~ 13 95	16 06	13 98 ~ 18 13	94 63	72 71 ~ 118 68	1129	1270 ~ 989	18 85	8
	9	14 03	11 22 ~ 16 83	14 71	12 87 ~ 16 74	13 25	11 73 ~ 14 78	17 89	15 58 ~ 20 20	115 10	88 44 ~ 144 36	1073	1207 ~ 939	20 47	9
	10	15 00	12 00 ~ 18 00	15 63	13 71 ~ 17 72	13 90	12 30 ~ 15 50	19 70	17 20 ~ 22 20	137 14	105 78 ~ 172 05	1031	1160 ~ 900	22 05	10
	11	15 94	12 75 ~ 19 12	16 41	14 33 ~ 18 65	14 46	12 80 ~ 16 12	21 51	18 72 ~ 24 28	160 68	123 46 ~ 201 53	996	1121 ~ 872	23 54	11
	12	16 84	13 47 ~ 20 21	17 11	14 95 ~ 19 45	14 95	13 23 ~ 16 67	23 29	20 28 ~ 26 30	185 70	142 68 ~ 232 90	970	1091 ~ 849	25 02	12
	13	17 72	14 18 ~ 21 27	17 75	15 50 ~ 20 17	15 40	13 62 ~ 17 16	25 06	21 82 ~ 28 30	212 13	162 99 ~ 266 06	949	1068 ~ 831	26 43	13
	14	18 58	14 86 ~ 22 29	18 32	16 00 ~ 20 82	15 78	13 97 ~ 17 60	26 83	23 36 ~ 30 29	239 95	184 36 ~ 300 95	930	1047 ~ 815	27 82	14
	15	19 41	15 53 ~ 23 29	18 84	16 45 ~ 21 41	16 14	14 28 ~ 17 99	28 58	24 89 ~ 32 27	269 11	206 77 ~ 337 53	917	1031 ~ 802	29 17	15
	2	2 32	1 44 ~ 3 59	2 53	2 14 ~ 2 91	2 80	2 34 ~ 3 26	2 91	2 28 ~ 3 53	4 27	2 77 ~ 5 97	18045	19803 ~ 16288	2 92	2
	3	3 26	1 86 ~ 4 65	4 11	3 48 ~ 4 73	4 30	3 59 ~ 5 00	4 22	3 31 ~ 5 12	8 18	5 44 ~ 11 72	4144	4548 ~ 3741	5 11	3
	4	3 91	2 21 ~ 5 58	5 52	4 68 ~ 6 35	5 54	4 63 ~ 6 46	5 50	4 31 ~ 6 67	13 51	8 78 ~ 18 91	2607	2862 ~ 2351	5 14	4
	5	4 50	2 ~ 6 44	6 75	5 72 ~ 7 77	6 57	5 49 ~ 7 65	6 74	5 29 ~ 8 19	19 58	12 72 ~ 27 41	2064	2266 ~ 1863	6 07	5
	6	5 06	2 89 ~ 7 23	7 81	6 63 ~ 8 99	7 43	6 20 ~ 8 65	7 97	6 25 ~ 9 68	26 51	17 23 ~ 37 11	1791	1965 ~ 1616	6 94	6
	7	5 58	3 19 ~ 7 97	8 73	7 41 ~ 10 05	8 14	6 80 ~ 9 48	9 18	7 20 ~ 11 15	34 26	22 26 ~ 47 95	1628	1787 ~ 1470	7 75	7
III	8	6 07	3 47 ~ 8 68	9 53	8 09 ~ 10 97	8 75	7 31 ~ 10 18	10 37	8 14 ~ 12 60	42 77	27 80 ~ 59 88	1519	1667 ~ 1371	8 51	8
	9	6 53	3 74 ~ 9 33	11 24	8 68 ~ 11 78	9 27	7 74 ~ 10 79	11 55	9 07 ~ 14 04	52 02	33 81 ~ 72 83	1443	1581 ~ 1303	9 26	9
	10	7 00	4 00 ~ 10 00	10 83	9 17 ~ 12 53	9 70	8 10 ~ 11 30	12 70	10 00 ~ 15 40	61 82	40 50 ~ 87 01	1385	1520 ~ 1250	9 80	10
	11	7 34	4 25 ~ 10 63	11 40	9 67 ~ 13 13	10 11	8 44 ~ 11 77	13 89	10 91 ~ 16 87	72 63	47 21 ~ 101 67	1340	1471 ~ 1210	10 21	11
	1	7 60	4 49 ~ 11 23	11 89	10 09 ~ 13 69	10 45	8 73 ~ 12 17	15 05	11 81 ~ 18 27	83 93	54 55 ~ 117 50	1304	1432 ~ 1178	10,51	12
	13	7 85	4 73 ~ 11 96	12 33	10 16 ~ 14 20	10 77	8 93 ~ 12 53	16 19	12 71 ~ 19 67	94 88	62 12 ~ 131 23	1277	1402 ~ 1153	11 05	13
	14	8 06	4 95 ~ 12 39	12 74	10 80 ~ 14 65	11 01	9 22 ~ 12 85	17 33	13 61 ~ 21 05	101 35	69 39 ~ 141 83	1252	1371 ~ 1130	12 48	14
	15	8 26	5 18 ~ 12 94	13 09	11 10 ~ 15 07	11 28	9 42 ~ 13 14	18 46	14 49 ~ 22 42	121 64	79 06 ~ 170 28	1233	1353 ~ 1113	13 19	15

出典

Tzu-Yu Lin (1974) Estimation of the productivity woodland and preparation of yield tables for Malacca albizzia. Technical Bulletion No. 124, Dept. of Forestry, Collage of Agriculture, National Chung Hsing University, Taiwan.

樹種：LEGUMINOSAE（マメ科）
Cassia siamea（タガヤサン）
国　：サイプロリア

データ採取地の立地環境

Locality:	Forest Research Institute, Nigeria, Ibadan
Altitude:	200 m
Rainfall:	1 250 mm
Soil:	fairly shallow, gravelly sandy loam
Stocking:	2 500 stems/ha

成長・収穫に関する表，図，式など

Yield (2)	Dry Matter Production (1)
Data source: not indicated Stand age: 10 years MAI = 13.5 m^3/ha (good site) MAI = 9.7 m^3/ha (poor site) (Original figure is in stacked volume and conversion factor 0.6 has been used for solid volume.) Remarks: crop of the first coppice growth	Data source: 38 trees Measurement: all trees including root above 5 mm diameter and dried at 60°C to constant weight. Stand age: 10 years Dry matter production: 136 tons/ha Remarks: crop of second coppice growth based on measurement of 38 trees

出典

(1) Ola-Adams, B.A. 1976 Dry matter production and nutrient content of a stand of coppiced *Cassia siamea* Lam. in Ibadan fuel plantation. The Nigerian Journal of Forestry.

(2) Ross, J.K. 1957 Some notes on the soil of western region with special reference to plantation of exotic trees. British Commonwealth Forestry Conference Paper Nigeria.

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO　1983　所収

樹種：LEGUMINOSAE（マメ科）

Dalbergia latifolia（ソノケリン，インディアンローズウッド，サルバシタン）

國　：インドネシア

データ採取地の立地環境

5. Dalbergia latifolia Roxb.
(SONOKELING)

Data.

Lokasi	Jumlah petak coba/ukur	Jumlah pemeriksaan	Tinggi dari muka laut	Keadaan lapangan/tanah
Bagelen	2	2	100	
Pati	1	5	45	
Jumlah:	3	7		
Pasuruan	2	10	400	
Jember	4	6	50 s/d 500	
Brantas Timur	6	15	400 s/d 575	
Blitar	1	5	200	
Mojokerto	1	1		
Malang	9	18	700	
Jumlah:	23	55		
Jumlah semua:	26	62		

成長・収穫に関する表，図，式など

Umur (Age) (Tahun/Year)	Peninggi (Upper-height) (m)	TEGAKAN TETAP (MAIN STAND) (T.T.) Jumlah pohon/ha (Number of trees/ha) (N)	S %	Rata-rata tinggi (Average height) (m)	Rata-rata diameter (Average diameter) (cm)	Bidang dasar/ha (Basal area/ha) (m^2)	V.kayu tebal/ha (Thick-wood/ha (m3)	Tegakan penjarangan (T.P.) (Thinnings) V.kayu tebal/ha (Thick-wood/ha (m3)	Vkt kumulatip/ha (ΣVtw /ha) (m3)	Jumlah volume (Total volume) (Vol.T.T + ΣT.P.) (m3/ha)	Riap rata-rata tahunan (Mean annual increment) (m3/ha)	Riap tahunan berjalan (Current annual increment) (m3/ha)	Umur (Age) (Tahun/Year)
Dalbergia lathifolia Roxb.(Sonokeling)													
BONITA I (SITE CLASS I)													
5	6,1	2765	33,4	5,2	5,3	6,2	14	-	-	14	2,8	-	5
10	12,7	1185	24,6	11,8	11,7	12,8	61	13	13	74	7,4	12,0	10
15	17,7	540	26,1	15,7	19,6	16,3	117	62	75	192	12,8	23,6	15
20	21,3	365	26,4	20,4	25,7	19,0	172	67	142	314	15,7	24,4	20
25	23,9	300	25,9	23,1	30,0	21,2	217	60	202	419	16,8	21,0	25
30	25,8	260	25,8	25,0	33,4	22,8	254	55	257	511	17,0	18,4	30
35	27,2	230	26,0	26,2	36,4	24,0	280	47	304	584	16,7	14,6	35
40	28,1	210	26,4	27,2	38,8	24,9	300	43	347	647	16,2	12,6	40
45	28,7	200	26,5	28,0	40,2	25,4	316	41	388	704	15,6	11,4	45
50	29,3	190	26,6	28,5	41,6	25,8	328	39	427	755	15,1	10,2	50
55	29,8	180	26,8	29,0	43,0	26,1	336	37	464	800	14,5	9,0	55
60	30,0	180	26,7	29,2	43,1	26,3	342	35	499	841	14,0	8,2	60

BONITA II (SITE CLASS II)

5	9,2	2290	24,5	8,3	6,5	7,6	26	2	2	28	5,6	5,6	5
10	15,9	685	25,8	15,0	16,5	14,7	97	50	52	149	14,9	24,2	10
15	20,9	375	26,6	20,0	25,3	18,9	165	67	119	284	18,9	27,0	15
20	24,7	280	26,0	23,8	31,6	22,0	231	57	176	407	20,4	24,6	20
25	27,4	230	28,7	26,4	36,4	24,0	286	45	221	507	20,3	20,0	25
30	29,2	195	26,4	28,4	40,9	25,6	327	39	260	587	19,6	16,0	30
35	30,4	175	26,7	29,6	44,0	26,6	352	35	295	647	18,5	12,0	35
40	31,2	160	27,2	30,5	46,7	27,4	372	31	326	698	17,4	10,2	40
45	31,9	150	27,5	31,2	48,8	28,0	387	28	354	741	16,5	8,6	45
50	32,4	150	26,7	31,7	49,1	28,4	399	26	380	779	15,6	7,6	50
55	32,7	145	27,3	32,0	50,2	28,7	408	25	405	813	14,8	6,8	55
60	33,0	140	27,5	32,1	51,2	28,8	414	25	430	844	14,1	6,2	60

BONITA III (SITE CLASS III)

5	10,4	1890	23,6	9,6	8,2	10,0	42	3	3	45	9,0	9,0	5
10	19,3	425	27,0	18,6	22,8	17,4	141	69	72	213	21,3	33,6	10
15	24,7	275	26,2	24,0	31,8	21,9	230	59	131	361	24,1	29,6	15
20	28,2	220	25,4	27,5	36,3	22,8	295	43	174	469	23,4	21,6	20
25	30,2	180	26,5	29,8	43,5	26,8	354	34	208	562	22,5	18,6	25
30	32,4	150	27,1	31,4	49,0	28,3	399	27	235	634	21,1	14,4	30
35	33,6	140	27,0	32,6	51,6	29,3	429	22	257	686	19,6	10,4	35
40	34,5	120	28,4	33,6	56,4	30,0	450	19	276	726	18,2	8,0	40
45	34,9	115	28,7	34,2	58,2	30,6	464	17	293	757	16,8	6,2	45
50	35,4	110	29,1	34,8	59,9	31,0	475	15	308	783	15,7	5,2	50
55	35,8	110	28,8	35,2	60,1	31,2	484	14	322	806	14,6	4,6	55
60	36,0	110	28,6	35,2	60,2	31,3	490	13	335	825	13,8	3,8	60

出典

Suharlan, A , Sumerna, K, and Sudiono, Y (1975). Yield table of ten industrial wood specoes. Lembaga Penelitian Hutan.

樹種：LEGUMINOSAE（マメ科）
Dalbergia sissu（シッソー）
國　：インド

データ採取地の立地環境

Locality:	Uttar Pradesh, Rajasthan and Haryana
Rainfall:	1 200 – 2 000 mm
Data source:	temporary sample plots
Number of plots:	44

成長・収穫に関する表，図，式など

General equation for site index obtained is:

$$\log H_t = 3.281853 - 6.5690069 \frac{1}{A} \qquad (r^2 = 0.8311)$$

where: H_t = top height in m corresponding to mean diameter of 250 largest diameter trees per hectare
A = stand age in years.

By grouping the site indices, the following site quality classes were defined, taking 20 years as reference age:

Site quality class	Site index
I	20 – 23
II	17 – 20
III	14 – 17

MAI (m^3/ha) by quality class and stockings

Quality class	I		II		III	
Age (years) \ Stocking	0.5	1.0	0.5	1.0	0.5	1.0
15	4.6	8.5	3.6	5.8	3.4	4.4
20	4.3	7.8	3.5	5.7	3.2	4.0
25	3.9	7.0	3.3	5.3	2.8	3.6
30	3.5	6.4	3.0	4.9	2.7	3.3
35	3.2	5.8	2.8	4.5	2.3	3.0
40	2.9	5.3	2.6	4.2	2.1	2.7

Remarks: Values 0.5 and 1.0 indicate ratio of basal area of main crop divided by total basal area (main and thinned). Value 1.0 will correspond to unthinned crop. Initial stocking was 1 200 stems/ha.

出典

(3) Sharma, R.P. 1979 Variable density yield table for Dalbergia sissoo (plantation origin). Indian Forester, Vol. 105 No. 6.

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO　1983　所収

樹種：LEGUMINOSAE（マメ科）

Dalbergia sissoo（シッソウ）

国：パキスタン

データ採取地の立地環境

Locality: Punjab

Measurement specification: Up to 5 cm top diameter over bark

MAI (m^3/ha) by site[1/] quality and age

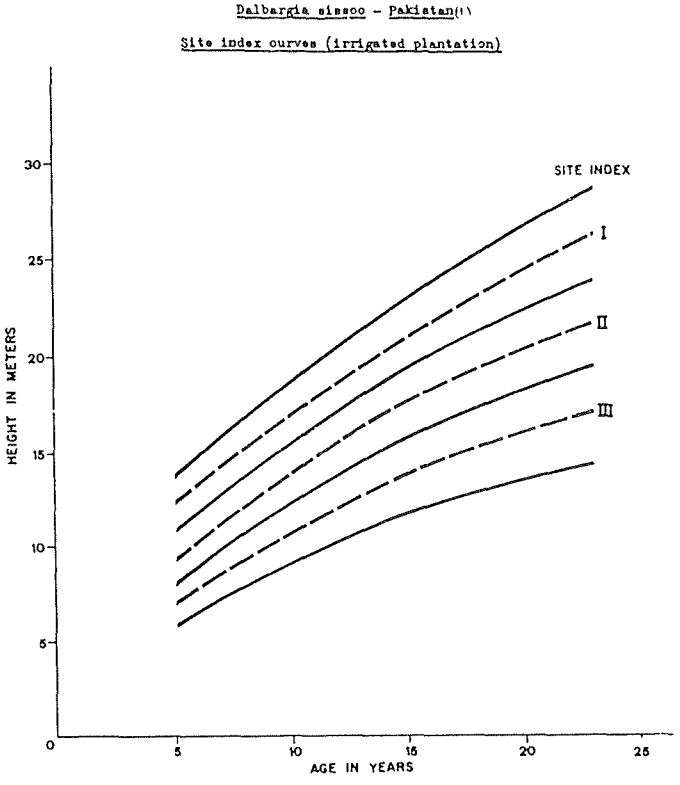
成長・収穫に関する表，図，式など

Age (years) \ Site quality	I	II	III
5	9.16	4.0	1.0
10	10.3	6.4	3.1
15	10.9 (22.6)[2/]	7.8 (17.5)[2/]	4.4 (12.7)[2/]
20	11.6 (30.0)	8.9 (24.4)	5.7 (18.8)

1/ At 20 years' age site qualitites correpond to top heights in metres I → 19.8–22.9; II → 16.8–19.8 and III → 13.7–16.8.

2/ Figures in brackets indicate average diameter in cm.

Remarks: Thinning yield has been predicted and included in MAI.



PAKISTAN (4)

Locality:	Changa Manga (irrigated plantation)	
Yield data:	Age	MAI (m^3/ha)
	16	3.7

Remark: No other details.

出典

(2) Santram, B. 1941 — Provisional yield table for plantations of Punjab. Indian Forest Record (new series). Quoted in growth and yield statistics of common Indian timber species. Vol. II. F.R.I. Dehra Dun.

(4) Troup 1935 — The silviculture of Indian trees. Vol. I.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：LEGUMINOSAE（マメ科）

Leucaena leucocephala (Lam.) de Wit （イピルイピル）

國　：インド

データ採取地の立地環境

Nursery

In the Bandapani Silvicultural Nursery located in the Jalpaiguri Forest Division 800 gms of the seeds of the Hawaiian Giant variety were used About 800 ml of water heated to 40 0°C was poured over the seeds in a container and the seeds were allowed to soak in the cooling water for 12 hours The seeds were then dried in the sun and sowing was done toward the end of May 60% of the seeds were sown directly in the nursery beds, which were prepared by trenching and then filling up with humus local earth and 72 grams of complete sulphate fertilizer (N P K=15 15 15) which was added to the thoroughly pulverised soil, at a spacing of 4 cm × 25 cm 40% of the seeds were sown into polypots filled with the same medium to which 1 gram of complete fertilizer had been added, at the rate of 2 seeds per pot. The seeds started germinating within a week and in about seven weeks time 70% of the seeds had germinated The seedlings in the nursery beds had reached an average height of 120 cm while those in the polypots had reached an average height of 40 cm by this time. In subsequent years seeds of selected strains like K-8 K 28 and the Hawaiian Giant variety from Uruli-Kanchan, Maharashtra were also obtained and tried.

All the three varieties were given pre-treatment similar to that indicated but the seeds were sown directly into polypots instead of the seed beds The germination percentages obtained with the different varieties are given in Table 6.

Table 6

Leucaena leucocephala Germination percentag- of seeds in experimental Nurseries

Variety	Germination per cent in Nursery at	
	Sukna	Rajabhatkhawa
K-8	52	48
K-28	35	36
Hawaiian Giant (Uruli-Kanchan)	90	51

Site factors

Leucaena is essentially a warmth loving tropical species with a distinct preference for neutral to alkaline soils in lower elevations Keeping the above factors in view, the first plantation was raised in Bandapani in the North Eastern border of the Jalpaiguri Forest Division. Both the nursery and the plantation were located in the same tested site to serve as a seed orchard for future propagations. Subsequent nurseries and plantations were raised in the Kurseong Forest Division (Sukna) and Buxa Forest Division (South Rajabhatkhawa). The site factors are given in Table 7

Table 7

Leucaena leucocephala Site factors of experimental plantations

Location	Annual rainfall (mm)	Altitude (m)	Soil Type	Soil pH	Frost
Bandapani, Jalpaiguri Forest Division.	3000	250	Clayey loam	7 0-7.5	Absent
Sukna Block, Kurseong Forest Divisign.	3048	180	Clayey loam	6.0-6.5	Absent
South Rajabhatkhawa Block, Buxa Forest Division.	3800	120	Clayey loam	6 0-6 5	Absent

成長・収穫に関する表，図，式など

Table 8

Leucaena leucocephala Growth rates in the Bandapani 1978 plantation (Age 1 year)

Leucaena leucocephala	Heights (cms)			Girth (cms)		
	Max	Min	Average	Max.	Min.	Average
Bare-root seedlings	470	100	224	10	2	4 66
Polypotted seedlings	472	150	335	17	3	7 64

Table 9

Leucaena leucocephala · Growth rates in 1979 plantations

Variety	Max ht (cms)	Min ht (cms)	Average ht. (cms)	Initial Number of seedlings	Plantation Survival %
Location—Sukna Experimental Plantation, Kurseong Forest Division (*Age* 2 months)					
K-8	35	20	27	120	100
K-28	30	20	25	120	100
Hawaiian Giant (Uruli-Kanchn)	35	21	26	120	100
Location—South Rajabhatkhawa Experimental Plantation, Buxa Forest Division (*Age* 4 months)					
K-8	195	10	80	178	96 7
K-28	155	10	80	170	92 4
Hawaiian Giant (Uruli-Kanchan)	185	5	78	170	92.4

出典

Palit, S (1980) Trials of *Albizia falcataria* (L.) Fosberg and *Leucaena leucocephala* (Lam) De Wit in North Bengal. Indian For., 106 : 456-465.

樹種：LEGUMINOSAE（マメ科）
Leucaena leucocephala (Lam.) de Wit （イピルイピル）
国　：フィリピン

データ採取地の立地環境

2) 調査地の概況

調査地はフィリピン国ミンダナオ島の北部に位置するミサミスオリエンタル（Misamis Oriental）州ラナオデルノルテ（Lanao Del Norte）州にあり，後者にはナアワン（Naawan），イニタオ（Initao），アッパーイリガン（Upper Iligan）の3地区，前者にはタラカグ（Talakag）地区の計4地区に分散する。ミサミスオリエンタル州都のカガヤンデオロ（Cagayan de Oro）市の気象観測によれば，年平均気温，年平均降水量は，それぞれ27.5℃，2,348 mmて，およそ2月から4月にかけて乾燥傾向にある。この地域では，台風の襲来はまれてある。調査地周辺の地質および土壌等については，別項を参照。

3) 材料および調査方法

今回の調査した品種はサルバトルタイプのK-8である。成長量及び現存量を把握するため，1981年から1983年にかけてナアワン，イニタオ，アッパーイリガンおよびタラカグの各地区において，植栽時期や播種時期のはっきりした林分を対象に，毎木調査を主体とした調査を行い，一部の林分については伐倒調査も実施した。

毎木調査の測定面積は，10 m×10 mを基準とした。しかし，調査林分の樹高や立地環境によっては，適宜，測定面積を変えて調査した。調査区設定後，デジタル照度計を用いて林内および林外の照度を測定し，相対照度を求めた。毎木調査は，区内の全立木について地上高1.3 mの幹の直径（胸高直径）をノギスを用いて測定した。伐倒調査を実施しなかった林分については，一部もしくは全ての個体を対象に樹高を測定した。

伐倒調査は，毎木調査終了後，林分内の直径の分布に応じて大小7本前後の伐倒木を選んで行った。（ナアワン地区の1林分については，調査区内の全立木を伐倒した）。各伐倒木とも，幹材積を求めるため，0.3，1.3，2.3 mと1 mごとに直径を測定し，各層ごとに幹，枝，葉および種子等の器官を分けて生重量の測定を行った。

それぞれの器官からサンプルを採取し，フィリピン大学に持ち帰り，乾燥器て乾燥し，乾重量率を求め生重量から乾重量に換算した。また，葉のサンプルについては，乾燥前に葉面積計て葉面積の測定を行った。

全立木の樹高を測定しなかった林分の平均樹高は，樹高測定木の樹高（H）と胸高直径（DBH）の関係をもとに

$$1/H = A/DBH + B \qquad (1)$$

よりA，Bを求め，毎木調査した胸高直径をあてはめて推定した。

また，本報告における現存量の推定は，KANAZAWA *et al*[8]と同様に相対成長式を用いて，一部については断面積比推定法により行った。

今回の調査期間に伐倒した調査木の胸高直径，樹高と各器官の幹重量をもとに，毎木調査の結果から重量を推定するための重回帰式を求めた。

ナアワン地区には，植栽密度や，立地条件等を異にしたMAFCOの試験植林場があり，3カ月ごとに定期的に毎木調査を行っている。この植林場内の林分において落葉落枝量を測定するため，1981年3月に固定試験区を設け，0.5 m×2 mの大きさのリッタートラップをそれぞれ6個ずつ設定した。

落葉落枝量の調査は，半月ごとに落葉落枝を採取し，1週間風乾した後，小葉，葉柄，枝，種子等に分け，器官ごとに重量を測定して行った。それぞれの器官から絶乾重量を得るためにサンプルを採り，乾燥後秤量し乾重量を算出した。

また，シャイアントイピルイピルの間伐効果を明らかにするため，ナタワン，イニタオおよびアッパーイリガンの3地区で，間伐強度や間伐木の選木基準を変えた試験地を計4ヵ所設定し，その後の成長状態を調査した。

いすれも試験区設定後，区内の全立木にナンバーを付し，毎木調査を実施した後，それぞれの間伐方法に基づき間伐木を選び伐採した。試験区の周囲についても同様の処理を行った。

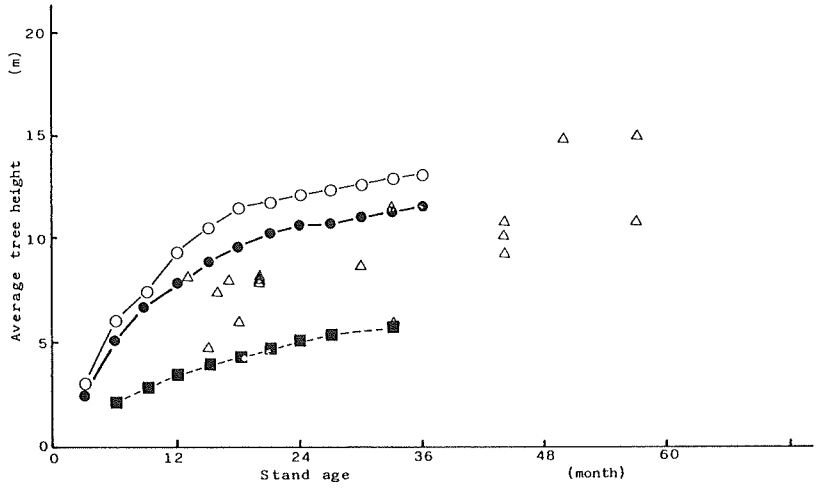


図1　樹高の成長経過
（●，Flat, 1 m×1 m, ○，Flat, 2 m×2 m, ■，Slope, 2 m×2 m, △，毎木調査区）

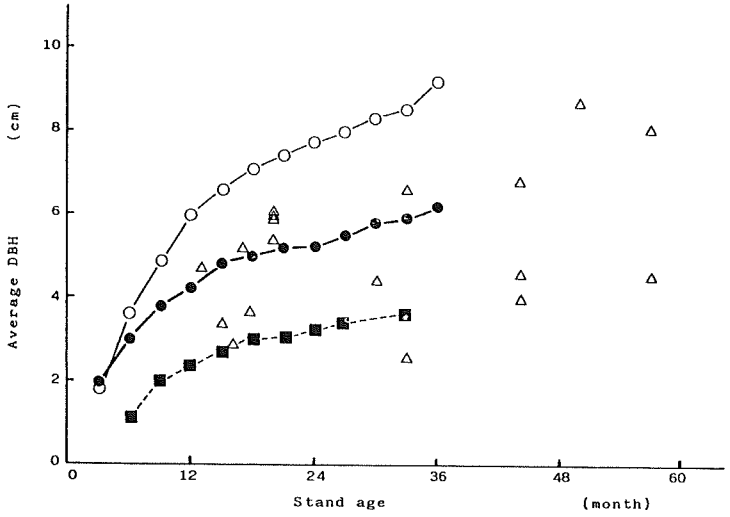


図2　胸高直径の成長経過
（●；Flat, 1 m×1 m, ○，Flat, 2 m×2 m, ■，Slope, 2 m×2 m, △，毎木調査区）

4) 結果及び考察

(1) 樹高及び胸高直径の成長

ナアワン地区の試験植林場内に設定した固定試験地の定期調査の結果に，各地の林分て測定した毎木調査の結果を加えて樹高及び胸高直径の成長経過を整理した。

樹高成長の経過（図1）をみると，植栽後1年て平均樹高が9mを越す林分も見られ，立地条件が良ければ2年生に達する以前に10mを越すものもまれてない。温帯性落葉広葉樹の中て，初期成長が早いといわれるドロノキ（*Populus maximowiczu Henry*）[18]で平均樹高が10mに達するのに早くとも7年前後，ンラカンバ（*Betula platyphylla var japonica*）[17]て10年以上の林齢を加えねばならないのと比へると極めて早い。

しかし，林齢の高い林分の測定例がないのてはっきりしないが，図1から判断する限り，平均樹高が20mに達するのは，容易てないように思われる。

次に，胸高直径の成長経過を図2に示す。胸高直径は，密度の違いに左右されやすいので単純な比較は難しいが，2m×2m間隔の植栽ては，20カ月生て平均胸高直径が6cm前後の値を示す林分が多い。

ジャイアントイビルイビルの樹高及び胸高直径は，図からも明らかなように生育立地によって大きく異なり，2～3倍程度の差の生じやすい傾向にある。このような傾向は，すでに林分幹材積および木質部現存量の成長を中心に指摘されている[8]。

(2) 伐倒調査に基づく林分の現存量

1981年及び1982年に伐倒調査を行なった林分の現存量を一覧表にまとめた（表1）。

林齢や立木密度などが異なり一様な比較はできないが，今回調査した林分の中で，最大のバイオマス量は，地上部現存量が96 ton/haを示した林分である。次いで高い値は90 ton/haて，これらはいずれも林齢が40カ月を越えていた。

林齢と地上部現存量の関係で比較すると，30カ月生で88 ton/haを示した林分が最も高い。そこで，この林分の年平均成長量を算出すると，35 ton/ha・yearの値が得られた。

今回伐倒調査した15林分の年平均成長量の平均値は，17.7 ton/ha・yearであった。これらの調査林分の分布と母集団である全林分の分布が一致しているとは言い難いので，得られた値が，ただちにジャイアントイビルイビルの年平均成長量てあるとは言えないが，一つの目安となるであろう。

地上現存量を平均樹高で割った見かけの現存量密度を求めた結果，KANAZAWA *et al* [8]の報告と同様にジャイアントイビルイビルは，フィリピンて調べられたアルビジア（*Albizzia falcata*）やヤマネ（*Gmelina arborea*）の値とほぼ等しく，日本の森林で測定させたものより低かった。

次に，調査林分の林分葉量を比較すると，最大で3 6 ton/ha，最小で0 7 ton/haと幅があった。今回の調査ては，着葉量から3 ton/haを越えた林分は，1林分にしか過ぎず，大半の林分が1 5から2 5 ton/haの範囲に含まれた。温帯性落葉広葉樹林の林分葉量が3 ton/ha前後であるとのTADAKI[20]の報告と比べると，ジャイアントイビルイビルの着葉量は幾分低い傾向にあるといえる。沖縄のギンネム林の調査結果[13]でも，測定させれた3林分とも林分葉量は2 ton/ha以下と少ない。

(6) 伐倒木に基づく各器官の幹重量回帰式による現存量の推定

材積表と同様の観点から，伐倒木の資料に基づいて各器官の乾物重量における関係式を求め，毎木調査の測定結果をもとに，各器官のそれぞれの関係式をあてはめて現存量を推定し，成長解析を行おうと試みた。

伐倒木115本の資料木により解析した各器官の重回帰式を以下に示す。

$$\log W_t = 2\ 44442 \log D + 2.12969 \quad \cdot (3)$$
$$(r = 0\ 9931)$$

$$\log W_{wood} = 2\ 4604 \log D + 2.0909 \quad \cdot (4)$$
$$(r = 0\ 9930)$$

$$\log W_s = 2\ 3770 \log D + 2\ 0487 \quad \cdot (5)$$
$$(r = 0\ 9850)$$

$$\log W_L = 2\ 8833 \log D - 1\ 1790 \log H + 1\ 65326 \cdots \cdots \cdots \cdots (6)$$
$$(r = 0.9518)$$

$$\log LA = 2\ 8833 \log D - 1\ 1790 \log H + 1\ 9216 \quad \cdots \cdots \quad (7)$$
$$(r = 0\ 9518)$$

ここで，D, H, W_t, W_{wood}, W_s, W_LおよびLAは，それぞれ胸高直径，樹高，地上部乾重量，木質部乾重量，幹乾重量，葉乾重量および葉面積を示す。

図7は，伐倒調査を行った林分を対象に地上部現存量および葉面積の実測値と上記の回帰式て得た推定値との関係を示したものである。

地上部現存量については，二又木の多い林分で過小推定が行なわれた他は，ほぼ満足できる推定値が得られた。

一方，葉面積は，地上部現存量に比してバラツキが大きかった。しかし，全体的にみれば，実測値と推定値との関係は地上部現存量の場合と同様の傾向にあるといえる。

葉面積でバラノキが見られた原因としては，水分条件が良く比較的着葉量の多かったナアワンの1林分で30本近い個体を伐倒したこと，生育立地によっては，乾期の末期に葉を著しく落とすことが観察されており，伐倒調査を行なった林分が，広範囲にわ

たっていて，土壌や地形などの立地条件も異なっていることから，調査林分によって落葉状態に差があったことなどが影響していると考えられる。

しかしながら，固定試験地の林分では，すでに述べたように測定開始時からの積算落葉量はほぼ比例関係にあり，葉面積の変動に葉の落ちた影響は大きくないと判断した。このため，今回推定した葉面積は，固定試験地の実際の値に比較的近いものと考えられる。

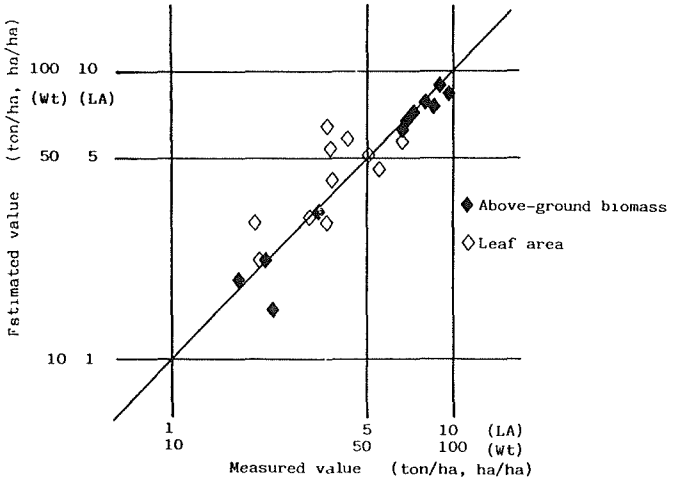


図7　地上部現存量，および葉面積における実測値と推定値の関係

(7)　固定試験地の資料に基づく成長解析

定期的に測定した固定試験地の資料から，それぞれの林分の乾物重量および葉面積を経時的に推定し，それらの値をもとに成長解析を行った。

個体群成長率（CGR），相対成長率（RGR）および純同化率（NAR）の算出法は以下の通りである。

$$BGR=(W_2-W_1)/(t_2-t_1) \quad \cdot \quad (8)$$

$$RGR=1/W\cdot dW/dt \quad \cdots \quad \cdots \quad (9)$$

$$NAR=1/LA\cdot dW/dt \quad \cdot \quad \cdot \quad (10)$$

ただし，W_1, W_2 は時点 t_1, t_2 における単位面積当たりの乾物重量，W はある時点における乾物重量，dW/dt はこの時点における乾物増加速度，LA はある時点における葉面積を示す。なお，ここでは t_2-t_1 を 90 日として計算した。

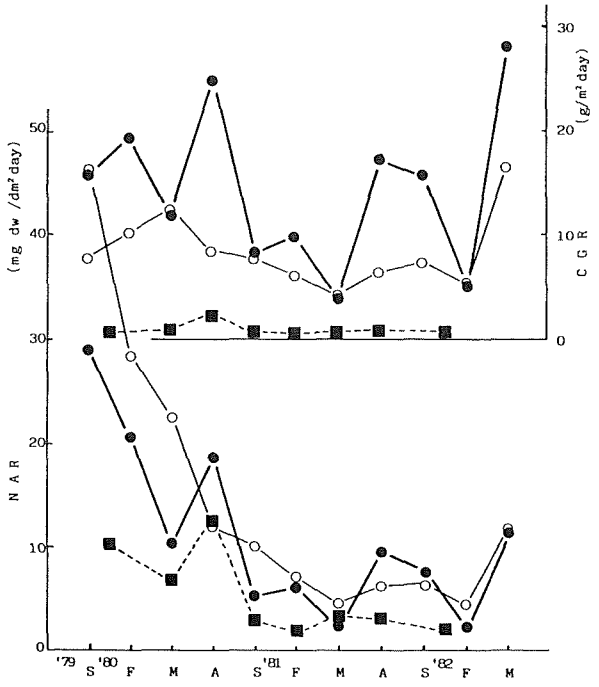


図8　固定試験地における CGR，および NAR の変化
（●，Flat, 1 m×1 m，○，Flat, 2 m×2 m，■，Slope, 2 m×2 m）

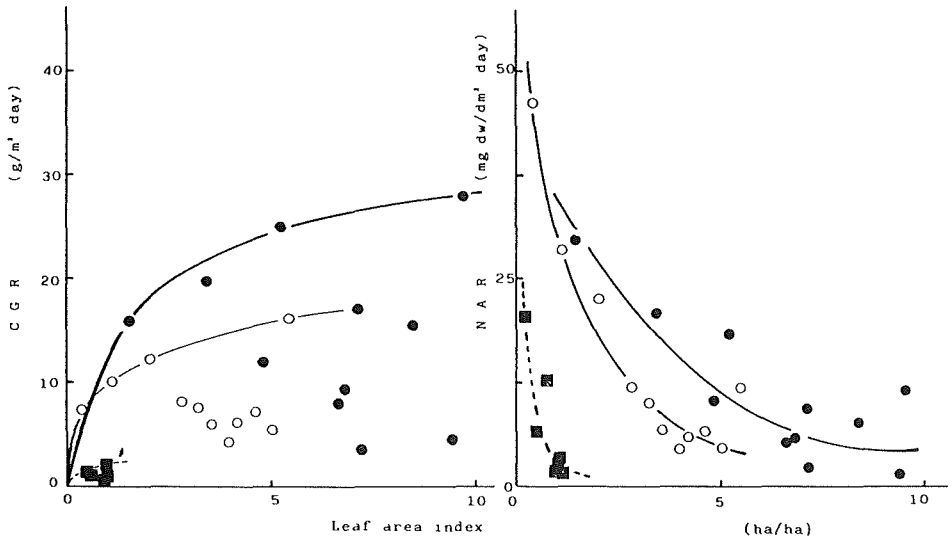


図9　葉面積指数と CGR，および NAR の関係
（●，Flat, 1 m×1 m, ○，Flat, 2 m×2 m, ■，Slope, 2 m×2 m）

(8)　純生産量の推定

熱帯林の純生産量はすでにいくつかの報告がみられる。しかし，熱帯地域における早生樹のそれは必ずしも豊富でない。

今回の報告ての純生産量は，設定時とその1年後の2回伐倒調査を行った林分を対象に以下の方法て推定した。

$$Pn=\Delta y+\Delta L+\Delta G \quad \cdots \cdots (11)$$

ここて，Pn, Δy, ΔL, および ΔG は，それぞれ1年間の純生産量，現存量の変化量，落葉落枝などの枯損量，および被食量である。

現存量の変化量は，同一林分を1年おいて2回伐倒した調査結果から算出した。また，枯損量の大部分を占める落葉落枝量は，胸高断面積合計が 4 m²/ha 以上になると 11 ton/ha•year 以上の落葉落枝量を示し，10 m²/ha 以上の胸高断面積合計では，おおよそ 12 5～13 5 ton/ha•year の値をもつこと[15]から，ここては 12 5 ton/ha•year とした。被食量については資料を持たないが，一応無視てきる程度の量と考えた。

表3　2回伐倒区における地上部純生産量

調査地	ナアワノ	イニタオ	
		1	2
生長量 (ton/ha•year)			
幹	18 6	5 3	16 6
枝	3 2	0 6	4 2
葉	−0 8	0 1	0 2
リターフォール量 (ton/ha•year)			
葉	7 7	7 7	7 7
その他	4 8	4 8	4 8
地上部純生産量	33 5	18 5	33 3

表1　伐倒調査林分における調査結果

調査地名		ナアワン							
		1	2	3	4	5	6	7	8
標高	(m)	20	20	20	20	20	20	20	20
地形		flat	flat	flat	flat	flat	flat	flat	flat
林齢	(month)	33	33	15	13	18	50	20	45
立木密度	(No /ha)	11630	3965	3500	3100	7310	2650	2420	4100
平均直径	(cm)	2 6	6 6	3 4	4 7	3 7	8 7	5 4	6 8
平均樹高	(m)	5 7	11 6	4 7	8 1	6 0	14 8	7 8	10 8
断面積合計	(m^2/ha)	6 65	15 56	3 60	5 78	7 35	17 83	5 80	18 95
幹材積	(m^3/ha)	24 8	109 6	10 8	25 2	18 9	155 3	23 0	152 3
現存量	(ton/ha)								
幹		14 1	58 0	5 8	12 1	11 0	78 5	13 2	77 6
枝		2 2	8 4	1 5	1 4	2 4	13 0	9 1	10 2
葉		1 1	2 9	0 7	1 4	1 1	3 6	1 6	2 0
その他		0 0	0 4	0 3	0 1	0 1	1 1	0 0	0 1
合計		17 4	69 6	8 3	14 9	14 5	96 3	23 9	89 9
相対照度	(%)	43 0	7 3	59 0	21 2	29 4	14 2	4 9	3 8

調査地名		イニタオ				アノバーイリガン		タラカグ
		1	2	3	4	1	2	1
標高	(m)	90	90	90	90	200	200	525
地形		20	20	20	20	flat	flat	flat
林齢	(month)	44	44	57	57	16*	30	17
立木密度	(No /ha)	9420	9210	9780	2880	12900	9000	2730
平均直径	(cm)	4 0	4 6	4 6	8 1	2 9	4 4	5 2
平均樹高	(m)	9 2	10 1	10 7	14 9	7 4	8 6	6 9
断面積合計	(m^2/ha)	15 77	18 88	19 98	15 33	10 04	18 49	6 28
幹材積	(m^3/ha)	108 9	130 1	139 2	113 2	50 2	129 4	23 9
現存量	(ton/ha)							
幹		53 0	63 3	70 4	55 8	27 8	70 1	13 6
枝		5 8	6 9	7 8	9 2	4 1	13 6	6 6
葉		2 3	2 8	2 0	2 1	2 0	2 4	1 7
その他		0 0	0 0	0 0	0 0	0 0	0 0	0 0
合計		61 1	73 0	80 2	67 0	33 8	86 1	21 9
相対照度	(%)	3 9	6 4	4 0	9 8	9 4	5 0	19 1

＊ 直播時期からの林齢

出典

佐藤明、金沢洋一、加茂皓一：ジャイアントイピルイピルの生長構造と成長解析、熱帯農業集報、No. 65、80～93．(1989)

樹種：LEGUMINOSAE（マメ科）
Pterocarpus dalbergioides（アンダマンカリン）
国　：インド

データ採取地の立地環境

Mixed with *Canarium euphyllum*, *Sterculia campanulata* and some other miscellaneous species like *Terminalia bialata*, *Lagerstroemia hypoleuca Albizia lebbek*, *Bombax insigne* etc., in 4 years, it acquires mean top height of 8 2 m and crop diameter of 5 5 cm (top diameter 8 6 cm) as revealed in measurements of Sample Plot No 31–36 of North Andamans In eigth year old Sample Plots (No 28 and 29) recorded mean top height was 13 6 m with crop diameter of 11.3 cm (top diameter 16 8 cm)

On account of its fast rate of growth and economic value, attempt is made to study its rate of growth which is considerably faster in plantations as compared to natural forests.

Data to determine species dependent coefficients of growth model were derived from 9 Sample Plots mentioned hereunder :

	S Plot No.
North Andamans Division	25, 28, 29 & 30
South Andamans Division	1, 2, 3, 4 & 8

In all there were 18 measurements, due to paucity of data, this study should be treated as *provisional*. Mean and standard deviation of basic parameters used are given as follows to indicate size and range of data.

* Presently Project Director, Land Project Directorate, (Forest Department), Dehra Dun

Parameter	Mean	Standard deviation	Denoted in text by	Units
Age	31.9	20 0	A	year
Top height	25.9	8.2	H	m
Standard timber volume/ha (before thinning)	128.87	97.14	V1 + V3	m^3
Total volume/ha (before thinning)	202.48	97.58	V2 + V4	m^3
Basal area/ha	19.05	6.06	BA	m^2
Basal area ratio	0.794	0.153	$BR=BA/BA_{Max}$	—
Number of trees/ha (before thinning)	499	351	S1 + S2	—
Height ratio	1.003	0 085	HR=(H/Mean height from curve)	—

A perusal of standard deviation of Height ratio indicates that there is not much variation in Top height for the same age. Hence no attempt will be made to distinguish site qualities.

Methodology

Following relationships were developed. These relationships are valid for the range covered in basic data.

1 *Site quality function*

$\text{Log}_e\ H = 5.29963 - 3.94173\ A^{-.3}$

$r = .972$

2. *Crop diameter function*

$\text{Log}_e\ (D2) = (1.85809 - 0.65428\ BR^2)\ \log_e H + 3.05282\ BR - 8.40884$

$r = .985$

Where D2 is mean crop diameter before thinnings.

Height ratio (H/Mean height from curve) and its various interactions with other variables were also used but none of them was found to have a significant effect.

3. *Volume functions*

(a) $V1 + V3 = (0.46879/BR^{.6} + 0.47756\ BR^2 - 0.60663\ BR)\ BA.H. - 67.78491$

$r = .981$

(b) $V2 + V4 = (1.20670 + 1.47321\ BR^2 - 2.31663\ BR)\ BA.H. + 28.25635$

$r = .965$

(c) $\text{Log}_e\ [V1/(V1+V3)] = (6.16290\ BR^2 - 0.05173\ HR + 2.00557/BR - 7.90918\ BR) \times \log_e [S1/(S1+S2)] - 0.00308$

where V1 is timber volume/ha after thinning

$r = .934$

(d) $V2/(V2+V4) = 0.45818\ S1/(S1+S2) + 0.54184$

where V2 is total volume/ha after thinning.

$r = 873$

Equation (c) and (d) is aimed to reduce standing volume before thinning to standing volume after thinning. The correlation coefficient of these regressions is not high. These figures could not be improved significantly by adding more variables. Probably in thinnings, the removal of thinning has not followed any systematic pattern (i.e. low thinning, mechanical or crown thinning) and hence this situation. Therefore, crop volume values will be more reliable than volume after thinnings generated in growth tables.

4. *Maximum basal area curve*

Graph between Top height and basal area/ha was plotted. Freehand curve was drawn to cover the maximum observed values (BA_{Max}). Suitable function to fit points taken from hand drawn curve was found.

$\text{Log}_e\ (BA_{Max}) = 3.43015 + 4.51314\ \text{Log}_e\ (1 - e^{-.12844\,H})$

Top height corresponds to the height of a tree of top diameter, where top diameter is mean diameter of 125 thickest trees/ha.

Maximum basal area curve helps to define capacity of soil and provides a check against simulating unrealistic values. The yield table is generated from these regressions for mean quality class (Table 1) for BR=1.

Table 1

Age (yrs)	Top height (m)	Crop diameter (m)	No. of trees/ha	Basal area per ha (m^2)	Volume/ha (m^3)		Thinning volume (m^3)		M.A.I. (m^3)	
					Standard timber	Total wood	Standard timber	Total wood	Standard timber	Total wood
1	2	3	4	5	6	7	8	9	10	11
5	11 5	0 089	1541	9.588	0	68.312	0	8.082	0	13 662
10	16 7	0 140	1143	17.605	32 094	135.062	1.690	13 478	3.209	14.314
15	20 2	0 176	894	21 755	81.505	187 900	3 664	16.078	5.546	13.964
20	23 0	0 206	727	24 253	121.717	230 901	4.476	16 148	6.354	13 427
25	25 3	0 231	616	25.831	154.230	265 669	4 735	15 408	6 562	12 778
30	27 2	0.252	538	26 866	180.467	293.725	4.841	14.753	6.501	12 097
35	28.9	0 271	479	27.620	203 386	318 233	4.926	14.300	6.365	11 491
40	30 4	0 288	432	28.171	223.151	339 369	4 897	13.671	6 187	10.940
45	31 8	0 304	394	28.604	241.227	858.698	4 663	12.507	6 010	10.458
50	33 0	0.318	364	28.921	256.441	374.968	—	—	5.807	9.988

Note : Value in Col 2 to 7 pertain prior to thinnings.

出典

Singh, S P., Sharma, R.S. and Singh, Jai (1984). Provisional growth estimate of *Pterocarpus dalbergioides* (Andaman Padauk). Indian For , 110 : 396-400.

樹種：SIMAROUBACEAE（ニガキ科）
Ailanthus excelsa
国　インド

データ採取地の立地環境

Study Area

The study area is situated at 650 m above m s l (latitude between 29°-45′ N to 30°-25′ N and longitude between 77°-35′ E to 76°-10′ E) receiving an average annual rainfall between 280 mm to 307 mm and classified as Dry Shiwalik Sal Forest and Northern Dry Mixed Deciduous Forests (Champion and Seth, 1968) The soil of the area is of low quali y and sandy.

Five plantations of 3, 6 11, 16 and 21 years old were selected for the present study and the details of these plantations are given in Table 1

Methods

A representative sample plot measuring between 0 04 to 0 09 ha (Table 1) was laid out in each plantation and d b h of all the standing trees within the plot were recorded and grouped into 3 to 5 diameter classes, depending upon the diameter range in each plantation One mean tree from each diameter class was felled and fresh weight of each component recorded separately for estimation of biomass The roots of one sample tree (close to the mean diameter of the crop) was dug out in each plantation for estimation of under-ground biomass Representative samples of each tree component were collected for dry weight estimation and nutrient analysis

成長・収穫に関する表，図，式など

Table 1

Details of Ailanthus excelsa plantations

Age (Yrs)	3	6	11	16	21
Area of enumeration plot (ha)	0 06	0 04	0 09	0 09	0 04
No of trees on the enumeration plot	141	67	90	75	49
No of trees/ha	2350	1675	1000	834	1225
Mean diameter of the crop (cm)	6.95 (3 0-14 0)	10 2 (6 0-17 0)	13 5 (9 0-18 0)	14 4 (9 0-20 0)	10 3 (6 0-14 0)
Class A	4 1 (3 0-5 0)	7 7 (6 0-8 0)	9 5 (9 0-10 0)	11 0 (9 0-12 0)	7 1 (6 0-8 0)
Class B	7.3 (6 0-8 0)	9 8 (9 0-11 0)	11 8 (11 0-12 0)	14 1 (13 0-16.0)	10 0 (9 0-11 0)
Class C	9 5 (9 0-11 0)	13 1 (12 0-14 0)	13 5 (13 0-14 0)	18 3 (17 0-20 0)	13.4 (12 0 14 0)
Class D	12 25 (12 0-14 0)	16 1 (15 0-17 0)	15 5 (15 0-16 0)	—	—
Class E	—	—	17 5 (17 0-18 0)	—	—
Mean height of the crop (m)	5 6	9 45	11 5	10 95	8 45
Class A	5 2	4 67	10.5	7 3	6 35

Class B	5 6	9 45	11 2	10 95	8 45
Class C	6 65	10 5	11 5	10 95	6 80
Class D	8 75	10 8	10 5	—	—
Class E	—	—	12 10	—	—

Table 7

Total standing biomass (kg/ha) at different ages

Age (Yrs)	3	6	11	16	21
Bole	9990 (50.0)	25209 (60.2)	25794 (64 1)	18927 (59.4)	17852 (57.0)
Bark	3988 (19.9)	9636 (23 0)	9372 (23 3)	6854 (21 5)	7074 (22 6)
Leaf	913 (4.6)	1105 (2 6)	301 (0.7)	602 (1.9)	828 (2 6)
Twig	2215 (11.1)	1592 (3.8)	896 (2 2)	1129 (3 5)	1049 (3 4)
Branch	2898 (14.5)	4354 (10 4)	3898 (9 68)	4342 (13 6)	4491 (14.4)
Total above-ground biomass	19996	41896	40261	31854	31294
Root	5008 (25.0)	9380 (22.4)	7189 (17.9)	5769 (18 1)	6490 (20 7)
Total biomass	25004	51276	47450	37623	37784
Productivity (kg/ha/yr)					
Non-photosynthetic above-ground biomass	6361	6799	3633	1953	1451
Non-photosynthetic root biomass	1669	1563	654	361	309
Total	8030	8362	4287	2314	1760

出典

Pande, M.C., V.N. Tandon and Mridula Negi (1988). Biomass Production in Plantation Ecosystem of Ailanthus excelsa at Five Different Ages in Uttar Pradesh. Indian For, 114 : 362-371.

樹種：MELIACEAE(センダン科)
Azadirachta indica (インドセンダン)
国　：ナイジェリア

データ採取地の立地環境　：

NIGERIA (1)

Locality:	northern Nigeria
Rainfall:	700–1 050 mm
Altitude:	300 m
Data source:	temporary sample plots
Number of plots:	89
Size of plots:	101 m^2
Measurement specification:	4 cm diameter
Stems/ha:	1 700 (Initial stocking)

MAI (m^3/ha) by site class

成長・収穫に関する表，図，式など

Age (years) \ Site class	I	II	III	IV
	..... m^3/ha			
3	9.3	5.8	3.5	2.3
4	12.4	7.8	4.4	1.8
5	14.7	9.0	4.9	2.0
6	15.7	9.9	5.2	1.8
7	17.0	10.0	6.0	2.0
8	18.0	10.5	5.2	2.2
9	16.7	9.7	5.0	1.9

Remarks: There seems to be some inconsistency in MAI of site class IV due to rounding of figures when calculating volume production.

Single tree volume equation:

$$\log_e V = -7.40769 + 1.69402 \log_e G + 0.97788 \log_e H$$

where:
V = volume of the tree in cubic feet
G = girth at breast height (1.3 m) in inches
H = height of the tree in feet

5.5.4 Comments

There is a marked difference in the mean annual increment, with change of site. On poor sites culmination of MAI is at an early age, as compared with better sites. On an average site, mean annual increment of 5 m^3/ha would be a reasonable estimate on an eight year rotation (3).

出典

(1) Gravsholt, S.; Jackson, J.K.; Ojo, G.O.A. 1967 Provisional table for growth and yield for Neem (Azadirachta indica) in northern Nigeria. Research Paper No. 1 of the Savanna Forestry Research Station, Zaria.

(3) Savanna Forestry Research Station, Nigeria. Silviculture and mensuration. 1974 UNDP/FAO Technical Report No. 7.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MELIACEAE(センダン科)
Cedrela odorata (セドロ)
国　：ナイジェリア

データ採取地の立地環境

Latin Name	Cedrela odorata L. Family Meliaceae
Trade Names	Spanish Cedar, Cigar box Cedar (English), Cedro (Spanish).
Local Names	Cedro Cebolla (Panama), Cedro Amargo (Venezuela), Cedar (Trinidad, Tobago and Jamaica), Red Cedar (British Honduras), Acajou Rouge (Guadelope and Martinique), Cedro macho (Cuba). For numerous other names see Record and Mell (1924).
	Nigeria

成長・収穫に関する表，図，式など

6.2 Height Increment

Oseni obtained measurements of the average height increment in six young Cedar plantations at Ibadan, Nigeria (49 inch, 1, 245 mm. per an. rainfall, 800 feet, 244 m. a. s. l.) and correlated this with rainfall. After planting in June 1962 there was an initial period of very slow growth till April 1963, the end of the dry season, indicating a period of settling and root development, thereafter almost continuous growth occurred as follows.

Period	Year	Ht. Incr. inches	Rainfall inches	Remarks
Jan.-Apr.	1963	3	7.77	November to March are the driest months and average less than 2 inches rainfall per month.
May-Aug.	1963	11	39.27	
Sept.-Dec.	1963	14	16.17	
Jan.-Apr.	1964	15	9.58	The six trees averaged 20 inches high when planted.
May-Aug.	1964	47	27.93	
Sept.-Dec.	1964	22	11.35	
Jan.-Apr.	1965	28	10.24	
May-Aug.	1965	67	43.18	
Sept.-Dec.	1965	15	10.67	

Height growth was strongly influenced in this plantation by the sloping ground in the plantation. Height at the drier upper side of the compartment was much less than at the bottom of the slope.

In the Sapoba 1929 plantation the mean height of the 40 largest trees per acre at 32 years old was 127 feet (38.7 m.) or an annual increment of four feet (1.22 m.).

In Misiones, Argentine, Martin (1946) records a height of 23 to 25 metres at 106 years old in natural forest.

The Ghana sample plot figures quoted by Streets (1962) compare closely with those for height and girth given for Sapoba, Nigeria.

6.3 Volume Increment

Horne (1962) gives true volume data for the 1929 Sapoba plantation for the main crop only ignoring thinnings.

Year	Age	Mean Height feet	Mean G.B.H. inches	True Vol. per acre u.b.	M.A.I. u.b. Cu.ft. per ac.	Remarks
1954	25	105	50	4500	180	No adequate data for thinnings are available
1961	32	120	56	5368	167	

Horne estimated a yield at 40 years old of 6,500 cu.ft. per acre (455m^3 per ha) with a mean girth of about 7 feet o.b., b.h. (2.13 m.). Lest these figures be thought exceptional, figures for a half acre plot in the adjacent arboretum in the thirty-second year of growth were higher. This plot was originally planted closer and thinning was light. There were 167 trees per acre (twice the density of the other plots) and the basal area was 280 square feet). This is equivalent to 10,000 cubic feet per acre (680 m^3 per ha).

出典

Lamb, A.F.A. (1968). Fast growing timber trees of the lowland tropics No.2. Commonwealth Forestry Institute, Department of Forestry, University of Oxford.

樹種：MELIACEAE（センダン科）
Cedrela odorata（セドロ）
国：ナイジェリア

データ採取地の立地環境

成長・収穫に関する表，図，式など

Locality:	Sapoba (western Nigeria)
Altitude:	0 - 500 m
Rainfall	2 500 mm
Soil:	sedimentary origin
Other broad characters:	tropical rain forest
Data source:	temporary sample plots

Number of plots:	2
Number of stems/ha:	210
MAI at 32 years:	11.8 m^3/ha under bark

Remarks: MAI has been calculated for the standing crop and no data on thinning were available.

出典

(1) Horne, J.E.M. Growth rate in the timber plantation of western Nigeria. 1962 Nigerian Forestry Information Bulletin (N.S.) No.12.

ダイジェストデータ．Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MELIACEAE(センダン科)
Swietenia macrophylla (オオバマホガニー)
国　：インドネシア

データ採取地の立地環境

Locality: Telawa, Semarang, Gunuru Kichul, Tasikmalaya
Altitude: 150 - 600 m
Data source: permanent sample plots
Number of plots: 36

成長・収穫に関する表，図，式など

Yield by site classes

Age in years	Site class I		Site class II		Site class III		No.of stems per ha[1/]
	Av. diam. in cm	MAI (m^3/ha)	Av. diam. in cm	MAI (m^3/ha)	Av. diam. in cm	MAI (m^3/ha)	
10	17.6	16.7	12.4	9.8	10.1	5.0	1 070
15	24.7	18.3	19.6	12.3	12.8	7.0	-
20	30.7	18.5	27.2	13.6	17.1	8.6	500
25	36.2	18.3	32.6	14.3	22.0	9.9	-
30	41.5	17.8	36.5	14.6	26.5	11.1	325
35	46.2	17.3	40.0	14.8	31.1	11.9	-
40	51.6	16.8	43.5	14.7	35.1	12.3	240
50	62.1	15.9	49.8	14.4	41.8	12.7	181
60	76.2	14.9	55.5	13.8	45.6	12.5	140

Remarks: Site classes I, II and III correspond to top heights 30.0, 28.0 and 25.0 m respectively at reference age 40 years.

1/ Number of stems/ha indicated are for site class II.

出典

(3) Indonesia Department of Agriculture, Forest Research Institute. Yield table for ten industrial wood species. 1975

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO　1983　所収

樹種：MELIACEAE(センダン科)
Swietenia macrophylla (オオバマホガニー)
国　：フィリピン

データ採取地の立地環境

PHILIPPINES (2)

Locality: Makiling Forest, Laguna, Cebu and Bohol
Altitude: 40 m and up
Number of plots: 191 (Relaskop plots)

成長・収穫に関する表，図，式など

(a) Site index equation (reference age 40 years)

$$\log S = \log H + 0.76605 (\log 40 - \log A) \qquad (r^2 = 0.736)$$

where: S = site index
H = mean total height in m based on at least 5 dominant and co-dominant trees around sampling point
A = stand age in years

About 90 percent of the area studied belongs to site index (20-30).

(b) Yield equation

$$\log V = 1.7348 - 6.6721 \frac{1}{A} + 0.053801 \times S - 0.78406 \times \frac{S}{A} \qquad (r^2 = 0.878)$$

where: V = stand volume (m^3/ha) measured up to 20 cm top diameter under bark. Other symbols stand as in (a).

MAI (m^3/ha) by site index classes

Age (years) \ Site index	15	20	25	30	35	No. of stems per ha 1/
	..... m^3/ha					
15	1.3	1.4	1.4	1.4	1.5	
20	2.1	2.4	2.9	3.4	4.0	690
25	2.5	3.3	4.3	5.5	7.1	
30	2.8	3.8	5.3	7.3	10.0	440
35	2.9	4.2	6.0	8.7	12.5	
40	3.0 (31.0) 1/	4.4 (33.0)	6.6 (35.0)	9.8 (37.0)	14.5 (38.8)	330
45	3.0	4.3	6.9	10.5	16.0	
50	3.0 (36.2)	4.6 (38.2)	7.2 (40.0)	11.1 (41.8)	17.2 (42.6)	270
53	2.9	4.6	7.2	11.4	18.0	

1/ Number of stems/ha indicated are the same for all the sites
2/ Figures in brackets show average stand diameter at breast height

出典

(2) Revilla Jr., A.V.; Bonita, M.; Dimapilis L. A yield prediction model 1976 for Swietenia macrophylla King plantations. The Pterocarpus, A Philippine Journal of Forestry. Vol. 2 No. 2.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MELIACEAE（センダン科）

Swietenia macrophylla（オオバマホガニー）、*S. mahagoni*（マホガニー）

国　：インドネシア

データ採取地の立地環境

6. Swietenia mahagoni Jack/
Swietenia macrophylla King
(MAHONI DAUN KECIL/
MAHONI DAUN BESAR)

Data.

Lokasi	Jumlah petak coba/ukur	Jumlah pemeriksaan	Tinggi dari muka laut	Keadaan lapangan/tanah
Tasikmalaya	4	4	150	
Telawa	10	17		
Semarang	9	40		
Balapulang	2	10		
Kendal	1	6		
Purwodadi	1	8	45 s/d 160	
Kedungjati	1	1		
Banyumas	1	3		
Gunung Kidul	4	18		
Mantingan	2	10		
Jumlah:	35	117		
Ngenjuk	1	6	600	
Jumlah semua:	36	123		

成長・収穫に関する表，図，式など

Umur (Age) (Tahun/Year)	Peninggi (Upper-height) (m)	TEGAKAN TETAP (MAIN STAND) (TT) Jumlah pohon/ha (Number of trees/ha) (N)	S %	Rata-rata tinggi (Average height) (m)	Rata-rata diameter (Average diameter) (cm)	Bidang dasar/ha (Basal area/ha) (m^2)	V kayu tebal/ha (Thick-wood/ha (m3)	Tegakan penjarangan (TP) (Thinnings) V.kayu tebal/ha (Thick-wood/ha (m3)	Vkt kumulatip/ha (ΣVtw /ha) (m3)	Jumlah volume (Total volume) (Vol T.T + ΣT P) (m3/ha)	Riap rata-rata tahunan (Mean annual increment) (m3/ha)	Riap tahunan berjalan (Current annual increment) (m3/ha)	Umur (Age) (Tahun/Year)
Swietenia mahagoni Jack & Swietenia macrophylla King													
BONITA I (SITE CLASS I)													
5	6,1	2405	35,9	4,8	6,7	4,2	4	1	1	5	1,0	1,0	5
10	10,4	1545	26,2	9,2	10,1	9,3	39	10	11	50	5,0	9,0	10
15	13,7	1065	24,0	12,6	12,8	13,2	75	19	30	105	7,0	11,0	15
20	16,5	780	23,3	15,5	17,1	16,4	112	29	59	171	8,6	13,2	20
25	19,0	575	23,6	18,0	22,0	19,4	149	40	99	248	9,9	15,4	25
30	21,3	450	23,8	20,3	26,5	22,1	188	45	144	332	11,1	16,8	30
35	23,4	365	24,0	22,4	31,1	24,0	227	45	189	416	11,9	16,8	35
40	25,0	305	24,6	24,2	35,1	26,6	262	43	232	494	12,3	15,6	40
45	26,7	265	24,7	25,9	38,9	28,3	294	40	272	566	12,6	14,4	45
50	28,0	230	25,3	27,2	41,8	29,8	323	38	310	633	12,7	13,4	50
55	29,0	210	25,6	28,3	44,1	31,2	348	36	346	694	12,6	12,2	55
60	29,9	190	26,1	29,0	45,6	32,2	368	34	380	748	12,5	10,8	60

BONITA II (SITE CLASS II)

5	7,8	2030	30,6	6,6	9,3	6,2	16	4	4	20	4,0	4,0	5
10	13,8	1070	23,8	12,7	12,4	13,2	75	19	23	98	9,8	15,6	10
15	17,5	676	23,6	16,3	19,6	17,5	127	34	57	184	12,3	17,2	15
20	20,3	500	23,7	19,3	27,2	20,9	172	43	100	272	13,6	17,6	20
25	22,6	397	23,8	21,8	32,6	23,6	213	45	145	358	14,3	17,2	25
30	24,7	325	24,1	23,8	36,5	26,0	251	43	188	439	14,6	16,2	30
35	26,5	280	24,2	25,6	40,0	28,2	289	40	228	517	14,8	15,6	35
40	28,0	240	24,8	27,2	43,5	30,1	323	37	265	588	14,7	14,2	40
45	29,4	206	25,5	28,6	46,7	31,8	355	35	300	655	14,6	13,4	45
50	30,5	180	26,2	30,0	49,8	33,2	386	32	332	718	14,4	12,6	50
55	31,7	159	26,9	31,0	53,0	34,4	413	30	362	775	14,1	11,4	55
60	32,6	140	27,8	31,9	55,5	35,3	438	28	390	828	13,8	10,6	60

BONITA III (SITE CLASS III)

5	9,8	1650	27,0	8,6	8,1	8,6	33	8	8	41	8,2	8,2	5
10	17,3	710	23,3	16,2	17,6	17,3	124	35	43	167	16,7	25,2	10
15	21,1	456	23,8	20,2	24,7	21,9	186	45	88	274	18,3	21,4	15
20	24,0	340	24,3	23,1	30,7	25,2	238	44	132	370	18,5	19,2	20
25	26,2	270	25,0	25,4	36,2	27,8	284	41	173	457	18,3	17,4	25
30	28,0	222	25,7	27,2	41,5	30,0	325	37	210	535	17,8	15,6	30
35	29,8	190	26,2	28,9	46,2	31,8	363	34	244	607	17,3	14,4	35
40	30,9	160	27,5	30,4	51,6	33,5	399	31	275	674	16,8	13,4	40
45	32,2	140	28,2	31,6	56,4	35,0	434	28	303	737	16,4	12,6	45
50	33,4	120	29,4	32,8	62,1	36,4	466	26	329	795	15,9	11,6	50
55	34,7	100	30,8	33,9	69,2	37,6	495	23	352	847	15,4	10,4	55
60	35,6	85	32,6	34,9	76,2	38,8	523	21	373	896	14,9	9,8	60

出典

Suharlan, A., Sumerna, K, and Sudiono, Y (1975) Yield table of ten industrial wood specoes. Lembaga Penelitian Hutan.

樹種：MELIACEAE（センダン科）

Swietenia mahagoni（マホガニー），*S. macrophylla*（オオバマホガニー）

国：フィリピン

成長・収穫に関する表，図，式など

樹　令(年)	樹　高(m)	胸高直径(cm)	材　積(m^3)	測定本数	場　所（島名）
17	19 1	25 9	0 20	64(本)	ロスハニョス（ルソン）
22	19 0	39 0	0 37	12〃	〃
36	21.3	50 3	0 79	25〃	〃
21	15.3	37 9	—	36〃	ミンダナオ（セブ）
18	13 6	20 9	—	87〃	カノニャオ（ルソン）

各地の情報をもとにして，30年伐期で平均生長量を25m^3/haとしている例もあるが，最近のインドネシアの収穫表をみると，この予想は過大なように思われる。

Swietenia mahagoni, S. macrophylla 収穫表（抜粋）

林　令	本数/ha	平均樹高 (m)	平均胸高直径 (cm)	主林木材積 (m^3/ha)	間伐材積 (m^3/ha)	年平均生長量 (m^3/ha)
〔地位Ⅰ〕						
5	2,405	4 8	6.7	4	1	1.0
10	1,545	9 2	10 1	39	10	5 0
15	1,065	12 6	12 8	75	19	7 0
20	780	15 5	17 1	112	29	8 6
30	450	20 3	26.5	188	45	11.1
40	305	24.2	35.1	262	43	12 3
50	230	27.2	41 8	323	38	12.7
60	190	29 0	45 6	368	34	12 5
〔地位Ⅲ〕						
5	1,650	8 6	8.1	33	8	8 2
10	710	16 2	17 6	124	35	16 7
15	456	20.2	24.7	186	45	18 3
20	340	23.1	30.7	238	44	18 5
30	222	27 2	41.5	325	37	17.8
40	160	30 4	51 6	399	31	16 8
50	120	32.8	62.1	466	26	15.9
60	85	34.9	76 2	523	21	14.9

（SUHARIAN, SUMERNA & SUDIONO, 1975 による）

出典

浅川澄彦(19??)．熱帯樹種の造林特性（Ⅶ）．熱帯林業 No 67 . 41-44.

樹種：BOMBACACEAE(パンヤ科)

Ochroma bicolor (バルサ)

国　：インドネシア

成長・収穫に関する表，図，式など

Umur (Age) (Tahun/Year)	Peninggi (Upper-height) (m)	TEGAKAN TETAP (MAIN STAND) (T.T.) Jumlah pohon/ha (Number of trees/ha) (N)	S %	Rata-rata tinggi (Average height) (m)	Rata-rata diameter (Average diameter) (cm)	Bidang dasar/ha (Basal area/ha) (m^2)	V.kayu tebal/ha (Thick-wood/ha (m3)	Tegakan penjarangan (T.P.) (Thinnings) V.kayu tebal/ha (Thick-wood/ha (m3)	Vkt kumulatip/ha (ΣVtw /ha) (m3)	jumlah volume (Total volume) (Vol.T.T. + ΣT.P.) (m3/ha)	Riap rata-rata tahunan (Mean annual) increment) (m3/ha)	Riap tahunan berjalan (Current annual increment) (m3/ha)	Umur (Age) (Tahun/Year)

Ochroma bicolor Rowlee (Balsa)

BONITA I (SITE CLASS I)

1	4,6	1225	66,8	4,1	9,2	8,2	24	11	11	35	35,0	-	1
2	9,6	827	39,0	8,8	13,2	11,4	74	25	36	110	55,0	75,0	2
3	13,9	573	32,3	13,1	17,1	13,1	108	38	74	182	60,7	72,0	3
4	17,8	405	30,0	17,0	21,1	14,2	133	50	124	257	64,0	75,0	4
5	21,0	303	29,4	20,3	25,1	15,0	152	57	181	333	66,6	76,0	5
6	23,1	244	29,8	22,5	28,5	15,6	166	60	241	407	67,8	74,0	6
7	24,6	209	30,2	24,1	31,2	16,0	177	60	301	478	68,3	71,0	7
8	25,7	188	30,5	25,2	33,2	16,3	184	60	361	545	68,1	70,0	8
9	26,4	175	30,8	25,9	34,6	16,5	190	60	421	611	67,9	66,0	9
10	26,8	167	31,0	26,3	35,6	16,6	194	60	481	675	67,5	64,0	10

BONITA II (SITE CLASS II)

1	6,5	1050	51,1	5,9	10,9	9,8	42	16	16	58	58,0	-	1
2	13,2	613	32,9	12,4	16,3	12,8	102	36	52	154	74,0	96,0	2
3	17,6	414	30,0	16,8	20,9	14,2	133	50	102	235	78,3	81,0	3
4	21,3	295	29,4	20,6	25,5	15,1	156	59	161	316	79,0	81,0	4
5	24,0	223	30,0	23,4	30,1	15,9	173	60	221	394	78,8	78,0	5
6	26,1	180	30,7	25,6	34,1	16,4	188	60	281	469	78,2	75,0	6
7	27,7	152	31,5	27,3	37,6	16,9	200	59	340	540	77,1	71,0	7
8	28,7	137	32,0	28,3	40,0	17,2	208	59	399	607	75,9	67,0	8
9	29,4	127	32,5	29,0	41,8	17,4	214	58	457	671	74,6	64,0	9
10	29,8	121	32,8	29,4	42,9	17,5	217	57	514	731	73,1	60,0	10

BONITA III (SITE CLASS III)

1	8,4	896	42,7	7,7	12,5	11,0	62	22	22	84	84,0	-	1
2	16,9	440	30,3	16,1	20,1	13,9	127	48	70	197	98,5	113,0	2
3	21,5	287	29,4	20,9	25,8	15,1	156	58	128	284	94,7	87,0	3
4	24,6	211	30,1	24,1	31,1	16,0	178	60	188	366	91,5	82,0	4
5	27,0	164	31,1	26,5	36,0	16,7	196	60	248	444	88,8	78,0	5
6	29,0	132	32,2	28,6	40,9	17,3	210	59	307	517	86,2	73,0	6
7	30,6	111	33,4	30,3	45,1	17,7	222	56	363	585	83,6	68,0	7
8	31,7	97	34,4	31,5	48,7	18,1	230	54	417	647	80,9	62,0	8
9	32,4	90	35,0	32,1	50,9	18,3	236	52	469	705	78,3	58,0	9
10	32,8	86	35,4	32,6	52,2	18,4	239	51	520	759	75,9	54,0	10

出典

Suharlan, A , Sumerna, K, and Sudiono, Y. (1975) Yield table of ten industrial wood specoes Lembaga Penelitian Hutan

樹種：MYRTACEAE(フトモモ科)
Eucalyptus spp. (Eucalyptus plantations)
国　：インド

データ採取地の立地環境

成長・収穫に関する表，図，式など

Table 3

Growth data of some Eucalyptus plantations of Punjab raised under Social Forestry programmes.

Spacing (m×m)	Age (yrs)	Av dia (cm)	Quality of cultural operations	M A I (m^3/ha)	Site type	Location
3.0×2.5	6.0	12.3	Good	18.04	Poor	V. Piareana
5.0×2.0	5.5	12.3	Average	13.50	Poor	Chak Sarkar RF
2.0×2.25	8.5	14.1	Average	15.57	Poor	V. Dhilwan Khurd
6.5×1.5	14.0	17.3	Average	22.80	Poor	R.F. Ludhiana
2.5×1.8	3.5	11.5	Poor	29.48	Poor	V. Sodhiwala
1.7×1.7	8.0	12.4	Good	28.40	Poor	V. Behlewala
1.8×1.5	4.5	9.9	Average	18.54	Average	V. Malsian
3.0×3.0	20.5	35.2	Average	22.90	-do-	Bir Bhare Agol Patiala
3.0×4.0	14.0	27.6	Average	29.90	Poor	Govt. Forests Nasrala Hoshiarpur
4.0×4.0	3.0	12.7	Good	11.33	Good	V. Aima Mangat

Source　Dogra *et al*., 1984

出典

Kapur, S.K. and A.S. Dogra (1989). Fast Growing Species for Meeting Rural and Industrial Needs of Punjab - Present Status and Future Research Needs. Indian For., 115 : 201-208.

樹種：MYRTACEAE(フトモモ科)
Eucalyptus spp.(*E. grandis*, *E. saligna*, *E. alba*, *E. urophylla*, *E. citriodora*, *E. camaldulensis*, *E. tereticornis*, のデータを主とした)
国　：ブラジル

データ採取地の立地環境

For Eucalyptus the situation is reversed· the culture was established in the state more than seventy years ago, and therefore the existing yield tables are sufficiently trustworthy and exhaustively tested. In practice, however, more studies on the correlation between development and site will be necessary (Van Goor 1975) The Eucalyptus species generally used are E. grandis, E. saligna, E. alba (hybrid or urophylla), E. urophylla, E. citriodora, E. camaldulensis, and E. tereticornis.

Site and the Factors of Growth

The factors of site, fundamental for growth, are related to climate and soil. The topography in subtropical and tropical regions does not influence growth directly, for it is implicitly considered in the development of the soil. Growth is, however, directly influenced by the soil.

Climate

In accordance with Thornthwaite, the state of São Paulo can be divided into climatic regions based on the average annual temperature and rain deficit as follows:

Region A: Below 20°C, without hydric deficit.
Region B: Below 20°C, with hydric deficit less than 30 mm
Region B_1: Below 20°C, with hydric deficit between 30 and 60 mm.
Region C: Above 20°C, without hydric deficit.
Region D: Between 20 and 22°C, with hydric deficit less than 30 mm.
Region E: Between 20 and 22°C, with hydric deficit between 30 and 60 mm.
Region E_1· Between 20 and 22°C, with hydric deficit above 60 mm.
Region F: Above 22°C, with hydric deficit above 60 mm.
Region F_1: Above 22°C, with hydric deficit between 30 and 60 mm.
Region F_{11}: Above 22°C, with hydric deficit below 30 mm.

The definition of these regions is based on water-holding capacity of 300 mm. The regions indicated with the digits 1 and 11 are of lesser importance and in this study were included in the principal types of climate as shown in Figure 3.

Based on essentially climatic parameters, the state of São Paulo was classified in regions qualified and not qualified for the cultivation of several kinds of Pinus (Golfari 1967) and later several kinds of Eucalyptus.

Soils

Soil factors are divided into physical, chemical, and biological. Physical factors determine the conditions for nitrogen fixing, mycorrhizae, and so forth, and are well defined by the great soil groups. The fertility of the soil is more difficult to determine. Since the soil is covered with natural vegetation, the fertility is reasonably related to the great soil groups. But even under natural conditions, fertility varies. As one discovers in practice, there is variation of natural vegetation on the same unit of soil; the atropical influence is so remarkable that the fertility of the site can be determined only through a chemical analysis.

Concerning physical properties, particular soils encountered include latosols, podzolized soils, lithosols, hydromorphic soils, regosols, and Mediterranean soils. From the great soil group in the state of São Paulo, Pv (podzolized red green), PVp (podzolized red green variation Piracicaba), Plm (podzolized variation Lins), and Pml (podzolized variation Marília) were grouped.

Table 3 Yields for Eucalyptus species (simple coppice).*

	Age (yrs)	Outside Bark (m^3)	Inside Bark (m^3)	Stacked Volume Inside Bark (m^3)
P1	7	375	300	360
	12	161	129	155
	17	128	102	122
	Total	664	531	637
P2	7	285	228	273
	12	122	98	118
	17	97	77	92
	Total	504	403	483
P3	7	214	171	205
	12	91	73	87
	17	73	58	70
	Total	378	302	362
P4	7	153	122	146
	12	65	52	62
	17	52	42	51
	Total	270	216	259

*Percentage of bark = 20%. Bark factor = 0.894. Form factor = 0.55. Coefficient of stacking = 1.2. Square bark factor = 0.80 (% of wood).

The total of costs adjusted to the beginning of rotation is:

$$\Sigma C = PL + \frac{S_1}{1{,}0\ i^1} + \frac{S_2}{1{,}0\ i^2} + \frac{a\ (1{,}0\ i^r - 1)}{0{,}0i \cdot 1{,}0\ i^r} + \frac{T\ (1{,}0\ i^r - 1)}{1{,}0\ i^r}$$

where:

Da, Db, etc. = amount of thinned wood during the years a, b, and so on
Cr = amount of wood at final cutting
P = price of wood at factory
E = cost of exploitation (cutting, debarking, piling)
PL = cost of planting and silvic treatment during the first year
S_1, S_2 = cost of silvic treatment during the following years
a = annual cost of management, including maintenance and depreciation of installations
T = land value

Table 4. Yields for Eucalyptus species (rotation 35 years) *

	Age (yrs)	Outside Bark Thinned (m^3)	Inside Bark Thinned (m^3)	Inside Bark Thinned, as Pulp (m^3)	Stacked Volume Inside Bark, as Pulp (m^3)	Inside Bark for Sawmill (m^3)
P1	7	105	84	84	101	--
	9	128	102	77	92	25
	12	156	124	56	67	68
	16	175	141	22	26	119
	23	198	158	16	19	142
	35	774	619	62	75	557
	Total	1,536	1,228	317	380	911
P2	7	80	64	64	77	--
	9	97	77	70	84	7
	12	113	91	46	55	45
	16	127	102	21	25	81
	23	141	113	12	14	101
	35	568	454	54	65	400
	Total	1,126	901	267	320	634
P3	7	60	48	48	58	--
	9	72	57	53	63	4
	12	84	67	44	53	23
	16	94	75	15	18	60
	23	103	83	10	13	73
	35	412	330	33	38	297
	Total	825	660	203	243	457
P4	7	43	34	34	41	--
	9	51	41	41	49	--
	12	60	48	34	41	14
	16	66	53	16	19	37
	23	73	58	9	11	49
	35	290	232	24	29	208
	Total	583	466	158	190	308

*See note for Table 3.

The potental profitability coefficient (i) is determined by comparing

$$\Sigma_r = \Sigma_c .$$

To calculate the economic transportation radius of wood from the site of production (plantation) to the place of consumption (industry), one again uses the basic forest equation. It gives the total available for transportation (T_r), once the profitability rate demanded for the investment is fixed. The result is obtained by transforming the basic forest equations:

$$P - E - T_r = \frac{\Sigma c}{\Sigma q}$$

出典

Victor, M A M , Kronka, F J M et al Land Classification for Industrial Afforestation in the State of Sao Paulo, Brazil, Forest Site and Productivity, 69-92

樹種：MYRTACEAE（フトモモ科）
Eucalyptus spp.（*E. citriodora*, *E. saligna*, *E. robusta*, *E. teroticornis*, *E. camaldulensis*, *E. grandis* についてまとめたもの）
国　：ブラジル

データ採取地の立地環境

Reference Heinsdijk *et al*, 1965
Area Brazil *Number of sample plots* 981
Stocking Average N varies from about 2 800/ha (QC 6, age 4) to 700/ha (QC 1, age 25)
Volume Stem volume overbark to tip, including stump Volume of thinnings shown separately, included in calculation of MAI
Remarks Mean site quality was 3 to 4 Distribution of plots over four years old was found to be QC 1 36, QC 2 87, QC 3 255, QC 4 325, QC 5 195, QC 6 21

成長・収穫に関する表，図，式など

Quality class 1

Age *(years)*	N	h_{dom} *(m)*	$\bar{h}$ *(m)*	$\bar{d}$ *(cm)*	V (total crop) *(m^3)*	V (thinnings) *(m^3)*	MAI *(m^3)*
4	1 640	22 1	15 3	10 2	135	—	33 8
5	1 337	26 7	18 9	12 4	211	32	42 2
8	983	35 2	26 0	16 6	412	30	55 5
11	855	40 0	30 0	19 1	558	23	56 4
14	790	43 0	32 5	20 4	664	18	53 5
17	750	45 0	33 9	21 3	743	14	49 8
20	724	46 5	35 8	22 3	804	17	46 1
25	695	48 3	37 3	22 9	879	13	40.5

Quality class 2

4	1 688	19 1	12 9	10 0	93	—	23 3
5	1 375	23 0	16 0	11 8	146	22	29 2
8	1 012	30 4	22 0	15 9	285	20	38.4
11	880	34 5	25 4	18 1	386	16	38 9
14	813	37 1	27 6	19 4	460	13	37 0
17	772	38 9	29 1	20 4	515	10	34 5
20	745	40 2	30 3	21 0	557	12	31 9
25	715	41 7	31.6	22.0	609	9	28 1

Quality class 3

4	1 759	15 6	10 6	9 2	63	—	15 8
5	1 434	19 3	13 1	11 1	99	15	19 8
8	1 055	25 5	18.0	15 0	193	14	26 0
11	918	29 0	20 8	16 9	261	11	26 4
14	847	31 2	22 6	18 1	311	9	25 1
17	805	32 6	23 8	19 1	347	6	23 3
20	776	33 7	24 7	19 7	376	8	21 6
25	745	35 0	25 8	20 7	411	6	19 0

Quality class 4

Age (years)	N	h_{dom} (m)	$\bar{h}$ (m)	$\bar{d}$ (cm)	V (total crop) (m^3)	V (thinnings) (m^3)	MAI (m^3)
4	1 878	12 9	8 2	8 3	41	—	10 3
5	1 530	15 5	10 2	10 2	63	9	12 6
8	1 126	20 5	14 0	13 4	124	9	16 6
11	980	23 3	16 2	15 3	168	7	16 9
14	904	25 0	17 6	16 6	200	6	16 1
17	859	26 2	18 5	17 5	224	5	15 0
20	829	27 1	19 3	18 1	242	5	13 9
25	795	28 1	20 1	18 8	264	3	12 2

Quality class 5

4	2 112	9 6	5 9	7 0	24	—	6 0
5	1 721	11 5	7 3	8 6	37	6	7 4
8	1 266	15 3	10 0	11.1	72	5	9 8
11	1 101	17.3	11 6	12.7	97	4	9 8
14	1 017	18 6	12 5	14.0	116	3	9 4
17	966	19 5	13 2	14.6	130	3	8 7
20	932	20 1	13 8	15.0	140	3	8 1
25	894	20 9	14 1	15.6	153	2	7 1

Quality class 6

4	2 777	6 1	3 5	4.5	10	—	2 5
5	2 263	7 3	4 4	5.7	16	3	3 2
8	1 665	9 7	6 0	7 6	30	2	4 1
11	1 448	11 0	6 9	8 6	41	1	4 2
14	1 337	11 9	7.5	9 2	49	1	3 9
17	1 270	12 4	8 0	9 6	55	1	3 7
20	1 225	12 8	8 3	9 9	59	1	3 4
25	1 176	13 3	8 6	10 5	65	1	3 0

出典

Jacobs, M R Eucalyptus for planting Species monograph p 394 FAO Rome 1979

樹種：MYRTACEAE(フトモモ科)
Eucalyptus camaldulensis (ユーカリ・カマルドレンシス)
国　：タイ

データ採取地の立地環境

成長・収穫に関する表，図，式など

14－1　王室林野局、TFATから得られた成長量関連データ

樹種：E. camaldulensis　　GT：グリーントンで約1 m³

(1) TFAT構想のチップ輸出プロジェクトにおける植林伐採計画より

50GT／ライ・5年 （MAI 625 GT／*ha*）

(2) TFAT構想の民間経済植林方針（Economic Reforestation Policy of Thai Private Sector）より

無施肥、無耕耘の場合	106GT／ライ・年
TFAT指導による通常の手入の場合	16 〃 〃
〃 最高の手入の場合	32 〃 〃

以上平均 196GT／ライ・年 （MAI 1225 GT／*ha*）

(3) TFAT構想の植林コストと収益計算より

Fire－Wood（平均） 190 m³／ライ・5年（MAI 2375 m³／*ha*）

Log －Wood（平均） 109 m³／ライ・5年（MAI 1363 m³／*ha*）

(4) 科学技術エネルギー小委員会への政府報告（1984年）より

33 GT／ライ 年 （MAI 206 GT／*ha*）

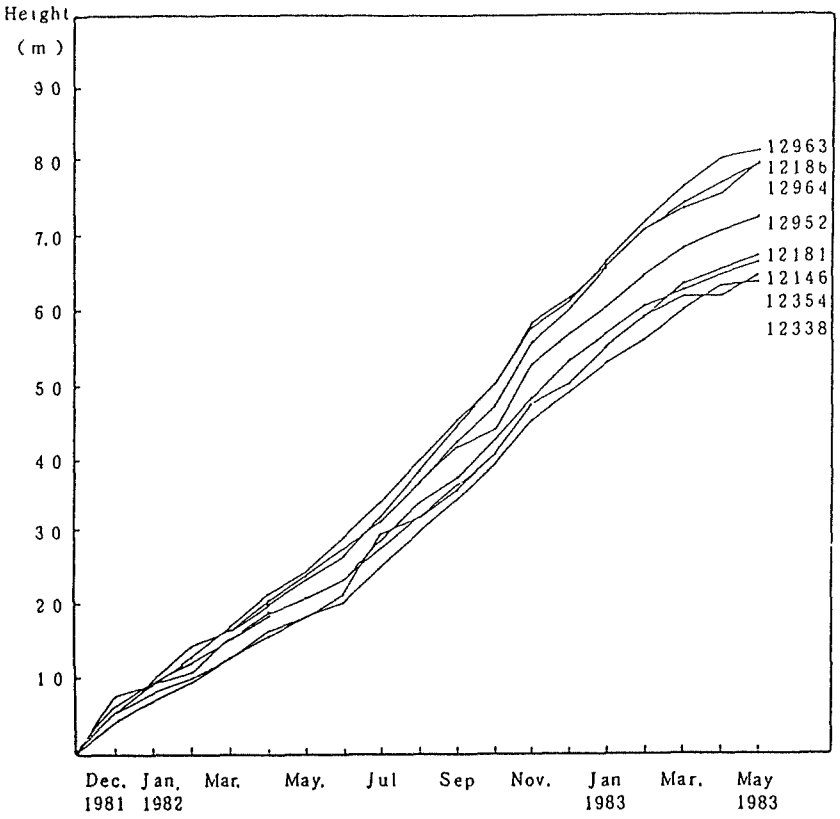
(5) 民間会社 Soom Hua Seng の成長予測より

5 m³／ライ・年 （MAI 3125 m³／*ha*）

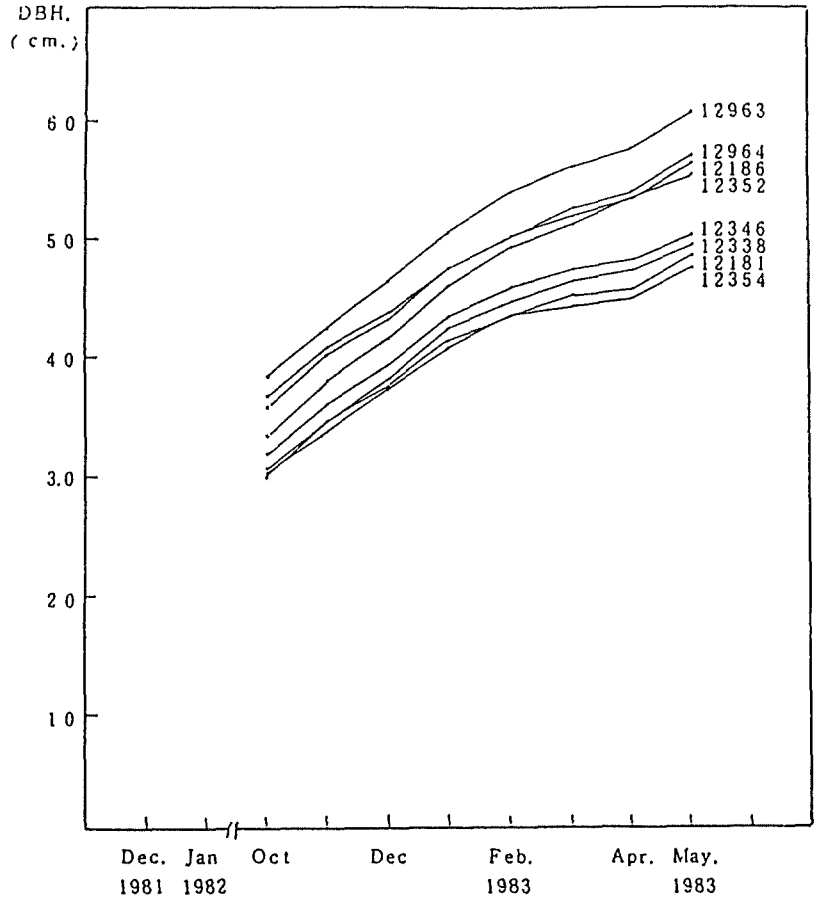
14－2　タイプライウッド社の成長測定データ

ウタイタニ試験林　E camaldulensis Provenance Trial　4×2mの例

(1) 樹　　高



(2) 胸高直径



14－3　今回の調査て実測したデータ

注．《 》内の材積は１４－４の立木材積式による。

(1)　カンチァナフリ県KC　Farm社有林

①　E camaldulensis　２年９ケ月　　3×15m

胸高直径　　69cm　（２８本平均　Max 12　Min 3）

樹　　高　　10m　（　〃　　Max 13　Min 9）

《１本当り材積　001541 m³》

②　E. camaldulensis　　１年４ケ月　　3×15m

胸高直径　　65cm　（２０本平均　Max 90　Min 30）

		胸高直径	樹　高	材　積
単木測定	No. 1	65 cm	85 m	《001134m³》
	2	55	75	《000677 》
	3	60	82	《000914 》

E. deglupta

胸高直径　　76 cm　（１８本平均　Max 90　Min 55）

		胸高直径	樹　高	材　積
単木測定	No. 1	85 cm	80 m	《002196m³》
	2	50	64	《000676 》

(2)　チョンブリ県　私有林　E. camaldulensis ５年生時伐採、伐後１年３ケ月の萌芽林（伐後放置で芽かきはしていない）

		胸高直径	樹　高	材積（平均）
単木測定	No. 1	6, 6, 7, 7, cm	85～90m	《001170m³》
	2	5, 8, 8	75～80	《 001214》
	3	7, 7,	70～80	《 001174》
	4	5, 7, 7	80	《 000992》

(3)　チャチェンサオ県　私有林　３年２ケ月　　ユーカリ１０種混植

単木測定		胸高直径	樹　高	材　積
E. tereticornis	No. 1	110 cm	150 m	《005643m³》
E. camaldulensis	No. 1	155	160	《012216 》
	2	125	140	《007071 》

(4) スーリン県　私有林　E.camaldulensis　7ケ月　3×13m

胸高直径　　49cm　（10本平均　Max 55　Min 40）

樹　　高　　54m　（　〃　　Max 60　Min 49）

《1本当たり材積　000328m³》

(5) スーリン県　私有林　E.camaldulensis　3年7ケ月　伐倒試験

幹材積（実材積）は伐倒木を2mに採材、末口二乗法で算出した。

		胸高直径	樹　高	幹材積	生重量
伐倒木	№1	185cm	193m	01757m³《020444》	228kg
	2	220	190	02469 《028390》	320

(6) スーリン県　タトウン郡　政府のNational Provenance Trial

E.urophylla 7年生　28×28m。材積はE.camaldulensisの材積式を使用した。

単木測定		胸高直径	樹　高	材　積
№1	林縁樹	190cm	170m	《019289m³》
2	〃	240	225	《039073 》
3	林内樹	180	180	《018216 》
4	〃	170	190	《017068 》
5	〃	160	190	《015147 》

(7) ナコンラチャシマ県　カンタレソー郡　私有林　E.camaldulensis

3年1ケ月　2×2m

胸高直径　　81cm　（30本平均　Max 120　Min 30）

樹　　高　　135m　（3本平均　Max 145　Min 125）

《1本当たり材積　002843m³》

(8) ナコンラチャシマ県　ダンクント郡　FIO植林地（Agroforest Trial）

E.camaldulensis　8×2m　6年生

胸高直径　　116cm　（30本平均　Max 170　Min 40）

樹　　高　　130m　（3本平均　12 ～ 14m）

《1本当たり材積　005725m³》

(9) ロッブリ県 チャイバダン郡 私有林 E.camaldulensis 1年3ケ月

3 × 13m

胸高直径 50 cm (10本平均 Max 70 Min 20)

樹 高 73 m (〃 Max 101 Min 30)

《1本当たり材積 000523m³》

(10) ウタイタニ県

① タイプライウッド社試験地

E.camaldulensis 5年生 4 × 2 m

胸高直径 117 cm (9本平均 Max 140 Min 80)

② タイプライウッド社社有林

E.camaldulensis 4年生 3 × 2 m

胸高直径 82 cm (10本平均 Max 100 Min 60)

樹 高 106 m (〃 Max 125 Min 85)

《1本当たり材積 002322m³》

14－4 成長量の推定

タイ国では、E.camaldulensisの立木材積表や立木材積式はまだ調製されていない。

このため、今回の調査で実施した前記14－3－(5)のスーリン県の私有林(3年7ケ月)での伐倒試験データをもとに検討を行った結果、次に示すイタリヤMatera地方のE.camaldulensisの立木材積式(FAO資料による)が、比較的よく適合するように考えられる。

$$V(\text{皮付}) = \frac{117D^2 + 024D^2H + 061DH - 860D}{10,000}$$

ちなみに、伐倒試験木の2m採伐丸太の末口二乗法による材積(皮なし)計と、上式による立木材積(皮付き)とを比較すれば次のとおりである。

表14－1

伐倒木	末口二乗法m³ (A)	立木材積式m³ (B)	A／B %
No.1	01757	020444	860
No.2	02469	028390	870

樹皮率は測定できなかったが、TFATの説明では15%程度とのことのよう

であり、かなりよく適合しているといってよい。

この材積式をもとに、ほゝ同年齢の１４－３－(7)の農家林について試算すると、haあたり材積は７１㎥、年平均成長量は２３㎥となる。

また、１４－３－(10)－②のタイプライウッド社社有林（４年）では、haあたり材積は３９㎥、年平均成長量は９７㎥となる。

前者はタピオカ畑の転作植林であり、後者は天然林の伐採権見合いの義務的植林といった差があるほか、比較的成育良好な供試木をもととした本材積式自体や、若齢林に対し、少数標本をもとに、haあたりの植栽本数をベースとして試算したものであること等多くの問題点が含まれている。

一列植栽で、耕耘、施肥等が十分に行われている場合には、かなり成育の良好な箇所も見受けられたが、１４－１－(1)～(3)に示すＴＦＡＴの成長見込み（haあたり年６２５～２３７５㎥）は、いずれにしても過大であり、これをもって、将来の成長量を予測することは危険というべきであろう。

出典

南方造林協会（1987年2月）　タイ国におけるユーカリの植林動向とチップ輸出に可能性に関する調査報告書，南方造林　71-78

樹種：MYRTACEAE(フトモモ科)
Eucalyptus camaldulensis (ユーカリ・カマルドレンシス)
国　：モロッコ

データ採取地の立地環境

成長・収穫に関する表，図，式など

Locality: Mamora
Stocking density: 800 stems/ha (initial)
Measurement specifications: stem volume over bark, limits not specified

MAI (m^3/ha) by quality class[1/]

Age (years) \ Quality class	I	II	III	IV	V
6	5.8	4.9	3.9	3.2	2.5
7	6.8	5.5	4.4	3.5	2.6
8	7.7	6.1	4.8	3.8	2.8
9	8.3	6.7	5.2	3.9	2.9
10	9.0	7.1	5.4	4.1	2.9
11	9.6	7.5	5.6	4.1	2.9
12	10.0	7.8	5.8	4.2	2.8
13	10.3	8.0	5.9	4.2	2.7
14	10.6	8.0	5.9	4.1	2.7
15	10.9	8.1	5.8	3.9	2.6
16	11.0	8.1	5.7	3.8	2.5

1/ Limits for quality classes not provided

出典

(2) Jacobs, M.R. Eucalyptus for planting. FAO. Rome. 1979

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MYRTACEAE(フトモモ科)
Eucalyptus camaldulensis (リバーレッドガム)
地域：ギロッコ

データ採取地の立地環境

成長・収穫に関する表，図，式など

Stocking Spacing 3 5 × 3 5 m, therefore initially N = 800/ha
Volume Stem volume overbark Inclusion/exclusion of tip and stump not specified

Quality class I

Age (years)	h_w (m)	d_g (cm)	G (m^2)	V (m^3)	MAI (m^3)	CAI (m^3)	f
6	11.1	11 6	8 7	35 1	5 8	12 1	0 365
7	12.4	13 0	10 9	47 7	6 8	13 3	0 353
8	13 6	14 3	13 1	61 7	7 7	13 7	0 346
9	14 6	15 4	15 2	75.1	8 3	14 2	0.340
10	15 6	16 5	17 4	90 2	9 0	15 1	0 333
11	16 5	17 4	19 5	105 4	9 6	15 0	0 328
12	17 3	18 3	21 5	120 1	10 0	14 4	0 323
13	18 0	19 1	23 3	134 1	10.3	14 4	0 320
14	18 7	19 8	25.1	149 0	10 6	14 2	0.317
15	19 3	20 5	26 9	162 6	10 9	14 0	0 313
16	19 9	21.1	28 6	177 0	11 0	13 4	0 311

Quality class II

6	10 4	10 9	7 6	29 3	4 9	8 7	0.373
7	11 5	12.0	9 3	38 7	5 5	8 7	0 363
8	12 5	13 1	11 0	48 8	6 1	10 8	0 354
9	13 5	14 2	12 9	60 4	6 7	11 0	0 346
10	14 3	15 1	14 5	70 9	7 1	11 0	0 341
11	15 1	15 9	16 2	82 4	7 5	10 9	0 336
12	15 8	16 7	17 8	93 5	7 8	10 6	0 331
13	16 4	17 3	19 2	103 6	8 0	9 6	0 329
14	16 9	17 9	20 4	112 6	8 0	9 2	0 325
15	17 4	18 4	21 7	122 1	8 1	8 7	0 323
16	17 8	18 8	22 8	130 0	8 1	8 3	0 320

Quality class III

Age (years)	h_g (m)	d_g (cm)	G (m^2)	V (m^3)	MAI (m^3)	CAI (m^3)	f
6	9 6	10 0	6 4	23 5	3 9	7 1	0 382
7	10 6	11 1	7 9	30 9	4 4	7.6	0 370
8	11 5	12 0	9 3	38 7	4 8	7 9	0 363
9	12 3	12 9	10 7	46 7	5 2	7 8	0 356
10	13 0	13 7	12 0	54 4	5 4	7 5	0 350
11	13 6	14 3	13 1	61 7	5 6	7 5	0 346
12	11 2	14 9	14 2	69 5	5 8	7 4	0 342
13	14 7	15 5	15 3	76 5	5 9	6 5	0 339
14	15 1	15 9	16 2	82 4	5 9	5 3	0 336
15	15 4	16 2	16 9	87.0	5 8	4 5	0 334
16	15.7	16 5	17 6	91 8	5 7	4 6	0 331

Quality class IV

6	8 9	9 2	5 5	19 1	3 2	5 8	0 393
7	9 7	10 1	6 5	24 2	3 5	5 6	0 382
8	10 5	10 9	7.7	30 1	3 8	5 4	0 372
9	11 1	11 6	8 7	35 1	3 9	5 3	0 368
10	11 7	12 3	9 6	40 7	4 1	5 2	0 361
11	12 2	12 8	10 5	45 6	4 1	4 6	0 356
12	12 6	13 2	11.2	49 9	4 2	4 4	0 354
13	13 0	13 7	12 0	54 4	4 2	3 4	0 350
14	13 2	13 9	12 3	56 8	4 1	2 4	0 348
15	13 4	14 1	12 7	59 2	3 9	2 4	0 347
16	13 6	14 3	13.1	61 7	3 8	2 0	0 346

Quality class V

6	8 1	8 4	4 5	14 7	2 5	4 3	0 404
7	8 8	9 1	5 4	18 5	2 6	3 8	0.393
8	9 4	9 8	6 1	22 2	2 8	3 7	0 388
9	10 0	10 4	6 9	26 3	2 9	3 5	0 379
10	10 4	10 9	7 6	29 3	2 9	2 5	0 373
11	10 7	11 2	8 0	31 7	2 9	2 5	0 370
12	11 0	11 5	8 5	34 3	2 8	2.1	0 368
13	11 2	11 7	8 8	36 0	2 7	1 7	0 365
14	11 4	11 9	9 1	37 8	2 7	1 3	0 363
15	11 5	12 0	9 3	38 7	2 6	0 9	0 362
16	11 6	12 1	9 5	39 7	2 5	0 7	0 361

出典

Jacobs, M R Eucalyptus for planting Species monograph p 394 FAO Rome 1979

樹種：MYRTACEAE(フトモモ科)

Eucalyptus camaldulensis (リバーレッドガム)

樹　：オイルエリア

データ採取地の立地環境

5.9.4 Provenance trials

In the international provenance trials, which started in 1966, 14 countries, Mediterranean as well as tropical, participated. Provenances identified with good performance, particularly in the tropical zone (based on results from Nigeria, Zambia and Madagascar) are described below.

Name	Sub-region	Region	Altitude (m)	Rainfall (mm)
Lake Albacutya (6845)	Salt Lake	Basin of River Murray	183	341
Petford (6953)	Ettinity with E. tereticornis	Northern Queens Island	510	704
Katherin (6869)	North	Northern Territory	110	943
Wiluna (7046)	Northern Goldfield	Western Australia	330	200

成長・収穫に関する表，図，式など

Yield of some provenances at Ataka (Nigeria) at 6 years of age (1) is reported as follows:

Provenance		MAI (m^3/ha)
Lake Albacutya		9.4
Petford	(best)	11.2
Katherine		10.0
Wiluna		8.5
Walpora Island	(worst)	3.7

5.9.5 Weight (fresh)/volume relation (3)

Regression equation (based on measurement of 106 trees):

$$\log W = -0.673523 + 2.01801 \log D + 0.025196 H$$

($r^2 = 0.932$, SE = 20.9%)

where: W = weight in kilograms
H = height of the tree in metres
D = diameter at breast height in cm

Remarks: Volume of the wood has been measured up to 4 cm top diameter over bark, both main stem and branches, and trees were of dominant and co-dominant classes.

The DBH range was 11.0 - 36.0 cm
and heights range 9.2 - 28.2 m

出典

(1) Lacaze, J.F. 1978 Study of the ecological adaptation of Eucalyptus: A study of provenance of Eucalyptus camaldulensis. Dehn. FAO Project No. 6. Progress and Problems of Genetic Improvement of Tropical Forest Trees. Vol. 2.

(3) Malik, M.A. et al. 1981 Fresh weight tables for Eucalyptus camaldulensis grown in the irrigated plantation of Northern Iraq. Mesopotamia Journal of Agriculture. Vol. 16/No. 2.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MYRTACEAE（フトモモ科）
Eucalyptus cloeziana
国　：ザンビア

データ採取地の立地環境

Zambia (Copperbelt)

成長・収穫に関する表，図，式など

Reference· Country statement (provisional yield table)

Stocking Initial N = 720/ha, thinned at ages 5 and 8, final N = about 250/ha
Volume Stem volume. Volume of thinnings shown separately, included in the calculation of MAI

Age (years)	$\bar{h}$ (m)	$\bar{d}$ (cm)	N	G (m^2)	V (m^3)	CAI (m^3)	MAI (m^3)	Roundwood volume m^3 to· 10 cm	15 cm	20 cm	Roundwood volume percent to 10 cm	15 cm	20 cm	Assortment percent Saw	Small poles	Pur-lins	Waste
1																	
2	9 0	8 5	720														
3	12 5	12 6	720														
4	14 2	14 2	720		51 8		13 0										
B[1] 5	16 5	16 3	720	15 0													
A[1]	(17 0)	17.0	494														
T[1]	15 0	15 0	226	4 0	19			12			66				44	28	18
6	18 8	19 2	494														
7	20 5	21 0	494														
B 8	22 0	22 7	494	20.0	130		18 6	114	78		88	60		47	15	26	13
A	(22 6)	23.3	247														
T	20 6	21 2	247	8 7	54			46	26		85	48		36	19	31	14
9	24 0	25 2	247														
10	25 5	27 0	247	14 1	105		17.8	95	83		91	79		60	5	11	14
11	27.0	28.7	247	16 0													
12	28 2	30 4	247	17 9	146		18.2	135	130		93	89		60	4	9	17

[1] B = before thinning, A = after thinning, T = thinnings

出典

Jacobs, M R　Eucalyptus for planting. Species monograph p 394　FAO Rome 1979

樹種：MYRTACEAE(フトモモ科)
Eucalyptus deglupta (カメレレ)
国　：フィリピン

データ採取地の立地環境

Locality:	Surigao del Sur (Mindanao)
Altitude:	20 m
Rainfall	3 500 mm
Driest month:	more than 100 mm precipitation
Data source:	temporary sample plots
Number of plots:	135
Method:	point sampling

成長・収穫に関する表，図，式など

(a) General site index equation:

$$H = -18.176946 + 50.47292 \log A \qquad r^2 = 0.93789$$

where: H = mean total height of 5 dominant and co-dominant trees in the plot
A = stand age

(b) Yield prediction function:

$$\log (V + 1) = 3.538342 - 14.021407 \times \frac{1}{A} + 0.2314196 \times \frac{S}{A} \qquad r^2 = 0.882$$

where: V = volume in m^3 per ha measured up to 10 cm diameter top
S = site index in m
A = stand age (only 3 to 6 years old plantations studied).

MAI (m^3/ha) by site index

Age (years) \ Site index	18	20	22	24
5	7.2	9.0	11.2	13.8
6	13.0	15.5	18.5	22.2
7	19.1	22.3	26.0	30.3
8	25.1	28.8	32.9	37.6
9	30.6	34.6	39.0	43.8
10	35.6	39.6	44.1	49.1
11	39.8	43.9	48.4	53.6
12	43.3	47.2	51.8	56.6

Remarks: Site index has been calculated for the reference age of 6 years. Ninety eight percent of the sample plots have a site index of 18 to 24 and the most common is 20. No thinning has been carried out. Stand density of 625 stems/ha was uniform in all the plots.

出典

(2) Tomboc, C.C. Growth, yield and economic rotation of Bagras (Eucalyptus deglupta) pulp timber in PICOP plantations (Mindanao). Part 2 Yield prediction model. Sylvatrop. Philipp.For.Res.J. 2(2).

ダイジェストデータ　Pandrey, D　Growth and yield of plantation species in the tropics, FAO　1983　所収

樹種：MYRTACEAE(フトモモ科)
Eucalyptus deglupta (カメレレ)
図 ：フィジー
表4-6 の樹種は、マホガニー・*Swietenia macrophylla*（オオバマホガニー）、コーディア：*Cordia alliodora*（カナレッテ）、マエソプシス：*Maesopsis eminii*（ムシジ）、カダンバ：*Anthocephalus chinensis*（カランパヤン）、カウプラ：*Endospermum macrophyllum*（カウブラ）、デグラプタ：*E. deglupta*（カメレレ）

データ採取地の立地環境

(1) 樹高による地位の検討

同一樹種で同林齢の樹高成長の良否は地位の良否を現わす指標とされてい

表４－６　６樹種の造林推定面積

樹　　種	歩合(%)	造林推定面積(ha)
マホガニー	14	1,800
コーディア マエソプシス	27	3,500
カダンバ	2	300
カウプラ	1	100
デグラプタ	56	7,300
計	100	13,000

る。そこで、図４－６に示すようにdegluptaの郷土で、Mollic Andosolsの良好な土地に造成されたP.N.のN.B.島ケラバノトの成績（図４－６の●印で示す）とFijiのNukurua地区の成績（図４－６の◎印て示す）を比較すると、高次の比較で一般的に前者は後者より著しく良好であると判断される。

なお、ケラバノトの調査はP.N.G.の林務局で行われたもので、測定方法が示されていないので詳細な評価はできないが、ＪＯＡＡ（坂口・松田・渡辺）によって０１haについて調査した成績（図４－６の⊕で示す）と比べてやや良すぎるかと思われるが、ＪＯＡＡの成績と比べてもNukurua地区はかなり劣るようてある。

また、Nukurua地区の成績はＪＩＣＡ（山谷ら）によって３－１６年生の実測値から回帰曲線によって修正した値によるものてある。これをNavua川流域についてN.Z.のGroomeらが記録した成績（図４－６の×印て示す）は、資料が少なくかつバラつきが甚しいが、概括的にみてNukurua地区よりやや

良好のようにうかがわれる。これはNukurua地区の土壌の２７型土壌に比べて、Navua地域の土壌が８３型土壌の多いことに起因するものであろう。

ここで、NukuruaとNavuaの成績をfree hand curveによって比較すると１５年生でNukurua　３０m、Navuaで３５m（Nukuruaの約１７％増）となる。

成長・収穫に関する表，図，式など

(2)　林齢とha当たり材積の検討

林齢に対する材積の関係は、図４－６に示すようにP.N.G.の成績はNukurua地区に比べて抜群の良好な成績を示している。またNukurua地区の著しく材積成長の低いのと、Navua地区のバラツキの著しいのは、一つにFijiで行われている列状植栽においてha当たり植栽本数の著しく少ないことに起因するものと思われるので、このことに関しては後述することとする。

現在ではNukuruaでは１５年生でha当たり約２００m^3（詳しくは１５年生で１９１m^3、１６年生で２０６m^3）が期待されるが、Navuaでは１３年生頃に２００m^3が期待されると読みとれる。

(3)　林齢と平均成長量の検討

林齢と平均成長量は、図４－７に示すとおりである。尚これはha当たり材積から算出されるので、当然同一傾向を示すものである。Nukuruaの資料では１７～２０年生で平均成長量最大（約１３m^3／ha）に達するようである。

さて、Nukuruaでは１３年生で１２２m^3、１５年生で１２７m^3であるが、前述(2)の材積からはNavuaでは１３年生頃に１３m^3に達するかと読みとれる。

図４－６　Eucalyptus deglupta の林齢と樹高

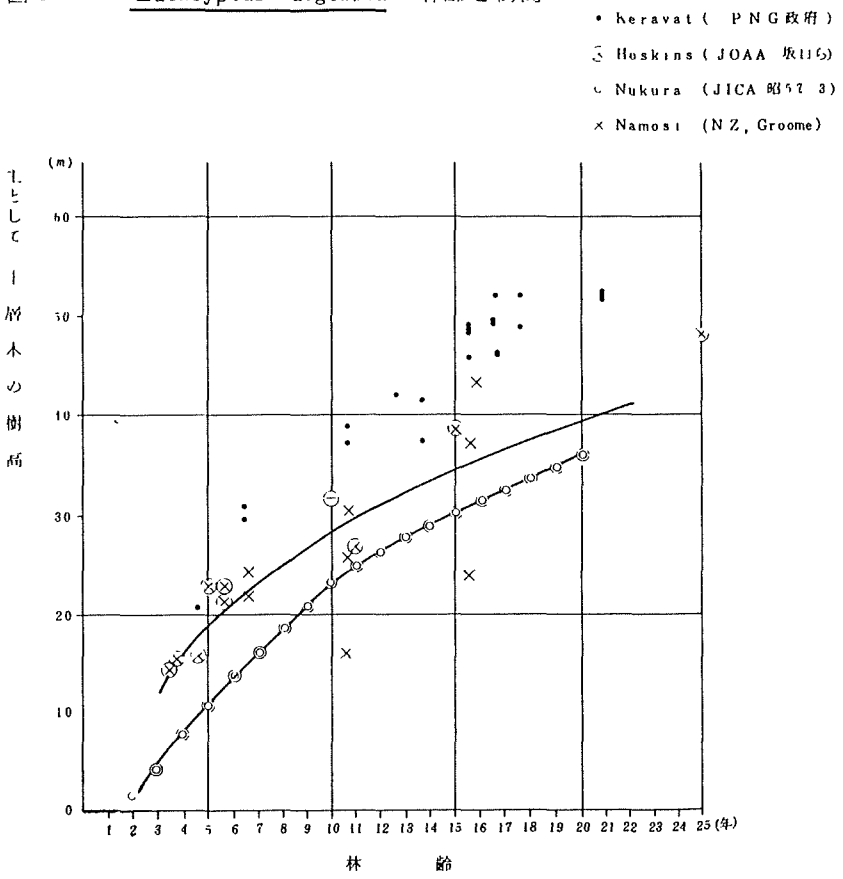


図４－７　Eucalyptus deglupta の林齢と ha 当たり材積

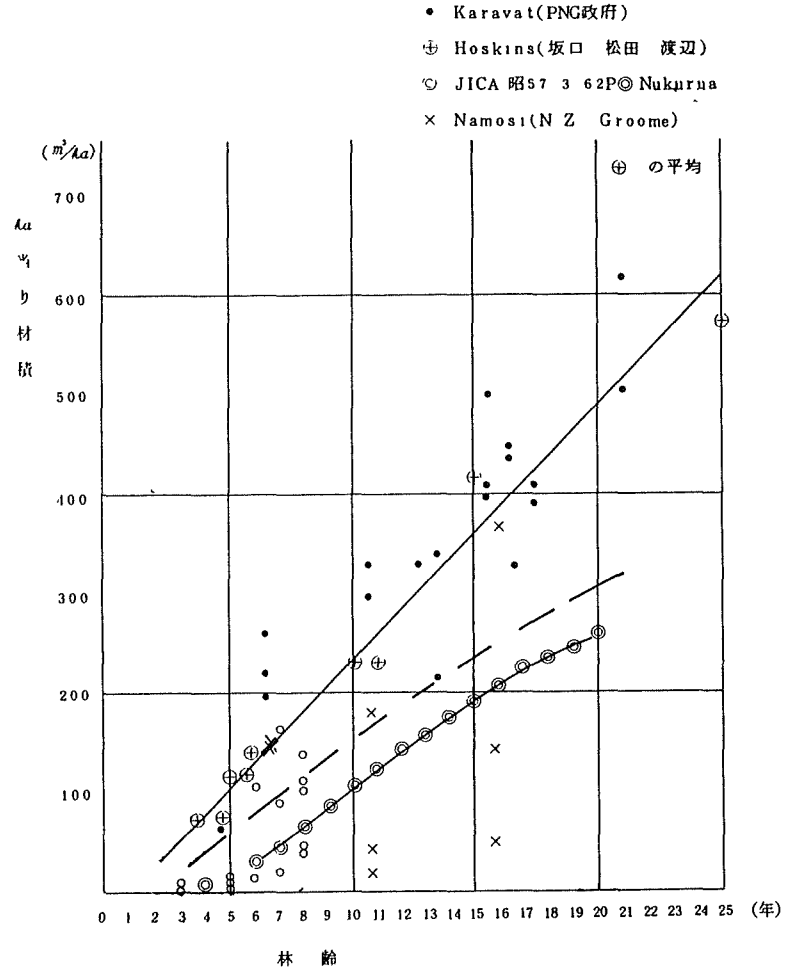
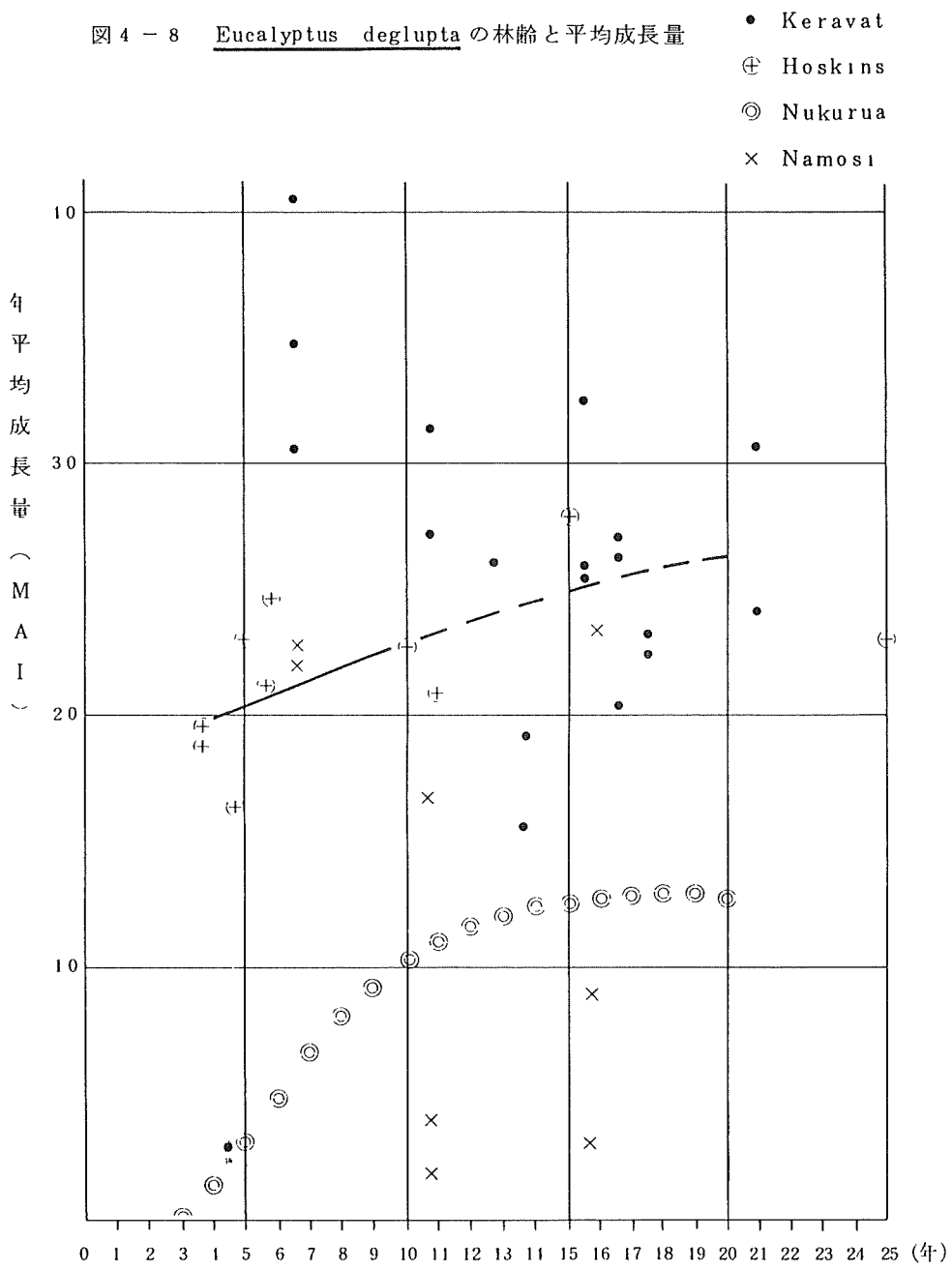


図４－８　Eucalyptus deglupta の林齢と平均成長量



出典

南方造林協会：フィジー国ビチレブ島東南部の林業開発促進に関する調査報告書、南方造林、No．27、（1983）

樹種：MYRTACEAE（フトモモ科）
Eucalyptus deglupta（カメレレ）
国：パプアニューギニア

パプアニューギニア

ニューブリテン島

データ採取地の立地環境

調査地と調査の概要　N.B 島のカメレレ人工造林の発祥は，第二次世界大戦中に日本の旧海軍省が同島におけるマラリア病に悩まされ，その加源を媒介する蚊の発生を防止するため該地域の湿地帯をカメレレの造林によって乾燥化することと，あわせて地域住民の福祉を向上する目的で1943年以降旧海軍省熱帯衛生研究所によってカメレレの養苗を開始したことに起因している。この企画は曼輪満大，向井田重助らによって鋭意進められ[20]，山行苗が得られるまでの育苗に成功したが，その時点で終戦を迎えることになった。おそらく，これが影響をうけてPNG政府はラバウルの近くのケラバット国有林で1948年（終戦後3年目）にカメレレの人工造林をいち早く開始した。この当初の人工林は1983年11月現在で35年生に達しており，おそらく世界で最も古い林分の歴史をもつものである。それ以来，ケラバット営林署のケラバット，オーノンバイ両国有林，タ、営林署のヒサ，タバツ・リカウ（面積不詳）両国有林に，1983年末で875 haの人工林を造成した。一方，北岸中央部に位置するフルマに所在するステッティンバイ・ラノハー社（SBLC）らは，その南方に展開する平坦ないし波状丘陵地のオスキノス林区において1976年以来試験造林を行い，1983年末で1,054 haに達している。なお，韓国も西NB州で造林を進めているが詳細な資料は入手していない。

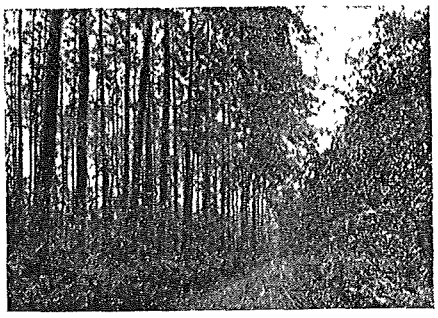


写真-1　ケラバットのカメレレ人工林
（25年生，4.6×4.6 m 植栽）

筆者らは，上述の既造林地に1981年11～12月と1983年10～11月の2回にわたり標準地を設定し，立木調査を行った。標準地面積は，1981年の設定は等高線に沿って一辺40 m，それに直角の斜面上に一辺25 mの長方形，すなわち0.1 ha，1983年の設定は同一手段で，調査期間の制約から25 m×20 m＝0.05 haをそれぞれ原則とした。立木調査は，胸高直径は地上1.2 mで測定し，2 cm括約とし，樹高は比較的低いものは8 mの測竿によって毎木調査，比較的高いものは測高器によって標準木を実測し，その周辺木はそれとの比較目測により，何れも1 m括約とした。標準地数は3.8年生から25年生にわたって26カ所を設定した。これによって得られた成果の概要は下記のとおりである。

成長・収穫に関する表，図，式など

成長経過　林齢に対する樹高，胸高直径，材積の各成長は，標準地の数が少ないので回帰曲線式を求めることができないため，各測定値を方眼紙上にプロットし，フリーハンドによる作図によって各成長曲線を求めた。ただし，15年生以上の林分は樹型級区分を行わなかったが，劣勢木がほとんどなかったため全木と上層木は同じ値とした。その結果は表-5に示すとおりである。

さて，育種効果を考慮しての成長推定は，詳記しないと誤解をまねくおそれがあるが紙面の制約があるので，前述のように約6年生の育種効果で伐期の数値を推定することは危険があるので育種の効果は大幅に内輪にとどめた。ただし，胸径は無間伐林

分てえられたものてあるから，間伐と育種の相乗効果を考慮にいれた。それらを踏まえての成長予想を暫定試案としたものが表-6てある。

表-5 林齢別成長経過

林齢（年）		5	10	15	20	25
全木	平均樹高（m）	18	28	39	44	49
	平均胸径（cm）	16	26	35	42	49
	平均材積（m^3/ha）	120	230	420	490	580
	年平均成長量（m^3/ha）	24	23	28	25	23
上層木	平均樹高（m）	21	32	39	44	49
	平均胸径（cm）	20	29	35	42	49

表6 育種効果を含めた成長予想

林齢（年）	5	10	15	20	25	備考
樹高 10%増（m）	23	35	43	48	54	上層木に適用
胸径 23%増（cm）	20	32	43	52	60	全木に適用
材積 40%増（m^3/ha）	170	320	590	690	810	同上
年平均成長量（m^3/ha）	34	32	39	35	32	同上

出典

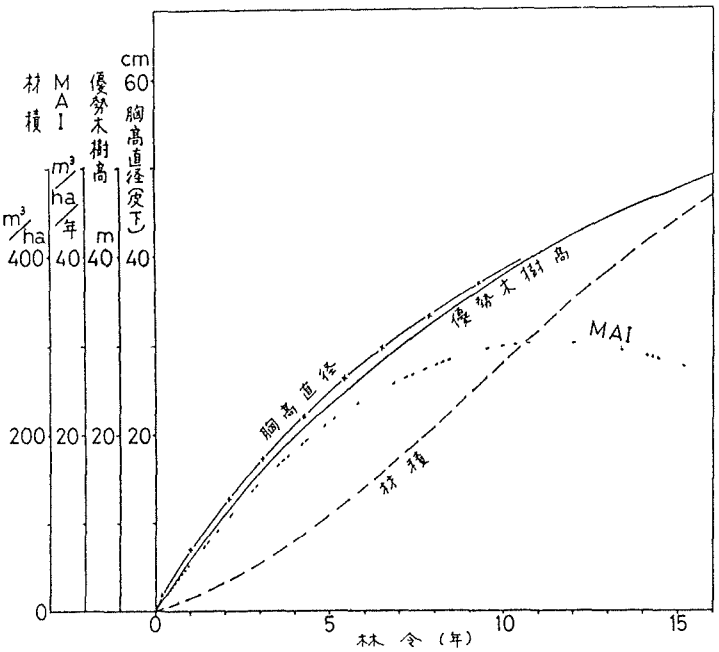
坂口勝美(1984)．カメレレ人工造林の現状．熱帯林業 No 1 : 25-35.

樹種：MYRTACEAE（フトモモ科）
Eucalyptus deglupta　（カメレレ）
国　：パプアニューギニア

データ採取地の立地環境

パプアニューギニア，ニューブリテン，ケラバット

成長・収穫に関する表，図，式など



図－1　パプアニューギニア（ニューブリテン，ケラバット）における生長事例── 植栽間隔 4.5m×4.5m

出典

浅川澄彦(1982)．熱帯樹種の造林特性（VI）．熱帯林業 No.66 : 42-44.

樹種：MYRTACEAE(フトモモ科)
Eucalyptus deglupta (カメレレ)
国　：パプアニューギニア

データ採取地の立地環境

Eucalyptus deglupta Bl.

Synonym: E. naudiniana F. muell.

Family: Myrtaceae

NEW BRITAIN (1)

Locality: Keravat

成長・収穫に関する表，図，式など

Yield table

Age (years)	MAI (m^3/ha)
5	18.2
10	17.3
15	20.5
20	26.0

Remarks: No other details.

出典

(1) Jacobs, M.R. Eucalyptus for planting. Species monograph p.394. FAO Rome 1979

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MYRTACEAE(フトモモ科)
Eucalyptus deglupta (カメレレ)
樹　：パプアニューギニア

成長・収穫に関する表，図，式など

PAPUA NEW GUINEA (1)

Yield data: Age: 12 - 15 years
MAI: 31.0 m^3/ha

出典

(1) Horne, J.E.M. Growth rate in the timber plantation of western Nigeria. 1962 Nigerian Forestry Information Bulletin (N.S.) No.12.

ダイジェストデータ Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MYRTACEAE(フトモモ科)
Eucalyptus globulus (ササンゴルーガム)
国　：インド

データ採取地の立地環境

INDIA (3)

Locality: Nilgiri Hills
Altitude: 1 800 - 2 250 m
Rainfall: 1 300 - 1 400 mm
Data source: No indication

成長・収穫に関する表，図，式など

MAI (m^3/ha) by quality class and age

Age (years) \ Quality class	I	II	III
5	31.1	22.7	14.4
6	32.3	23.5	14.8
7	32.5	23.7	15.0
8	32.8	23.9	15.1
9	32.9	23.9	15.1
10	32.9	23.9	15.1
11	32.7	23.9	15.0
12	32.2	23.6	14.8
13	31.6	23.4	14.8
14	31.0	23.0	14.6
15	30.3	22.5	14.4
16	29.7	22.0	14.1

Remarks: Volume is measured over bark, limit not specified. Original data are in stacked volume and coversion factor 0.625 has been used to convert into solid volume. Dominant heights, corresponding to quality classes, are I to 29.6 m; II to 23.8 m; and III to 17, at reference age of nine years. Crop not thinned.

出典

(3) Jaydev, J. 1970 Working plan of Nilgiris Division (1954-64), Growth and yield statistics of common Indian timber species. Vol. II.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MYRTACEAE(フトモモ科)
Eucalyptus globulus (サザンブルーガム)
国　：インド

データ採取地の立地環境

Area India (Nilgiri Hills)
Volume Overbark volume, derived from stacked volume of firewood by use of reducing factor 0.625

成長・収穫に関する表，図，式など

Quality class I

Age *(years)*	h_{dom} *(m)*	d_{dom} *(cm)*	V *(m^3)*	MAI *(m^3)*
5	21 9	21 0	155 3	31 1
6			193 5	32 3
7	26.2	25 9	227 4	32 5
8			262 4	32 8
9	29 6	29 9	296 3	32 9
10			329 1	32.9
11	32.9	33.1	359 7	32.7
12			385 9	32.2
13	35 4	37 2	411 1	31.6
14			434.1	31 0
15	37.8	39 6	454 8	30 3
16			474 5	29.7
17			494 2	29 1
18			512 8	28.5
19			530 3	27 9
20			547 8	27.4

Quality class II

5	16.2	15 4	113 7	22.7
6			141 0	23.5
7	20 1	19 4	166 2	23.7
8			191 3	23 9
9	23.8	23 5	215 4	23.9
10			239 4	23.9
11	26 5	26 7	262 4	23 9
12			283 2	23.6
13	29 0	29 9	303 9	23 4
14			321 4	23.0
15	31 1	32 3	336 8	22.5
16			352 1	22 0
17			367 4	21.6
18			382 6	21.3
19			394 7	20 8
20			410 0	20 5

Quality class III

Age (years)	h_{dom} (m)	d_{dom} (cm)	V (m^3)	MAI (m^3)
5	11 3	12 1	72 1	14 4
6			88 6	14 8
7	14 6	15 4	104 9	15 0
8			120 3	15 0
9	17 7	18 6	135 6	15 1
10			150.9	15 1
11	20 1	21 8	166 2	15 1
12			180 4	15 0
13	22 3	23 5	192 4	14 8
14			207 8	14 8
15	24 4	25 9	218 7	14 6
16			229 6	14 4
17			240 2	14 1
18			251 4	14 0
19			261 3	13.8
20			272 3	13 6

出典

Jacobs, M R Eucalyptus for planting Species monograph p 394 FAO Rome 1979

樹種：MYRTACEAE（フトモモ科）
Eucalyptus globulus　（ユーカリ・グロブラス）
国　：ポルトガル

データ採取地の立地環境

Area　Portugal (north of River Tagus)
Stocking　N = 1 100/ha
Volume　Stem volume overbark to tip, including stump

成長・収穫に関する表，図，式など

Quality class I

h_{dom} age 10 = 27 m — 1 100 trees/ha

Age (years)	h_{dom} (m)	$\bar{d}$ (cm)	V (m^3)	G (m^2)	MAI (m^3)
2	10	7 6	20	4 9	10 0
3	13	10 4	50	9 3	16 7
4	16	13 1	100	14 8	25 0
5	18	14 6	140	18 3	28 0
6	20	15 8	185	21 6	30 8
7	22	16 8	230	24 3	32 9
8	24	17 7	280	27 1	35 0
9	25 6	18 5	325	29 4	36 1
10	27 0	19 4	380	32 5	38 0
11	28 6	20 0	430	34 6	39 1
12	30 0	20 6	480	36 8	40 0
13	31 0	21 0	512	37 9	39 4
14	32 0	21 3	545	39 1	38 9
15	32 6	21 5	566	39 8	37 7
16	33 2	21.6	586	40 4	36 6
17	33 6	21 7	600	40 9	35 3
18	34 0	21 8	610	41 1	33 9
19	34 4	21 9	620	41 3	32 6
20	34 8	21.9	630	41 4	31 5

Quality class II

h_{dom} age 10 = 23 m — 1 100 trees/ha

2	8 6	6 4	12	3 5	6 0
3	11 0	8 5	28	6 2	9 3
4	13 4	10 6	54	9 7	13 5
5	15 4	12 5	88	13 5	17 6
6	17 0	13 9	120	16 7	20 0
7	18 8	15 2	160	20 0	22 9
8	20 4	16 0	194	22 2	24 3
9	21 6	16 6	220	23 7	24 4
10	23 0	17 3	255	25 8	25 5
11	24 2	17 8	286	27 4	26 0
12	25 4	18 4	322	29 3	26 3
13	26 6	19 1	364	31 6	28 0
14	27 6	19 7	400	33 4	28 6
15	28 2	19.9	418	34 2	27 9
16	28 8	20 2	440	35 2	27 5
17	29 2	20 3	454	35 8	26 7
18	29 6	20 5	465	36 1	25 8
19	30 0	20 6	480	36 8	25 3
20	30 4	20 7	492	37 2	24 6

Quality class III

h_{dom} age 10 = 19 m — 1 100 trees/ha

Age (years)	h_{dom} (m)	$\bar{d}$ (cm)	V (m^3)	G (m^2)	MAI (m^3)
2	6 4	5 6	6	2.7	3 0
3	9 0	6 7	14	3 9	4 7
4	11 0	8 5	28	6 2	7 0
5	12 8	10 0	46	8 7	9 2
6	14 2	11.3	66	11 1	11 0
7	15 6	12 6	90	13 7	12 9
8	17 0	13 9	120	16 7	15 0
9	18 0	14 6	140	18 3	15 6
10	19 0	15 1	160	19 8	16 0
11	20.0	15.8	185	21.6	16 8
12	21.0	16 4	210	23 3	17 5
13	22 0	16 8	230	24 3	17 7
14	23 0	17.1	250	25 3	17 9
15	23.6	17 5	270	26.6	18 0
16	24 2	17 9	288	27.6	18 0
17	24 8	18 1	304	28.4	17 9
18	25.2	18 4	318	29 2	17 6
19	25.6	18 6	330	29 8	17 4
20	26 0	18.7	340	30 2	17 0

Quality class IV

h_{dom} age 10 = 15 m — 1 100 trees/ha

2	4 6	5 4	4	2.5	2 0
3	7 0	5 9	8	3 0	2 7
4	8 6	6 4	12	3.5	3 0
5	10.0	7 6	20	4 9	4 0
6	11 2	8.7	30	6 5	5 0
7	12 4	9 5	40	7 8	5 7
8	13.4	10 6	54	9.7	6 7
9	14 4	11 6	70	11 6	7 8
10	15 0	12 1	80	12 7	8 0
11	16 0	13 1	100	14 8	9 1
12	17 0	13 9	120	16 7	10 0
13	17 6	14 2	130	17.4	10 0
14	18 3	14 7	145	18 6	10 4
15	18 9	15 2	160	19 9	10 7
16	19 4	15 6	173	20 9	10 8
17	20 0	15 8	185	21.6	10 9
18	20 4	16 1	195	22 3	10 8
19	20 8	16 3	205	23 0	10 8
20	21.2	16 5	214	23 5	10 7

Quality class V

h_{dom} age 10 = 11 m — 1 100 trees/ha

Age (years)	h_{dom} (m)	$\bar{d}$ (cm)	V (m^3)	G (m^2)	MAI (m^3)
2	3 0	5 1	2	2 2	1 0
3	5 0	5 7	5	2 8	1 7
4	6 4	6 2	8	3 3	2 0
5	7 4	6 3	9	3 5	1 0
6	8 4	6 5	12	3 6	2 0
7	9 2	7 1	16	4 3	2 3
8	9 9	7 4	19	4 7	2 4
9	10 6	8 0	24	5 6	2 7
10	11 0	8 5	28	6 2	2 8
11	11 6	8 8	32	6 7	2 9
12	12 2	9 6	40	7 9	3 3
13	12 8	10 0	46	8 7	3.5
14	13 4	10 6	54	9 7	3 9
15	14 0	11 1	62	10 6	4.1
16	14 5	11 5	70	11 5	4 4
17	14 8	12 0	77	12 4	4 6
18	15 2	12 5	83	13 0	4 6
19	15 6	12 5	89	13 6	4 7
20	16 0	12 8	95	14 1	4 8

Area Portugal (south of River Tagus)
Stocking N = 1 100/ha
Volume Stem volume overbark to tip, including stump

Age (years)	Quality class I (h_{dom} age 10 = 18 m)		Quality class II (h_{dom} age 10 = 14 m)		Quality class III (h_{dom} age 10 = 10 m)	
	V (m^3)	MAI (m^3)	V (m^3)	MAI (m^3)	V (m^3)	MAI (m^3)
4	34	8 5	18	4 5	6	1 5
6	83	13 8	44	7 3	19	3 2
8	148	18 5	83	10 4	36	4.5
10	202	20 2	123	12 3	54	5 4
12	246	20.5	149	12 4	72	6 0

出典

Jacobs, M R Eucalyptus for planting Species monograph p 394 FAO Rome 1979

樹種：MYRTACEAE(フトモモ科)

Eucalyptus globulus (ユーカリ)

国　：スペイン

データ採取地の立地環境

Locality:	Province of Santander, Pontevedra, Oviedo and La Coruña
Altitude:	0 - 100 m
Rainfall:	1 200 mm
Data source:	permanent sample plots
Number of plots:	48
Size of plots:	625 m^2
Stand density:	2 400 - 3 000 stems/ha

MAI (m^3/ha) by age and quality class

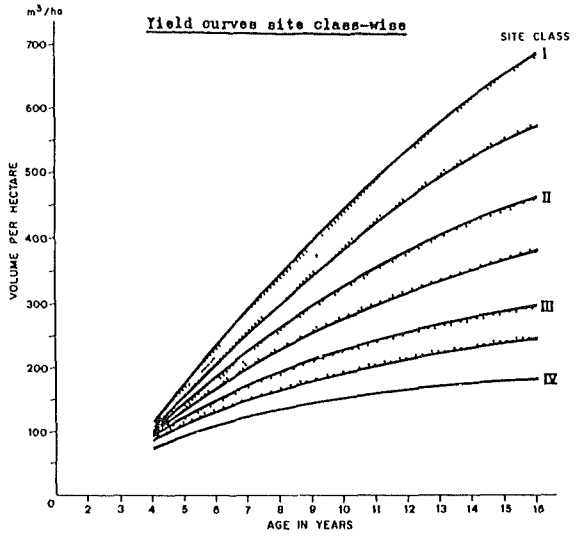
成長・収穫に関する表，図，式など

Age (years) \ Quality class	I	II	III	IV
4	27.5	26.0	23.3	18.8
6	37.7	31.7	25.3	18.3
8	42.0	32.8	24.4	16.8
10	44.3	32.9	23.2	15.2
12	44.8	31.7	21.6	13.9
14	44.1	30.2	20.4	12.6
16	42.9	28.9	18.8	11.7

Remarks: Volume measured over bark from ground level to tip and dominant heights corresponding to quality classes at 10 years reference age are: I to 22 m; II to 19 m; III to 16 m; and IV to 13 m.

Eucalyptus globulus - Spain (1)

Yield curves site class-wise



出典

(1) Carpenter, A.P. 1966　La producción de las masas de E. globulus en el norte de España. Anales I.F.I.E. Spain.

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO　1983　所収

樹種：MYRTACEAE（フトモモ科）
Eucalyptus globulus（サザンブルーガム）
国：スペイン

データ採取地の立地環境

Species *E globulus* var. *globulus* *Reference*: Pita Carpenter, 1966
Area Northern Spain (provinces of Santander, Pontevedra, Oviedo and La Coruña) *Number of sample plots* 48
Stocking N varies from 3 000/ha (age 4, QC IV) to 2 400/ha (age 16, QC I)
Volume Stem volume overbark from ground level to tip

成長・収穫に関する表，図，式など

Quality class I

Age (years)	$\bar{h}$ (m)	h_{dom} (m)	N	$\bar{d}$ (cm)	G (m^2)	V (m^3)	f	MAI (m^3)	CAI (m^3)
4	11 1	15 5	2 700	9 2	17 7	110	0 560	27 5	
6	15 8	20 9	2 651	11.4	27 3	226	0 524	37 7	58 0
8	19 2	24.7	2 604	12 9	34 1	336	0 513	42 0	55 0
10	22.0	27.9	2 557	14 0	39 6	443	0 508	44.3	53.5
12	24 2	30.4	2 511	14 9	43 9	537	0.505	44 8	47 0
14	25 9	32 3	2 466	15 6	47 3	617	0 504	44 1	40 0
16	27 3	33 9	2 421	16 2	50 0	687	0 503	42 9	35 0

Quality class II

4	10 8	15 2	2 800	8 8	17 1	104	0 563	26 0	
6	14 5	19.4	2 750	10 7	24 7	190	0 531	31 7	43.0
8	17 0	22 2	2 700	11 9	29 7	262	0 519	32 8	36 0
10	19 0	24 5	2 652	12 7	33 7	329	0 514	32 9	33 5
12	20 4	26 1	2 604	13 3	36 4	380	0 512	31 7	25 5
14	21 5	27 3	2 557	13 8	38.6	423	0 510	30 2	21.5
16	22 5	28 5	2 511	14 3	40 6	463	0 507	28 9	20.0

Quality class III

4	10 2	14 5	2 900	8 3	15 8	93	0 577	23 3	
6	13 0	17 7	2 848	9 8	21 6	152	0 541	25 3	29 5
8	14 7	19 6	2 797	10 7	25 1	195	0 528	24 4	21 5
10	16 0	21.1	2 746	11 3	27.7	232	0 523	23 2	18 5
12	16 9	22 1	2 697	11 8	29 5	259	0 520	21 6	13 5
14	17 7	23 0	2 648	12 2	31 1	286	0 518	20 4	13 0
16	18 2	23 6	2 601	12 5	32 1	301	0 515	18 8	8 0

Quality class IV

4	9 2	13 4	3 000	7.6	13 7	75	0 595	18 8	
6	11 1	15 5	2 946	8 8	17.7	110	0 560	18 3	17 5
8	12 2	16 8	2 893	9 4	20 0	134	0 549	16 8	12 0
10	13 0	17.7	2 841	9 9	21 6	152	0 541	15 2	9 0
12	13 6	18 4	2 790	10 2	22 9	167	0 536	13 9	7 5
14	14 0	18 8	2 740	10 5	23 7	177	0 533	12 6	5.0
16	14 4	19.3	2 690	10 8	24 5	187	0 530	11 7	5 0

Reference Data made available by courtesy of Servicio de Producción Forestal de la Dirección de la Producción Agraria del Ministerio de Agricultura, Madrid
Area Southwest Spain, sandy soils
Stocking N varies from about 600/ha in QC I to 400/ha in QC IV
Volume Stem volume overbark

Quality class I

Age (years)	h_g (m)	N	d_g (cm)	G (m^2)	V (m^3)	MAI (m^3)	CAI (m^3)
3	5 2	604	6 1	1 8	4 0	1 3	—
6	11 3	604	11 0	5 7	28 7	4 8	8 2
9	16 0	604	14 7	10 3	73 8	8 2	15 0
12	19 5	594	17 5	14 3	125 1	10 4	17.1
15	22 2	575	19 8	17 7	176 3	11 8	17 1

Quality class II

3	3 5	549	5 0	1 1	1 5	0 5	—
6	8 6	549	9.1	3 6	13 7	2 3	4 1
9	13 0	549	12 6	6 8	39 5	4 4	8 6
12	16 5	549	15 4	10 2	75 4	6 3	12.0
15	19 4	542	17 7	13 3	115 7	7 7	13 4

Quality class III

3	2 6	490	4 5	0 8	0 7	0 2	—
6	6 5	490	7.6	2 2	6 2	1 0	1 8
9	10 0	490	10.4	4 2	18 6	2 1	4.1
12	12 9	490	12.7	6 2	35 7	3 0	5 7
15	15 4	487	14 7	8 3	57 2	3 8	7 2

Quality class IV

3	1.9	415	4 4	0 6	0 3	0 1	—
6	4 6	415	6 6	1 4	2 7	0 5	0 8
9	7 0	415	8 5	2 4	7 3	0 8	1 5
12	8 9	415	10 0	3 3	13 0	1 1	1 9
15	10 4	407	11 3	4 1	18 9	1 3	2 0

Reference Data made available by courtesy of Servicio de Producción Forestal de la Dirección de la Producción Agraria del Ministerio de Agricultura, Madrid
Area Southwest Spain, soils derived from slates and shales
Stocking N varies from about 600/ha (age 3, QC I) to about 400/ha (age 15, QC V)
Volume Stem volume overbark

Quality class I

Age (years)	h_g (m)	N	d_g (cm)	G (m^2)	V (m^3)	MAI (m^3)	CAI (m^3)
3	5 8	597	5 5	1 4	3 9	1 3	—
6	13 5	597	13 0	7 9	45.7	7 6	13 9
9	20 0	597	19 4	17 1	145 6	16.2	33 3
12	25 1	597	24 4	26 0	277 3	23 1	43 9
15	29 1	534	28 4	33 8	417 8	27 9	46 8

Quality class II

3	4 5	559	4 3	0 8	2 0	0 6	—
6	11 1	559	10 8	5 1	24 5	4.1	7 5
9	17 0	546	16 6	11 8	85 6	9 5	20 4
12	21 8	534	21 3	19 0	176 2	14.7	30 2
15	25 8	510	25 2	25 4	278 5	18 6	34 1

Quality class III

3	3 7	522	3 7	0 6	1 4	1 4	—
6	9 2	522	9 0	3 3	13 3	2 2	4 0
9	14 0	511	13 7	7 5	45 0	5 0	10 6
12	17 9	493	17 6	12 0	91 6	7.6	15 5
15	21 1	482	20 8	16 4	147 3	9 8	18 6

Quality class IV

3	2 8	474	3 0	0 3	0 8	0 3	—
6	7 0	474	7 0	1 8	5 8	1 0	1.7
9	11 0	470	10 9	4 4	21 0	2 3	5 1
12	14 3	458	14 2	7 3	44 7	3 7	7 9
15	17 1	444	17 0	10 1	73 7	4 9	9 7

Quality class V

3	2 2	432	2 5	0 2	0 6	0 2	—
6	5 3	432	5 5	1 0	2 7	0 5	0 7
9	8 0	420	8 2	2.2	7 9	0.9	1 7
12	10 1	405	10 4	3 4	15 0	1.3	2 4
15	11 8	390	12 1	4 5	23 0	1.5	2 7

出典

Jacobs, M R Eucalyptus for planting Species monograph p 394 FAO Rome 1979

樹種：MYRTACEAE(フトモモ科)
Eucalyptus grandis (ユーカリ)
国　インド

データ採取地の立地環境

Locality:	Nilgiri & Munnar
Altitude:	800 to 1 800 m
Rainfall:	1 500 mm
Data source:	permanent sample plots
Number of plots:	15
Number of measurements:	38 (some plots measured twice, some three times)
Measurement specification:	up to 5 cm top diameter overbark

成長・収穫に関する表，図，式など

MAI (m^3/ha) by stocking density and site quality

Site quality	I		II		III	
Age (years) \ stems/ha	1000	1600	1000	1600	1000	1600
	.. .. m^3/ha					
5	23.0	27.5	10.6	13.6	2.6	4.2
6	28.2	33.2	14.0	17.1	4.5	6.2
7	32.3	37.7	16.8	20.1	5.9	7.6
8	35.1	40.8	18.7	22.1	7.1	8.9
9	36.4	42.2	19.8	23.3	8.0	9.8
10	36.1	41.8	20.5	23.9	8.7	
11	35.0	40.6	20.6	24.0	9.1	10.5
12	33.7	39.0	20.11	23.5	9.2	10.6

Remarks: No thinning was carried out. Age class covered is 4 to 5 years to 13.5 years. Site qualities are represented by top height measurements in metres and correspond I to 29.8; II to 21.9; III to 14.2 at reference age 8 years.

出典

(5) Pande, G.C. 1978 Yield tables for Eucalyptus grandis. Indian Forest Records (N.S.) Vol. 2 No. 1.

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO　1983　所収

樹種：MYRTACEAE(フトモモ科)
Eucalyptus grandis (ユーカリ)
国　：ケニア

データ採取地の立地環境

Locality:	Mugura (Kenya)
Altitude:	2 070 m
Rainfall:	950 mm
Soil:	deep fertile lateritic soil
Data source:	permanent experimental plots
Number of plots:	6
Size of plots:	2 020 m^2

成長・収穫に関する表，図，式など

Rotations age in years (crop origin)	5 (seedling org.)	5 (I coppice)	5 (II coppice)	7 (III coppice)
	..... m^3/ha			
MAI (m^3/ha)	18.8	38.7	26.5	16.3

出典

(3) Kayumi, S.Y.S. 1983 Four rotations of a Eucalyptus fuelwood trial. Commonwealth Forestry Review 62(1).

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO　1983　所収

樹種：MYRTACEAE（フトモモ科）
Eucalyptus grandis（ユーカリグランディス）
国　：南アフリカ

データ採取地の立地環境

Species *E grandis* *Reference* van Laar, 1961, courtesy of the author
Area South Africa (Transvaal) *Number of sample plots* 242
Stocking N = 1 100/ha
Volume Stem volume underbark to 7 5 cm top, including stump
Remarks Yield table assumes 100 percent stocking For planning purposes the author recommends reducing yields by 10 percent to allow for less than full stocking. Site Index I (the best) does not occur in the Transvaal Over the whole area SI IV was considered as occupying approximately 80 percent of the area and SI VI 20 percent. Original published tables have been converted from imperial to metric

成長・収穫に関する表，図，式など

Volume yield table for unthinned stands in the Transvaal

Site Index II

Age (years)	h_{dom} (m)	$\bar{h}$ (m)	$\bar{d}$ (cm)	G (m^2)	V_u (m^3)	CAI_u (m^3)	MAI_u (m^3)
3	19 1	16 9	11 9	11 7	57 4		19 1
4	23 3	20 8	14 3	17 0	112 7	55 3	28 1
5	27 1	24 3	16 1	21 6	172 1	59 5	34 4
6	30 6	27 5	17 4	25 4	236 5	64 4	39 4
7	33 7	30 2	18 5	28 8	299 5	63 0	42 9
8	36.3	32 6	19 2	31 0	356 1	56 7	44 5
9	38 7	34 8	19 8	33 1	409 3	53 2	45 5

Site Index III

3	16 9	15 1	11 4	10 7	44 1		14 7
4	20 7	18 5	13 5	15 1	85 4	41 3	21 3
5	24 1	21 6	15 1	19 1	131 9	46.5	26 4
6	27 2	24 4	16 4	22 5	180 9	49 0	30 2
7	30.0	26 9	17 4	25 3	229 9	49 0	32 8
8	32 3	29 0	18 2	27 7	276 7	46 9	34 6
9	34 4	30 9	18 8	29 8	320 5	43 7	35 6
10	36 0	32 3	19 4	31 5	360 3	39 9	36 0
11	37 8	34 0	19 8	33 0	395 0	34 6	35 9
12	39 0	35 1	20 1	34 1	424 7	29 7	35.4

Site Index IV

Age (years)	h_{dom} (m)	$\bar{h}$ (m)	$\bar{d}$ (cm)	G (m^2)	V_u (m^3)	CAI_u (m^3)	MAI_u (m^3)
3	14.8	13 1	10 7	9 4	32 2		10 7
4	18 1	16 1	12 5	13 0	60 9	28 7	15 3
5	21 1	18 8	14 1	16 5	97 3	36.4	19 3
6	23 8	21 3	15 3	19 7	135 7	38 5	22 6
7	26 2	23 5	16.4	22 4	173 5	37 8	24 8
8	28 3	25 4	17.2	24 7	209 2	35 7	26 2
9	30.1	27.0	17 8	26 6	242 8	33.6	27 0
10	31 7	28 4	18 3	28 2	273 6	30 8	27 4
11	32 9	29 6	18.7	29 3	301 6	28 0	27 4
12	34 1	30 7	19 1	30 5	326 8	25 2	27.2
13	35 1	31 5	19 3	31 4	349 9	23 1	26.9
14	36 0	32 3	19 6	32 2	371 5	21.7	26.5
15	36 9	33 2	19 7	32 8	390 4	18 9	26.0
16	37 5	33 7	19 9	33 3	406 5	16 1	25 4
17	38.4	34 5	20.0	33 7	420 5	14 0	24 8
18	39.0	35.1	20 1	34.1	432 4	11.9	24 0

Site Index V

3	12.7	11.2	10.2	8 6	23 8		7.9
4	15 5	13 8	11.7	11 3	42 0	18.2	10 5
5	18 1	16 1	13 0	14 1	66.1	24 1	13 3
6	20.4	18 2	14 1	16 6	93 1	26 9	15 5
7	22.5	20 1	15 1	19 0	121 0	28 0	17 3
8	24 3	21 7	15 9	21 1	148 0	26.9	18.5
9	25 8	23.1	16 6	23 0	173 2	25 2	19.2
10	27.1	24.2	17.1	24 6	196.3	23.1	19 6
11	28.2	25 3	17.6	26 0	217 3	21.0	19.7
12	29.3	26 2	18 0	27 2	236 8	19 6	19.7
13	30.1	27 0	18 3	28 3	254 7	17 8	19.6
14	30.9	27 8	18 6	29 1	271 1	16 4	19 4
15	31.6	28 4	18 8	29 9	286 2	15 0	19 1
16	32 2	28 9	19 0	30 4	300 2	14 0	18.8
17	32 9	29 5	19.2	30 9	313.1	12 9	18 4
18	33.5	30 1	19 3	31 3	325.0	11 9	18 1
19	33 8	30 4	19 4	31 7	336.2	11 2	17 7
20	34.4	30 9	19 5	32 0	346.4	10 1	17.4

Site Index VI

Age (years)	h_{dom} (m)	$\bar{h}$ (m)	$\bar{d}$ (cm)	G (m^2)	V_u (m^3)	CAI_u (m^3)	MAI_u (m^3)
3	10 6	9 3	9 5	7 4	15 4		5 1
4	13 0	11 4	10 7	9 4	28 0	12 6	7 0
5	15 1	13 4	11 7	11 4	43 0	15 0	8 6
6	17 0	15 1	12 6	13 3	59 8	16 8	9 9
7	18 7	16 6	13 4	15 0	77 3	17 5	11 1
8	20 2	18 0	14 1	16 7	95 2	17 8	11 9
9	21 5	19 2	14.8	18 3	112 7	17 5	12 5
10	22 6	20 2	15 3	19 7	129 1	16 4	12 9
11	23 5	21 0	15 8	21 0	144 5	15 4	13 2
12	24 4	21 8	16 3	22 1	159 2	14 7	13 3
13	25 1	22 5	16 6	23 1	172 5	13 3	13 3
14	25 8	23 1	16 9	24 1	185 1	12.6	13 2
15	26 3	23 6	17 2	24 9	196 3	11 2	13 1
16	26 9	24 0	17 5	25 6	206 4	10 1	12 9
17	27 4	24 5	17 7	26 2	215 5	9 1	12 7
18	27 8	24 9	17 9	26 7	223 9	8 4	12 5
19	28 2	25 3	18 0	27 2	231 6	7.7	12 2
20	28 7	25 7	18 1	27 5	238 6	7 0	12 0

Area South Africa (Transvaal)
Stocking Initial N = about 1 100/ha, heavily thinned at ages 3½, 5, 8 and 12 to final N = about 110/ha
Volume Stem volume underbark to 7 5 cm top, including stump
Remarks Original published tables have been converted from imperial to metric

Yield table for heavily thinned stands in the Transvaal

Site Index III

		Remaining stand						Thinnings				Total stand								
Age (years)	h_{dom} (m)	N	G (m^2)	$\bar{d}$ (cm)	$\bar{h}$ (m)	V_u (m^3)	S%	N	$\bar{d}$ (cm)	$\bar{h}$ (m)	V_u (m^3)	N	G (m^2)	$\bar{d}$ (cm)	$\bar{h}$ (m)	V_u (m^3)	S%	Sum of thinnings (m^3/ha)	Total production (m^3/ha)	Total vol of thinnings as per cent of total production
3½	18 8	638	9 78	14 2	17 2	52 9	21 0	487	10 2	13 7	12 2	1 125	13 13	12 4	16 8	65 1	15 9	12 2	65 1	18.7
5	24 1	356	9 09	18 3	23.3	72 2	22 0	282	14 0	21 0	27 7	638	13 22	16 5	22 7	99 9	16 4	39 9	112 1	35 6
8	32 3	183	10 63	27.3	30 2	115 0	22 9	173	24 1	28 7	80 4	356	18 76	25 9	29 6	195.4	16 4	120 3	235 2	54 0
12	39 0	114	12 97	38 1	36 9	166 9	24 2	69	33 0	35 7	73 9	183	18 94	36 3	36 3	240 8	19 0	194 2	361 0	53 8
Site Index IV																				
4	18 1	687	8 70	13.0	16 6	44 5	21.0	437	9 7	13 4	9 4	1 124	13.13	12 4	16.2	53 9	16 5	9 4	53 9	17 4
6	23 8	363	9 55	18.5	22.3	73 1	22 0	324	14.7	19 8	32 9	687	14 72	16 8	21 6	106 0	16 0	42 3	115 4	36 6
9	30.1	208	11.16	26.2	27 7	108 9	23.1	157	21.8	27.1	55 2	365	15 93	23.9	28 3	164 1	17 4	97 5	206 4	47 3
13	35 0	143	12 08	32.8	32 9	141 3	23 9	64	29 5	32.3	58.5	207	17.24	32.5	32 6	199.8	19 8	156 0	297 3	52 5
18	39 0	109	13.59	39.9	36.6	170 9	24 5	34	34 5	35.7	40 6	143	16 67	38 5	36 3	211 5	21 5	196 6	367 5	53 3

出典

Jacobs, M R Eucalyptus for planting Species monograph p 394 FAO Rome 1979

樹種：MYRTACEAE(フトモモ科)
Eucalyptus grandis (ローズガム)
国　：ウガンダ

データ採取地の立地環境

Locality:	distributed in different regions
Data source:	permanent sample plots
Measurement specification:	5 cm top diameter under bark
Stocking density:	1 680 stems/ha (fully stocked).

成長・収穫に関する表，図，式など

MAI (m^3/ha) by site index

Age (years) \ Site index	20	25	30	35	40
	.....		m^3/ha	.....	
5	20.6	25.0	35.2	44.1	52.2
6	18.7	24.1	33.8	43.3	52.4
7	17.0	23.3	32.6	42.3	52.4
8	16.0	22.7	31.7	41.6	52.0
9	15.1	22.1	30.9	40.7	51.4
10	14.5	21.5	30.1	40.0	50.8
11	14.0	20.9	29.4	39.1	50.0
12	13.5	20.5	28.8	38.4	49.0
13	13.0	20.0	28.2	37.6	48.3
14	12.7	19.5	27.6	36.9	47.4
15	12.3	18.6	27.0	36.2	46.6

Remarks: The site index-20 data for 5 and 6 years is unreliable. Site index represents the dominant height in metres at reference age 10. Volume has been derived from the product of height times over-bark basal area, multiplied by conventional form factor 0.3667 for all sizes of tree.

出典

(4) Kingston, B. The growth yield and rotation of E. grandis in Uganda. 1972 Forest Department Technical Note No. 193/72.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MYRTACEAE(フトモモ科)
Eucalyptus grandis (ロースガム)
国　：ウガンダ

データ採取地の立地環境

成長・収穫に関する表，図，式など

Reference Uganda Forest Department Technical Note 193/72 (Kingston, 1972)
Stocking N = 1 680/ha (assumes full stocking)
Volume "Silvolume" = stem volume underbark to 5 cm top excluding stump, derived from the product of height times overbark basal area by multiplying by the conventional form factor 0 3667 for all sizes of tree.

Silvolume yield table for *E. grandis*

SITE INDEX (SI)

Age (years)	20				25				30				35				40			
	h_{dom} (m)	CAI (m^3)	MAI (m^3)	V_u (m^3)	h_{dom} (m)	CAI (m^3)	MAI (m^3)	V_u (m^3)	h_{dom} (m)	CAI (m^3)	MAI (m^3)	V_u (m^3)	h_{dom} (m)	CAI (m^3)	MAI (m^3)	V_u (m^3)	h_{dom} (m)	CAI (m^3)	MAI (m^3)	V_u (m^3)
4	15 90		23 87	95 48	18 21		26.20	104 78	20 50		36 07	144 29	22 81		43 80	175 21	25.11		50 23	200 90
5	16 20	7 66	20 63	103 14	19 83	20 40	25 04	125 18	22 79	31 98	35.25	176 27	25 77	45 40	44 12	220 61	28 74	60 50	52 28	261 49
6	17 39	9 13	18 71	112 27	20 89	19 62	24 13	144 80	24 37	26 42	33 78	202 69	27 87	38 90	43 25	259 51	31 34	52 70	52 35	314 10
7	18 01	7 35	17 09	119 62	21 95	18 50	23.33	163 30	25 87	25.50	32 60	228 19	29.82	36 50	42 29	296 01	33 74	49 00	52 40	366 80
8	18 67	8 06	15 96	127 68	23 01	17 50	22.73	181 80	27.33	24 50	31 71	253.69	31 67	34 35	41.56	332 51	35 98	46 75	51 98	415 80
9	19 34	8 42	15 12	136.10	24 04	16.70	22.14	199.30	28 70	23.59	30.91	278 19	33 40	33.63	40.66	366 13	38 06	45 00	51 39	462.55
10	20 00	8 53	14 46	144 63	25 00	15 80	21 51	215 10	30 00	23.24	30 14	301 43	35 00	32.38	39 85	391 51	40 00	43 71	50 76	507 55
11	20 64	8 85	13 95	153 48	25 94	14 50	20.87	229 60	31 21	22 38	29 44	323 81	36 51	31 69	39 11	430 20	41 78	41 61	49 93	549 19
12	21 25	7 93	13 45	161 41	26 81	14 10	20 49	245 90	32 34	21 54	28 78	345 35	37.90	30 12	38 36	460 32	43 43	39.91	49 09	589 10
13	21 84	8 21	13 05	169 62	27.64	13.96	19.99	259 86	33 40	20.78	28 16	366.13	39 20	28 99	37 64	489 31	44 96	38 12	48 25	627 22
14	22 39	7 82	12.67	177.44	28 41	13 26	19 51	273 12	34 39	19 89	27.57	386.02	40 41	27.70	36.93	517 01	46 39	36.60	47 42	663 82
15	22 92	7.68	12.34	185.12	29.14	12 84	19.06	285 96	35 32	19.12	27.01	405 14	41.54	26 48	36 23	543 49	47.72	34 87	46 58	698.69
16	23.42	7 38	12.03	192 50	29 82	12.20	18 64	298.16	36.19	18 25	26 46	423.39	42 60	25 28	35.55	568 87	48 97	33 50	45 76	732 19
17	23 89	7 05	11.74	199 55	30 47	12 01	18.25	310.17	37.01	17.53	25 94	440 92	43.59	24 17	34 88	593 04	50 14	31 99	44 95	764 18
18	24.34	6.86	11 47	206.41	31.08	11 20	17.85	321.37	37.79	16.98	25.44	457.90	44.53	23 34	34 24	616 38	51 23	30 36	44.14	794.54
19	24.77	6.65	11.21	214.06	31.66	10 95	17.49	332.32	38.57	17.26	25.01	475.16	45.41	22.26	33.61	638.64	52 27	29.45	43 37	823 99
20	25 17	6 28	10 97	219 34	32.21	10.52	17.14	342 84	39.20	14 15	24 47	489 31	46.24	21.30	33.00	659 94	53 24	27 90	42 59	851 99

Note: SI 20 data from 4 6 years are very unreliable.

出典

Jacobs, M R　Eucalyptus for planting　Species monograph p 394　FAO Rome 1979

樹種：MYRTACEAE(フトモモ科)
Eucalyptus grandis (ユーカリグランディス)
国　：ザンビア

データ採取地の立地環境

Locality:	Copperbelt
Altitude	1 150 - 1 270 m
Rainfall:	1 200 mm
Stocking density:	720 stems/ha (initial)

成長・収穫に関する表，図，式など

Yield table

Age (years)	No. of trees/ha	MAI/ha (m^3)
2	720	11.5
3	496	18.3
4	496	23.7
5	496	27.0
6	329	27.4
7	329	28.2
8	329	29.0
9	329	29.1
10	220	28.8
11	220	28.8
12	220	28.4

Remarks: Crop has been thinned at ages 2, 5 and 9 years and volume has been included in MAI.

出典

(1) Dickens, C.H. 1972 Report on growth studies and yield predictions in Eucalyptus grandis. Forest Research Pamphlet No. 47.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MYRTACEAE(フトモモ科)
Eucalyptus grandis (ローズガム)
国　：ザンビア

データ採取地の立地環境

Area Zambia (Copperbelt)

成長・収穫に関する表，図，式など

Reference Country statement
Stocking Initial N = 720/ha, thinned at ages 2, 5 and 9, final N = 220/ha
Volume Stem volume
Volume of thinnings shown separately, included in calculation of MAI

Age (years)		$\bar{h}$ (m)	$\bar{d}$ (cm)	N	G (m^2)	V (m^3)	CAI (m^3)	MAI (m^3)	Roundwood volume m^3 to·			Roundwood volume percent to			Assortment percent			
									10 cm	15 cm	20 cm	10 cm	15 cm	20 cm	Saw	Small poles	Pur lins	Waste
	1																	
B[1]	2	10.0	9 2	720	5 0	23.0		11.5										
A[1]		10 0	9 2	496	3 45	15 0												
T[1]		10 0	9 2	224	1 55	8.0			—	—	—	—	—	—		40	4	56
	3	15 0	13 8	496	7 8	47	27 0	18.3										
	4	19 2	17 0	496	11 6	87	40 0	23.7										
B	5	22.0	19 2	496	15 0	127	40 0	27 0										
A		23 0	20 1	329	10 8	95												
T		20.1	17.5	167	4 2	32	29 0		28	8		87	25	—	14	14	32	40
	6	25 5	22 5	329	13 4	124		27 4										
	7	27.5	24 5	329	15 8	157	33 0	28 2										
	8	28.8	26.3	329	18 1	191	34.0	29 0							63	4	8	25
B	9	30 1	27 9	329	20 4	222	31.0	29 1										
A		30 4	28.5	220	14 3	156												
T		29 5	26.7	109	6 1	66			60	52	31	92	80	47	65	5	7	23
	10	31.3	30 3	220	16 1	183	27 0	28 8	172	157	119	94	86	65	75	2	4	19
	11	32.3	31 9	220	17.9	211	28 0	28 8	200	189	151	95	90	72	76	1	3	19
	12	33 0	33 5	220	19 8	234	23 0	28 4	224	215	177	96	92	76	78	1	3	18

[1] B = before thinning, A = after thinning, T = thinnings

出典

Jacobs, M R Eucalyptus for planting Species monograph p 394 FAO Rome 1979

樹種：MYRTACEAE(フトモモ科)
Eucalyptus hybrid
国　：インド

データ採取地の立地環境

成長・収穫に関する表，図，式など

Models to predict expected wood output

The expected output will depend on the rate of loss on account of illicit felling and the manner in which it occurs. There is no scientific or systematic study so far to throw light on these aspects.

Risk of illicit felling is generally quantified in terms such as "there is 10% loss per year on average". However, it is less commonly specified how such losses are made up. Are they scattered or concentrated spatially? Do they principally affect productive area, standing volume or crop increment? The manner of the loss has important implications for predicting wood output of plantations.

Three models (Trivedi, 1987) are discussed below to predict plantation yield under different assumptions about the way in which the loss due to illicit felling takes place In each model loss is assumed to occur according to an exponential rather than an arithmetic progression e g with a 10% loss per year, the remainder after two years is not 100%−2 (10%), but (100%−10%)².

Model 1—Loss of area · This model treats illicit felling simply as a proportional loss of forest area. That is, each year a given proportion of remaining forest area is completely felled illicitly, thereby taking that land out of forest production The volume obtainable at the end of the T^{th} year is given by

$$V_T = V\ (1-f)^T \qquad (1)$$

where V is the volume obtainable in the absence of illicit felling and f is the annual loss of area expressed as a decimal

Model 2—Loss of cumulative volume (increment unaffected) : This model treats illicit felling as a proportional loss of cumulative volume. That is, each year a given proportion of current standing volume is removed illicitly in scattered fellings. However, volume increment rate is treated as unaffected. This corresponds with the observation that authorized thinning does not, within wide limits of intensity, affect volume increment significantly The volume obtainable at the end of the T^{th} year is given by

$$V_T = V_{T-1} + \triangle V_T - (V_{T-1} + \triangle V_T/2)\, f \qquad (2)$$

where $\triangle V_T$ is the volume increment in the T^{th} year, V_{T-1} is the cumulative volume at the end of the $(T-1)^{th}$ year and f is the annual loss in cumulative volume expressed as a decimal. Increment rate dV/dT at any instant of time is treated simply as a function of the cumulative volume which would have existed at that instant in the absence of illicit felling

Model 3—Loss of cumulative volume (increment affected) : This model is similar to model 2 except that the rate of volume increment is treated as affected by the illicit felling The expression for volume obtainable in this model is the same as in model 2, but increment rate dV/dT is treated as a function of cumulative volume, which in turn is a function of number of trees remaining The assumption is made that each year a given proportion of remaining trees is removed illicitly, moreover, these trees are a proportional sample of the existing size class distribution The number of trees at the end of the T^{th} year is given by

$$N_T = N\ (1-f)^T \qquad (3)$$

where N stands for the initial plantation

density and f is the annual loss of tree numbers expressed as a decimal.

Expected utility of a forest plantation

The expected utility of a forest plantation under the risk of illicit felling can be measured in terms of the expected crop value which is a function of the volume of wood and the crop diamater expected at a given crop age. The crop diameter variable can be ignored if biomass production is treated as a measure of utility In such a case the discounted expected utility, for use in determining optimum rotation for the plantation, is obtained by discounting the volumes obtainable under the three models by the pure time-preference rate :

$$DEU = EU/1+r)^{T} \qquad (4)$$

where DEU stands for discounted expected utility, EU stands for expected utility and r stands for pure time-preference rate This treatment has been adopted for the appraisal of *Eucalyptus* plantations in India by Trivedi and Price (1986).

Application of models to appraise *Eucalyptus* plantations in India

An attempt is made in this section to generate a yield-table for the *Eucalyptus* hybrid plantations in India under risk-free condition as well as under conditions of risk represented by the three models discussed earlier A variable density yield equation, specified by Sharma (1978), is used as the basic equation and is reproduced below :

$$\log V = b_0 + b_1.(1/A) + b_2.S + b_3.(\log N) + b_4.(1/S) \qquad (5)$$

where V is the yield in cubic metres per hectare, A is the age of the crop expressed in years, S is the site index specific to the quality class and N is the number of stems per hectare The classification into three quality classes I, II and III (on the basis of top height) and the determination of the corresponding site indices and the values of the regression constants and coefficients by Sharma (1978) using data from 124 sample plots scattered all over India used in the present study These values are reproduced in Tables 1 and 2.

Let us consider a *Eucalyptus* plantation with N=2500. This corresponds to a spacing of 2m×2m Let us generate a yield table for the plantation age starting from year 1 to year 15 using the above equation (Sharma's tables contain an age-range of 4-14 years, but a little extrapolation does not matter for the aim is to illustrate the models). This gives risk-free volume Yield tables are also generated using the three models already discussed. The rate of volume increment in model 2 is obtained by differentiating equation (5) with respect to T and is expressed as

$$\frac{dV^{T}}{dT} = \frac{b1 - V_T}{T^{-2}} = -\frac{b1}{T^2} e^{[b_0 + b_1 (1/T) + b_2 S + b_3 . \log N + b_4 (1/S)]}$$

Table 1

Site indices for Eucalyptus hybrid plantation

Quality class	Top height at 8 years (m)			Site indices		
	Max.	Min.	Mean	Max	Min.	Mean
I	26 6	20 2	23 4	24	18	21
II	20.2	13 8	17.5	18	12	15
III	13 8	7 4	10 6	12	6	9

Table 2

Regression constants and coefficients for equation

Quality class	b_0	b_1	b_2	b_3	b_4
I	3.08754	– 7 51748	0.022068	0 609979	-44 4264
II	–2.34040	–10.93654	0 264975	0 216846	31.0078
III	3.50694	–14 93375	–0 045310	0 622400	-29 5316

Extracted from 'Yield tables for *Eucalyptus* hybrid (plantation) for various levels of stocking' (Sharma, 1978).

For model 3, dV_T/dt is evaluated by the same expression (6) except that N is replaced by N_T as given by equation (3) Introducing the concept of variable tree number during the life of the crop may not be compatible with the original assumptions behind equation (6), but this is being done to illustrate the models and no better equations are currently available. How much the estimated loss reflects the true quantum of loss in the field depends on how closely the models depict the individual field situations.

The value of f, i e , the annual rate of loss of area in model 1 and the annual loss of cumulative volumes in models 2 and 3, has been taken as 0.1 (or 10%) in the present study Loss from illicit felling does not occur as a single annual event, but may be scattered throughout the year. Accordingly, in models 2 and 3 the year is divided into 100 equal parts, in any of which illicit felling may take place. The mean rate of loss in each part is 0 105305% Owing to the exponential nature of loss, this would result in a loss after one year of precisely 10%

$$(100\%-0\ 105305\%)^{100}=90\%$$

In models 2 and 3, the net effect of volume increment and illicit removal is calculated at the mid-point of each period, and the remaining standing volume revised

Table 3

Yield table for Eucalyptus hybrid plantation in India

Quality class & plants per ha.	Age (years)	Volume (without illicit felling) (m^3)	Volume under illicit felling		
			Model 1 (m^3)	Model 2 (m^3)	Model 3 (m^3)
I	1	0.27	0 24	0.27	0 25
2500	2	11.57	9 37	11 14	10 03
	3	40.51	29.53	37.59	32 44
	4	75.80	49 73	67 34	55 93
	5	110.38	65.18	93 41	74 90
	6	141 82	75 37	113.87	88 35
	7	169 61	81 13	128 84	96 87
	8	193 98	83 50	139 06	101 46
	9	215 33	83.42	145 39	103 04
	10	234 09	81 62	148.64	102.39
	11	250 65	78.66	149 47	100 15
	12	265 34	74 94	148.45	96.79
	13	278 44	70 77	146 03	92 67
	14	290 18	66 38	142 56	88.08
	15	300 75	61 92	138 33	83 22
II	1	0.00	0 00	0 00	0 00
2500	2	0 93	0 76	0 91	0 87
	3	5 77	4.21	5.44	5 15
	4	14 35	9 42	13.07	12.17
	5	24 80	14 64	21.68	19 90
	6	35 70	18 97	29 87	27 04
	7	46 32	22 16	36 96	33 02
	8	56 31	24 24	42 74	37.70
	9	65 55	25 40	47 22	41 15
	10	74.02	25.81	50.54	43 50
	11	81 76	25 66	52 82	44 92
	12	88 82	25 09	54 24	45.58
	13	95 27	24 22	54.93	45 62
	14	101.17	23 15	55 03	45 17
	15	106 58	21 94	54 66	44 33
III	1	0 00	0 00	0.00	0 00
2500	2	0.06	0 05	0.06	0 05
	3	0 75	0 55	0.71	0 66
	4	2 60	1 70	2.41	1 94
	5	5 48	3 23	4.91	3 78
	6	9 01	4 79	7.78	5.74
	7	12.86	6 15	10 65	7.55
	8	16.79	7.23	13 32	9 08
	9	20 66	8 00	15 66	10 27
	10	24 39	8 50	17 63	11.14
	11	27.94	8 77	19.23	11 72
	12	31.28	8 84	20 48	12 04
	13	34 43	8.75	21 42	12 15
	14	37 37	8.55	22 07	12 09
	15	40 12	8.26	22 47	11 89

Table 4

Discounted yield table for Eucalyptus plantation in India

Quality class & plants per ha	Age (years)	Discounted Volume (no illicit felling) (m^3)	Discounted Volume		
			Model 1 (m^3)	Model 2 (m^3)	Model 3 (m^3)
I	1	0 25	0 22	0 24	0 23
2500	2	9 56	7 75	9 21	8 29
	3	30 44	22 19	28 24	24 37
	4	51 77	33 97	45.99	38 20
	5	68 54	40 47	58 00	46.51
	6	80 05	42.54	64 28	49.87
	7	87 04	41 63	66.11	49 71
	8	90 49	38 95	64 87	47 33
	9	91 32	35 38	61.66	43 70
	10	90 25	31 47	57 31	39 48
	11	87 85	27 57	52 39	35 10
	12	84.54	23 88	47 30	30 84
	13	80 65	20 50	42.30	26 84
	14	76 41	17 48	37 54	23.19
	15	72 00	14 82	33 12	19 92
II	1	0.00	0 00	0.00	0 00
2500	2	0 77	0 62	0 75	0 72
	3	4 33	3 16	4 09	3 87
	4	9 80	6 43	8 93	8 31
	5	15 40	9 09	13 46	12 36
	6	20 15	10 71	16 86	15 26
	7	23.77	11 37	18 96	16 94
	8	26 27	11.31	19 94	17 59
	9	27 80	10.77	20.03	17 45
	10	28.54	9 95	19.48	16 77
	11	28.66	8 99	18.51	15 74
	12	28 30	7 99	17 28	14.52
	13	27 60	7 01	15 91	13 21
	14	26 64	6 09	14.49	11 89
	15	25 52	5 25	13.08	10 61
III	1	0 00	0.00	0 00	0 00
2500	2	0 05	0.04	0.05	0 04
	3	0 56	0 41	0.54	0.45
	4	1.77	1.16	1 64	1 33
	5	3.40	2 01	3.05	2 35
	6	5 09	2 70	4.39	3 24
	7	6.60	3.16	5 47	3 88
	8	7.83	3.37	6.21	4.24
	9	8 76	3.39	6.64	4 36
	10	9.40	3 28	6 80	4.30
	11	9.79	3.07	6.74	4 11
	12	9.97	2.82	6.53	3.84
	13	9 97	2.53	6 20	3 52
	14	9 84	2 25	5 81	3 18
	15	9 61	1.98	5.38	2.85

Table 5

Expected mean annual increment for Eucalyptus plantation

Quality class & plants per ha	Age (years)	MAI (without illicit felling) (m^3)	Expected MAI under illicit felling		
			Model 1 (m^3)	Model 2 (m^3)	Model 3 (m^3)
I	1	0 27	0 24	0 27	0 25
2500	2	5 79	4.69	5 57	5.01
	3	13 50	9 84	12.53	10 81
	4	18 95	12 43	16 83	13.98
	5	22 08	13 04	18 68	14 98
	6	23 64	12.56	18 98	14 72
	7	24 23	11 59	18.41	13 84
	8	24 25	10 44	17 38	12 68
	9	23 93	9 27	16 15	11 45
	10	23 41	8.16	14 86	10 24
	11	22 79	7 15	13 59	9 10
	12	22 11	6 24	12 37	8 07
	13	21.42	5 41	11 23	7 13
	14	20.73	4 74	10 18	6 29
	15	20 05	4.13	9 22	5.55
II	1	0 00	0 00	0 00	0 00
2500	2	0 47	0 38	0 45	0 44
	3	1.92	1 40	1 81	1 72
	4	3 59	2 35	3 27	3 04
	5	4 96	2.93	4 34	3 98
	6	5 95	3 16	4 98	4 51
	7	6 62	3 17	5.28	4 72
	8	7 04	3 03	5 34	4 71
	9	7 28	2 82	5 25	4 57
	10	7 40	2 58	5 05	4.35
	11	7 43	2.36	4 80	4 08
	12	7.40	2 09	4 80	4 08
	13	7.33	1 86	4 23	3 51
	14	7 23	1 65	3 93	3 23
	15	7 11	1.46	3 64	2 96
III	1	0.00	0.00	0 00	0 00
2500	2	0.03	0 03	0 03	0 03
	3	0 25	0 18	0 24	0 20
	4	0.65	0 43	0 60	0 49
	5	1.10	0.65	0 98	0 76
	6	1.50	1 80	1 30	0 96
	7	1 84	0 88	1 52	1 08
	8	2 10	0 90	1 66	1.13
	9	2 30	0 89	1 74	1 14
	10	2 44	0.85	1.76	1 11
	11	2 54	0 80	1 75	1 07
	12	2 61	0 74	1 71	1 00
	13	2 65	0 67	1.65	0 93
	14	2 67	0 61	1 58	0 86
	15	2 67	0 55	1 50	0 79

出典

S.N. Trivedi (1989). Utility-based Paysical Appraisal of Eucalyptus Hybrid Plantations in India Under the Risk of Illicit Felling. Indian For, 115 : 771-779.

樹種：MYRTACEAE(フトモモ科)
Eucalyptus hybrid
国　：インド

データ採取地の立地環境

Materials and Methods

Data given in Table 1 pertains to Sample Plot No 7 of Bilaspur Plantation Division This plantation was raised in 1964 and is situated along Dewar-Dabra Road near Khodri Railway Station in Bilaspur District of Madhya Pradesh The planting was done at an espacement of 2 m×2 m The sample plot was formed in February, 1965, and measurements on seedling origin crop were taken in 1966-68 and again in November, 1971 The plantation was clearfelled in 1980 leaving an average stool height of about 15 cm New sample Plot Number 10 was then formed in November 1980 for taking growth measurements of first coppice crop between 1981-1987

Data summarised in Table 2 pertains to Sample Plot No 6 of North Bilaspur plantation Division which is situated in Jogeswar Block near Khodri Railway Station in forest Compartment No 452 Plantation was done at a spacing of 2 m×2 m in 1963 but sample plot was formed in 1965 Measurements of seedling origin plants were started in January 1966 and were continued annually upto March 1978 The area was clearfelled in August-September, 1979 A new sample plot to record measurements in first coppice crop was formed in February, 1980 Measurements were continued between November, 1980 to 1987 on yearly basis

In Table 3, the observations of Sample Plot No. 2 of Bilaspur Plantation Division have been given This plantation is located on Gorella (Pendra Road) to Tattanpur road in Comptt No 465 The plantation was raised in 1964 Before planting *Eucalyptus* hybrid, the area carried mixed dry deciduous forest of Madhya Pradesh Site Quality IV (a) with crop density 0 4—0 8 The plantation was done at a spacing of 2 m×2 m The measurements were taken every year from 1967 to 1978 The crop measurements were taken after 2½ years and 13½ years The seedling origin crop was clearfelled in June, 1979 and new sample plot was formed in November, 1980 (1½ years). The measurements of coppice crops were taken in January, 1982 to February, 1987 i e after 2 5, 3.5, 4 5, 5 5, 6,5 and 7.5 years.

成長・収穫に関する表，図，式など

Table 1

Comparative growth and yield of seedling and coppice crops of Eucalyptus hybrid

Year of Plantation 1964					Clearfelled in November, 1980				
Seedling origin (Sample Plot formed in 1969)					Coppice origin 1st rotation (Sample Plot formed in Nov , 1981)				
Age (yrs)	No of stems/ ha	Crop dia (cm)	Crop height (m)	Volume over bark (VOB) (m^3)	Age (yrs)	No of stems/ ha	Crop dia (cm)	Crop height (m)	Volume over bark (VOB) (m^3)
1	2500	Not available	NA	NA	1	3230	—	5 20	7 20
2	NA	NA	NA	NA	2	2244	4 0	6 69	8 92
3	NA	NA	NA	NA	3	1978	4 9	7 84	12 80
4	NA	NA	NA	NA	4	1700	6 5	10 40	16 66
5	NA	NA	NA	NA	5	1522	8 4	11 80	26 56
6	NA	NA	NA	NA	6	1472	10 1	12 90	41.55
7½	1931	7 5	10 4	23 72	7½	1472	11 1	15 15	58 95
8½	NA	NA	NA	NA	8½	899	12 2	16 40	46 05
17	1143	14 4	17 3	68.52	—	—	—	—	—

Table 2

Comparative growth and volume of seedling and coppice crop of Eucalyptus hybrid

Year of Planting 1963					Clearfelling in 1981				
Seedlings Origin (old S P No. 6)					Coppice origin 1st rotation (new S.P. No 8)				
Age (yrs)	No of Trees/ha	Crop dia (cm)	Crop height (m)	O B Volume/ ha (m^3)	Age (yrs)	No of Trees/ha	Crop dia (cm)	Crop height (m)	O B volume/ ha (m^3)
1½	2010	2.15	2 00	2.00	1½	1260	5 4	3 86	NA
2½	1850	2 40	5 00	4 00	2½	1211	5 4	7 37	13.29
3½	1650	2.45	5 20	4 24	3½	1144	7 3	10.52	25.59
4½	1490	3 20	5 60	5.97	4½	1089	7.7	11.55	29 64
5½	1375	3 65	6 20	7 54	5½	978	9 3	12 56	30 93
6½	1305	4 15	6.90	9.54	6½	900	10 0	13 50	38 97
13	1062	9.30	15 70	42 53	—	—	—	—	—
14	1019	10 80	17.09	45 05	—	—	—	—	—

Table 3

Comparative growth and yield of seedling and coppice crop of Eucalyptus hybrid

Particulars of plan-tation	Year of Plantation 1964					Clearfelled in 1980 (Spacing 2 × 2 m)				
	Seedling origin (old S P. No 2)					(Coppice origin 1st rotation (new S P No 9)				
	Age (yrs)	Number of stems per ha	Crop dia (cm)	Crop height (m)	O B. volume /ha (m^3)	Age (yrs)	No of stems per ha	Crop dia (cm)	Crop height (m)	O.B volume /ha (m^3)
Year of	2½	1800	2 55	5.6	4 76	2½	1166	6 3	7 50	15 75
plantation —1964	3½	1705	2 60	6 0	5 20	3½	1155	7.3	10 15	24 69
Spacing	4½	1675	3 85	6 8	8 72	4½	1111	7 8	11 20	29 12
2 × 2 m	5½	1655	4 25	6.9	9.77	5½	933	9 6	12 00	38 40

出典

Prasad, Ram (1989). Comparative Growth and Yield of Seedling Origin Crop and First Coppice Crop in Eucalyptus Hybrid. Indian For., 115 : 281-285.

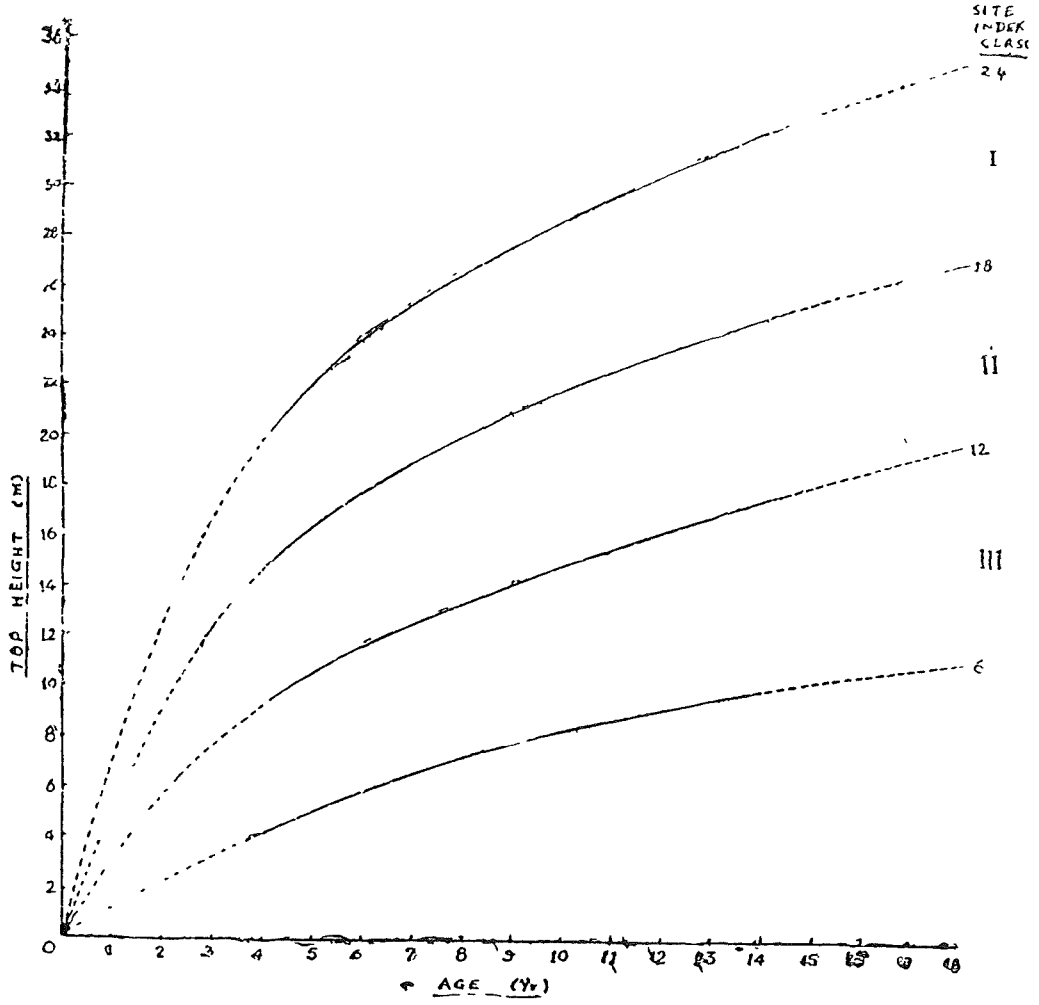
樹種：MYRTACEAE(フトモモ科)
Eucalyptus hybrid
国　：インド

データ採取地の立地環境

The technique of raising *Eucalyptus* hybrid has been developed independently in each region keeping in view the local conditions. Espacement in pure plantations varies from region to region and sometimes in the same region. Various spacings adopted are 1m×1m, 2m×2m, 2.5m × 2.5m, 3.5 m × 3.5m, 3m × 3m, etc. *Eucalyptus* hybrid plantations are generally pure but mixtures have also been tried, over small areas, with the species such as, teak, *Casuarina equisetifolia*, Cashew, etc. Nothing definite can be said about the success or otherwise of these mixed plantations at present. However, in the present study such mixed plantations have been excluded.

成長・収穫に関する表，図，式など

Fig 1



Site index curves for *Eucalyptus* hybrid at base age 6 years

Table 4

Average crop height (m) by number of stems : Age and Site Quality

Crop Age (years)	Site Quality	Number of stems per hectare										
		800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800
4	I	14.6	14.5	14.3	14 2	14.0	13.9	13.8	13 7	13 6	13 5	13 5
	II	9.3	9.2	9.1	9.0	8 9	8.8	8 8	8.7	8.6	8 6	8 5
	III	5.6	5 6	5.5	5 5	5 4	5.4	5.4	5.4	5.3	5 3	5 3
5	I	16.8	16.6	16.4	16 3	16 1	16 0	15 9	15 7	15.6	15 5	15 4
	II	11 3	11.2	11.1	11.0	10.9	10 8	10 8	10 6	10.6	10 5	10 4
	III	6.7	6.7	6.6	6.6	6 5	6.5	6 5	6 4	6 4	6 4	6 3
6	I	18.4	18.2	18.0	17.8	17.6	17 5	17.4	17.2	17.1	17 0	16 9
	II	13 0	12.8	12.7	12.6	12 4	12 3	12.3	12.2	12.1	12 0	11 9
	III	7.6	7.6	7.5	7.4	7.4	7 3	7 3	7.3	7 2	7 2	7 2
7	I	19.6	19.4	19 2	19 0	18.8	18.7	18.5	18 4	18 3	18 2	18.1
	II	14.3	14 1	14.0	13 8	13.7	13 6	13 6	13 4	13 3	13 2	13 2
	III	8.3	8 2	8.2	8.1	8.1	8.0	8.0	7.9	7 9	7 9	7.8
8	I	20.6	20.4	20.2	20 0	19.8	19 6	19 5	19.3	19 2	19 1	19 0
	II	15.3	15.2	15 0	14.9	14.7	14 6	14.5	14 4	14 3	14 2	14 1
	III	8.9	8.8	8.7	8.7	8.6	8.6	8.5	8.5	8 4	8 4	8 4
9	I	21.4	21.2	20.9	20 7	20.6	20.4	20.2	20.1	20 0	19 8	19 7
	II	16.2	16 0	15.9	15 7	15 6	15.4	15 3	15 2	15.1	15 0	14 9
	III	9.4	9.3	9.2	9.1	9.1	9.0	9.0	8 9	8.9	8 8	8 8
10	I	22.1	21 8	21.6	21.4	21.2	21.0	20.9	20.7	20.6	20.4	20 3
	II	17.0	16.8	16.6	16 4	16.3	16 2	16 0	15 9	15.8	15 7	15 6
	III	9.7	9.7	9.6	9 5	9.5	9 4	9 3	9 3	9 2	9 2	9 2
11	I	22.7	22.4	22.1	21 9	21.7	21.5	21.4	21.2	21 1	21 0	20 8
	II	17.6	17 4	17.2	17 0	16.9	16 8	16 6	16 5	16.4	16 3	16 2
	III	10.1	10 0	9,9	9.8	9.8	9,7	9.7	9 6	9.6	9 5	9 5
12	I	23.1	22.8	22 6	22 4	22.2	22.0	21 8	21.7	21 5	21 4	21 3
	II	18.1	17 9	17.7	16 6	17.4	17 3	17 1	17.0	16.9	16 8	16 7
	III	10.4	10.3	10.2	10.1	10 0	10.0	9.9	9.9	9 8	9 8	9 7
13	I	23.5	23 3	23 0	22 8	22.6	22.4	22 2	22.1	21.9	21 8	2 6
	II	18.6	18 4	18.2	18 0	17.9	17.7	17.6	17.5	17 4	17 3	17 2
	III	10.6	10 5	10 4	10 4	10 3	10 2	10 2	10.1	10 1	10 0	10 0
14	I	23.9	23 6	23.4	23 1	22.9	22 7	22 6	22 4	22.2	22 1	22 0
	II	19.0	18 8	18.6	18 4	18 3	18.1	18.0	17 9	17 7	17 6	17.5
	III	10.8	10.7	10.6	10 6	10.5	10 4	10 4	10 3	10 3	10 2	10 2

Table 5

Average crop diameter (cm) by number of stems Age and Site Quality

Crop Age (years)	Site Quality	Number of stems per hectare										
		800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800
4	I	11 7	11 3	11 1	10.8	10.7	10 5	10 4	10 3	10 2	10 1	10 0
	II	10.4	9 7	9 1	8 6	8 2	7 9	7 6	7 4	7.1	6.9	6.8
	III	4 2	4 1	4 0	3 9	3 9	3 9	3.8	3.8	3.8	3.7	3 7
5	I	12 5	12 1	11.9	11.7	11 5	11 3	11 2	11.1	11.0	10.9	10 8
	II	10 9	10 2	9 6	9 1	8 7	8 4	8.1	7.9	7.7	7 5	7 3
	III	4 8	4.7	4.6	4 6	4 5	4 5	4 4	4 4	4.4	4.4	4 3
6	I	13 1	12 9	12 7	12 5	12 3	12.1	12 0	11.9	11.8	11.7	11.6
	II	11 4	10 7	10.1	9.7	9.3	8 9	8.6	8.4	8.2	8.0	7.8
	III	5.4	5 3	5.2	5 2	5.1	5 1	5.1	5.0	5.0	5.0	4.9
7	I	14.1	13.8	13.5	13 3	13 1	12 9	12.8	12 7	12.6	12 5	12 4
	II	11 9	11 2	10 6	10 2	9 8	9 4	9 2	8 9	8.7	8 5	8 3
	III	6.0	5.9	5.9	5 8	5.8	5.7	5.7	5 6	5.6	5.6	5.6
8	I	14 9	14.6	14.3	14.1	13.9	13 7	13.6	13.5	13.4	13 3	13.2
	II	12.5	11.7	11 2	10.7	10 3	10.0	9.7	9.4	9 2	9.0	8.9
	III	6 6	6 6	6.5	6.4	6.4	6.3	6.3	6.3	6.2	6.2	6.2
9	I	15 7	15.4	15.1	14 9	14.7	14 5	14.4	14 3	14.2	14.1	14.0
	II	13 0	12.3	11.7	11.2	10.8	10 5	10.2	10 0	9.7	9 6	9.4
	III	7 3	7.2	7.1	7.0	7 0	6 9	6 9	6.9	6.8		6.8
10	I	16 5	16 2	15.9	15.7	15 5	15 3	15 2	15.1	15 0	14.9	14.8
	II	13 5	12.8	12 2	11 7	11 3	11 0	10.7	10 5	10.3	10.1	9.9
	III	7.9	7.8	7.7	7.7	7.6	7 6	7.5	7.5	7.5	7.4	7.4
11	I	17 3	17.0	16.7	16 5	16 3	16.1	16 0	15.9	15.8	15.7	15.6
	II	14 0	13 3	12.7	12 3	11.9	11 5	11.2	11 0	10.8	10 6	10 4
	III	8 5	8 4	8.3	8.3	8 2	8 2	8.1	8 1	8.1	8.1	8.0
12	I	18.1	17.8	17.5	17.3	17.1	17.0	16 8	16.7	16.6	16.5	16.4
	II	14 5	13 8	13 2	12.8	12.4	12.1	11.8	11.5	11.3	11.1	10.9
	III	9.1	9.0	9 0	8.9	8.8	8.8	8.8	8.7	8.7	8.7	8.7
13	I	18 9	18.6	18 3	18.1	17.9	17.8	17 6	17.5	17.4	17 3	17.2
	II	15.1	14.3	13.8	13 3	12 9	12.6	12.3	12 0	11.8	11 6	11.5
	III	9.7	9 6	9 6	9.5	9 5	9 4	9.4	9.3	9 3	9 3	9 3
14	I	19.7	19.4	19.1	18 9	18.7	18 6	18.4	18 3	18.2	18 1	18.1
	II	15.6	14.9	14.3	13.8	13 4	13.1	12.8	12.6	12.3	12 2	12.0
	III	10 4	10 3	10.2	10 1	10.1	10.0	10.0	10.0	9.9	9.9	9.9

Table 6

Basal area (Sq m/ha) by number of stems, Age and Site Quality

Crop Age (years)	Site Quality	Number of stems per hectare										
		800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800
4	I	8 079	8 730	9 356	9 961	10 548	11 118	11 673	12 215	12 744	13 263	13 770
	II	4 576	4 799	5 008	5 205	5 391	5 569	5 738	5 900	6 056	6 207	6 352
	III	1 003	1 090	1 173	1.254	1 333	1 409	1.485	1 558	1 630	1 701	1.770
5	I	10 116	10.929	11.713	12 471	13 205	13 919	14 614	15 292	15 955	16 604	17 240
	II	5.887	6 174	6 443	6 696	6 936	7.164	7 382	7 591	7.792	7.985	8 172
	III	1 429	1.552	1.671	1.786	1.899	2 008	2.115	2.220	2.322	2.423	2 522
6	I	11.922	12 882	13.806	14 699	15 565	16.406	17 225	18.024	18.806	19.571	20 320
	II	7.075	7 420	7.743	8 047	8 335	8 609	8.871	9 122	9 363	9 596	9 820
	III	1.897	2 060	2 213	2.371	2.520	2 665	2 807	2.946	3.082	3.216	3 347
7	I	13 479	14 565	15.610	16 619	17.598	18.549	19 475	20.379	21.262	22.127	22 975
	II	8 111	8 506	8 877	9 225	9 556	9 870	10 170	10 458	10 735	11 001	11 258
	III	2 398	2.604	2 804	2.997	3.185	3.369	3.548	3.724	3.896	4.065	4 231
8	I	14.783	15.973	17.119	18 226	19.300	20.343	21 368	22.350	23 319	24 267	25 196
	II	8.983	9.422	9 832	10.218	10.584	10 932	11.265	11.583	11.890	12.185	12 470
	III	2.925	3.176	3.419	3 655	3.885	4.109	4.327	4.542	4.751	4.957	5.160
9	I	15 840	17.115	18 343	19.529	20.679	21.797	22 885	23 947	24 986	26.002	26 998
	II	9.692	10.164	10 607	11.024	11.418	11.794	12 153	12.497	12 827	13 146	13 453
	III	3 470	3.769	4 057	4.337	4 610	4.876	5.135	5.389	5.638	5 883	6.123
10	I	16,663	18 005	19 297	20.545	21.755	22.930	24 075	25 193	26 285	27 354	28 402
	II	10 241	10.740	11.208	11.648	12 065	12 462	12 842	13 205	13 554	13.890	14 215
	III	4 031	4.377	4.712	5.037	5.354	5.662	5.964	6.259	6 548	6 832	7 111
11	I	17.272	18 663	20 001	21 295	22 549	23.767	24 954	26.112	27.244	28 352	29 438
	II	10 641	11.160	11 646	12 103	12.537	12.949	13 343	13 721	14 084	14.433	14 771
	III	4 600	4 995	5 370	5.749	6.110	6 462	6 806	7.143	7.473	7.798	8.116
12	I	17 684	19 108	20.479	21 803	23 087	24.335	25.550	26.736	27.895	29 029	30 141
	II	10 904	11 436	11 934	12 403	12.847	13 270	13 674	14 060	14 432	14 790	15 136
	III	5 175	5 620	6.050	6 467	6.874	7.270	7.657	8 036	8.407	8.772	9 130
13	I	17 921	19 364	20.753	22 095	23.396	24 660	25 02	27 094	28 268	29.418	30 544
	II	11 045	11.584	12 088	12 563	13.013	13 441	13 850	14 242	14 618	14 981	15 331
	III	5 752	6.246	6 724	7 188	7 640	8 080	8 510	8 932	9 345	9 750	10 148
14	I	18 002	19 452	20 847	22 195	23 502	24.772	26.009	27.217	28 396	29 551	30 683
	II	11 077	11.617	12 123	12 599	13.051	13 480	13.890	14 283	14 661	15 024	15 376
	III	6 327	6 871	7.397	7 908	8 404	8.889	9 362	9.825	10.280	10 725	11 163

Table 7

Yield of volume per hectare in Cubic metres by number of stems, Age and Site Quality

Crop Age (years)	Site Quality	Number of stems per hectare										
		800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800
4	I	37 829	40 647	43.345	45.939	48 443	50 867	53 219	55 507	57.736	59 911	62 036
	II	11.210	11 500	11 766	12 012	12 241	12 455	12.657	12 847	13 028	13 201	13 365
	III	1.278	1 375	1 468	1.558	1.644	1.728	1.810	1.889	1.967	2 042	2 116
5	I	55.089	59.192	63 121	66 900	70 546	74 076	77 501	80.833	84 078	87 246	90 341
	II	19 369	19 870	20 329	20 753	21 149	21 519	21 867	22 197	22 510	22 808	23 092
	III	2.696	2 901	3.097	3 286	3.469	3.647	3 819	3 986	4.150	4 309	4 465
6	I	70.776	76.048	81 096	85 951	90 636	95 171	99 572	103 852	108 021	112 091	116 068
	II	27.888	28.609	29.271	29.880	30 451	30.984	31.486	31 961	32 411	32 840	33 250
	III	4.434	4 772	5.095	5.406	5.707	5 999	6 282	6.558	6 826	7.089	7.346
7	I	84 649	90 954	96.992	102 798	108 401	113 825	119 088	124.207	129.194	134 061	138 818
	II	36.183	37.119	37 977	38 770	39.508	40.200	40 851	41 467	42 052	42 608	43 139
	III	6 328	6 809	7.271	7.715	8 144	8 560	8 964	9.358	9.741	10 116	10 482
8	I	96 810	104.022	110.926	117.566	123 975	130 178	136 198	142.052	147 755	153 322	158 762
	II	43.987	45 124	46.167	47.131	48.029	48 870	49 662	50.410	51 121	51.797	52 443
	III	8.262	8 890	9 493	10.073	10 633	11.176	11.704	12 218	12.718	13 207	13 686
9	I	107.465	115.470	123.134	130 505	137 619	144.505	151 187	157 685	164 017	170 196	176 234
	II	51.202	52 527	53.740	54.863	55 908	56.887	57 808	58 679	59.506	60 294	61 046
	III	10.166	10 939	11 681	12 394	13 084	13 753	14 402	15 034	15 650	16 252	16 840
10	I	116.827	125.529	133 861	141.874	149.608	157.093	164 358	171 422	178.305	185 022	191 587
	II	57.818	59 313	60 684	61 951	63.131	64 237	65 277	66.261	67 195	68 084	68 933
	III	12 001	12 914	13.789	14.632	15 446	16 235	17 001	17 747	18 474	19 185	19 880
11	I	125.090	134.408	143.329	151.909	160 189	168 205	175 983	183 547	190.917	198.109	205 138
	II	63 862	65.514	67 028	68.427	69.731	70.952	72.101	73 188	74.219	75.201	76.139
	III	13 746	14 791	15.794	16.759	17.692	18.595	19.473	20 328	21.161	21 975	22 770
12	I	132 420	142 284	151 729	160.811	169 577	178.062	186 296	194 303	202 105	209 719	217 160
	II	69 378	71.173	72.818	74.333	75.754	77.080	78 329	79 510	80.630	81 697	82 716
	III	15.392	16 563	17.686	18 767	19 811	20.823	21.806	22 763	23.696	24.607	25.498
13	I	138.958	149.309	159 219	168.750	177.949	186.853	195.493	203 896	212 083	220.072	227 880
	II	74 416	76.341	78.106	79 737	81.255	82.678	84 017	85.284	86 486	87.630	88 723
	III	16.939	18.227	19 462	20 652	21 801	22 915	23 996	25.049	26.076	27.079	28 059
14	I	144 818	155.605	165.934	175 867	185 453	194 732	203.737	212.494	221 026	229 353	237 490
	II	79.025	81.069	82 943	84 675	86 288	87.799	89 221	90.566	91.842	93 057	94 218
	III	18.387	19.786	21.127	22 418	23 665	24.874	26.048	27.191	28.806	29 394	30 459

Table 9

Mean Annual Increment (cu m/ha)

Crop Age (years)	Site Quality	Number of stems per hectare										
		800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800
4	I	9 457	10 162	10,836	11,485	12,111	12,717	13,305	13 877	14 434	14,978	15 509
	II	2 803	2 875	2,942	3,003	3,060	3,114	3,164	3,212	3,257	3,300	3 341
	III	0 319	0 344	0 367	0,389	0 411	0 432	0,452	0,472	0,492	0 511	0 529
5	I	11,018	11,838	12,624	13,380	14,109	14 815	15,500	16,167	16,816	17,449	18 068
	II	3 874	3 974	4,066	4,151	4 230	4 304	4,373	4,439	4,502	4,562	4,618
	III	0,539	0 580	0,619	0,657	0 694	0 729	0,764	0 797	0,830	0 862	0,893
6	I	11 796	12 675	13,516	14,325	15,106	15 862	16,595	17,309	18 004	18,682	19,345
	II	4 648	4 768	4,878	4,980	5,075	5 164	5,248	5,327	5,402	5,473	5,542
	III	0.739	0 795	0,849	0,901	0,951	1 000	1,047	1,093	1,138	1,181	1,224
7	I	12 093	12,993	13,856	14,685	15,486	16 261	17,013	17,744	18,456	19,152	19,831
	II	5 169	5 303	5,425	5,539	5,644	5,743	5,836	5 924	6,007	6 087	6,163
	III	0,904	0 973	1,039	1,102	1,163	1 223	1,281	1 337	1 392	1,445	1,497
8	I	12 101	13 003	13,466	14,696	15,497	16 272	17,025	17,756	18 469	19 165	19,845
	II	5,498	5 641	5,771	5,891	6,004	6,109	6 208	6 301	6,390	6,475	6,555
	III	1,043	1.111	1,187	1,259	1 329	1,397	1,463	1,527	1,590	1,651	1 711
9	I	11 941	12 830	13,682	14 501	15,291	16,056	16,799	17,521	18 224	18,911	19,582
	II	5 689	5 836	5,971	6,096	6,212	6 321	6,423	6 520	6 612	6 699	6 783
	III	1,130	1 215	1 298	1,377	1,454	1 528	1 600	1,670	1,739	1,806	1 871
10	I	11,683	12 553	13 386	14,187	14,961	15,709	16,436	17,142	17,831	18 502	19 159
	II	5,782	5 931	6 068	6 195	6 313	6,424	6 528	6 626	6,720	6 808	6 893
	III	1 200	1 291	1,379	1,463	1 545	1 623	1 700	1,775	1,847	1 918	1 988
11	I	11 3.2	12 219	13 030	13,810	14,563	15 291	15 998	16,686	17,356	18,010	18 649
	II	5 806	5 956	6 093	6,221	6,339	6,450	6 555	6 653	6,747	6,836	6,922
	III	1 250	1 345	1 436	1,524	1 608	1,690	1,770	1 848	1,924	1,998	2 070
12	I	11 035	11 857	12,644	13 401	14,131	14,838	15,525	16,192	16 842	17,477	18,097
	II	5,781	5 931	6,068	6,195	6,313	6,423	6,527	6 626	6,719	6 808	6,893
	III	1 283	1 380	1,474	1,564	1,651	1,735	1,817	1 897	1,975	2,051	2,125
13	I	10 689	11 485	12 248	12,981	13 688	14,373	15 038	15 684	16 314	16 929	17,529
	II	5,724	5 872	6 008	6,134	6 250	6,360	6,463	6,560	6,653	6,741	6 825
	III	1 303	1,402	1 497	1 589	1 677	1 763	1,846	1,927	2,006	2,083	2 158
14	I	10 344	11 115	11,852	12,562	13,247	13 909	14,553	15 178	15 788	16,382	16,964
	II	5,645	5,791	5 924	6 048	6,163	6,271	6,373	6,469	6,560	6 647	6 730
	III	1 313	1,413	1 509	1,601	1 690	1 777	1 861	1,942	2,022	2,100	2 176

出典

Sharma, R P (1978) Yield Tables for *Eucalyptus* Hybrid (Plantation) for Various Levels of Stocking, The Indian Forester 1978 vol 104, No 6

樹種：MYRTACEAE(フトモモ科)
Eucalyptus hybrid
国　：インド

データ採取地の立地環境

Material and Method

1.5 ha area was planted with *Eucalyptus* with 8357 plants, the density per ha being 5587 plants. A sample plot of 100 m^2 was laid out and height and diameter measurements were carried out at periodic intervals. The plantation is situated in the outskirts of Gandhinagar (Gujarat) (23.07 N Latitude; 72.63 E Longitude; 35 MASL; dry deciduous forests) in a semi-arid tract with the soil of sandy loam. The average annual rainfall is about 700 mm and the average annual temperature is of the order of 30°C; average maximum and minimum temperature being 41°C and 13°C, respectively. The rainfall almost completely occurs during the monsoon months of June to September. The plant to plant and row to row spacing within the plantation was kept constant (1 3 m × 1 3 m) The plantation was fenced with live hedge of *Euphorbia ceducifolia* to protect it from grazing and external interference. Weeding was done only during the first year. Subsequently, the weed growth declined as a result of shade due to close planting Biomass production in this plantation was estimated at 6 monthly intervals beginning 12 months of age. Detailed methodology for estimation of biomass has been published elsewhere (Kaul and Gurumurti, 1982).

成長・収穫に関する表，図，式など

Table 1

Componentwise biomass production by trees of different categories of Eucalyptus hybrid plantation at the age of 12 months (kg/ha)

Components	Category		Total	Mean/tree	Details of plantation	Category	
	A	B				A	B
Wood	513	687	1200	0.21	Number of trees	3976	1611
Bark	230	265	495	0.09	Per cent of trees	71	29
Branch	259	288	547	0.10	Per cent contribution of utilizable biomass.	45	55
Utilizable biomass	1002	1240	2242	0.40			
Leaf	830	617	1447	0.26	Per cent contribution of total biomass.	51	49
Root	713	596	1309	0.23	Leaf efficiency	3.1	4.0
Total biomass	2545	2453	4998	0.89			

Table 2

Componentwise biomass production by trees of different categories of Eucalyptus hybrid plantation at the age of 18 months (kg/ha)

Components	Category		Total	Mean/tree	Details of plantation	Category	
	A	B				A	B
Wood	1668	1252	2920	0 52	Number of trees	4469	1118
Bark	787	555	1342	0 24	Per cent of trees	80	20
Branch	970	682	1652	0 30	Per cent contribution of utilizable biomass.	58	42
Utilizable biomass	3425	2489	5914	1 06	Per cent contribution of total biomass.	62	38
Leaf	2074	1355	3429	0 61	Leaf efficiency	4.06	3.82
Root	2930	1326	4256	0.76			
Total	8429	5170	13599	2.43			

Table 3

Componentwise biomass production by trees of different categories of Eucalyptus hybrid plantation at the age of 24 months (kg/ha)

Components	Category		Total	Mean/tree	Details of plantation	Category	
	A	B				A	B
Wood	4783	6081	10864	1.94	Number of trees	4063	1524
Bark	1460	1818	3278	0 59	Per cent of trees	73	27
Branch	1583	1646	3229	0 58	Per cent contribution of utilizable biomass.	44	55
Utilizable biomass	7826	9545	17371	3.11	Per cent contribution of total biomass.	47	53
Leaf	1569	2113	3682	0 66			
Fruit	—	426	426	0.08	Leaf efficiency	8.73	7.45
Root	4297	3659	7956	1.42			
Total	13692	15743	29435	5.27			

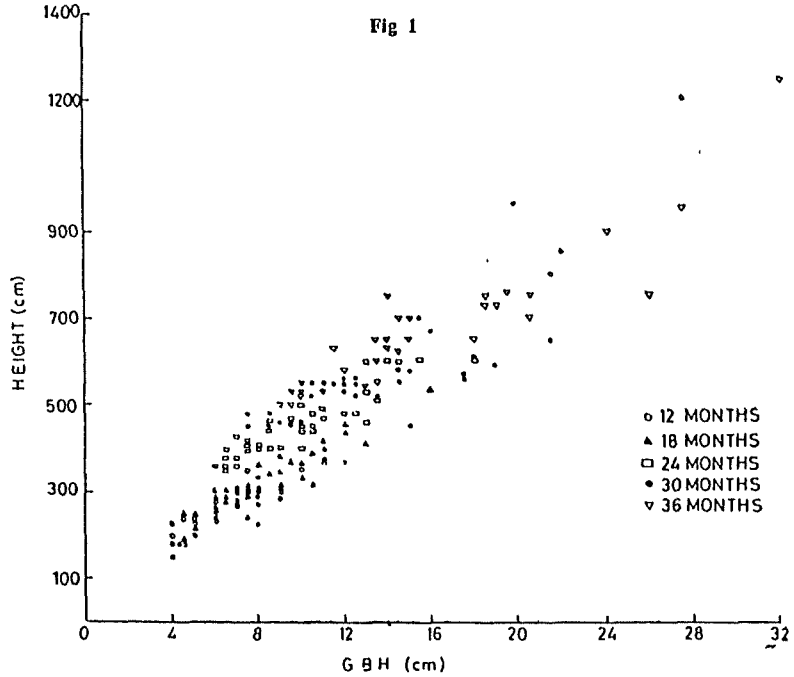
Table 4

Componentwise biomass production by tree of different categories of Eucalyptus hybrid plantation at the age of 30 months (kg/ha)

Components	Category			Total	Mean/tree	Details of plantation	Category		
	A	B	C				A	B	C
Wood	6810	3124	2964	12898	2 31	Number of trees	4097	1117	373
Bark	2498	1288	649	4435	0.79	Per cent of trees	73	20	7
Branch	4896	1340	1373	7609	1.36	Per cent contribution of utilizable biomass	57	23	20
Utilizable biomass	14204	5752	4986	24942	4.46	Per cent contribution of total biomass.	58	23	19
Leaf	2725	1130	906	4761	0.85	Leaf efficiency	8.2	7.8	7.7
Fruit	—	—	15	15	0.01				
Root	5336	1944	1074	8354	1.50				
Total	22265	8826	6981	38072	68.2				

From the foregoing observation it is clear that there exist considerable variatio among the population in the plantation. Further, a direct relationship between GBH, heig (Fig 1) and biomass production is also evident. These observations also clearly show th higher biomass production by catgories of trees in higher diameter/GBH classes is because larger number of leaves in these classes and not due to higher leaf efficiency. However, t exception to the above statements should be made with regard to category C of the trees 36 months of growth as these plants showed much higher biomass production despite p portionately lower leaf biomass. Incidentaly, the leaf efficiency of these plants was a nearly double that of plants in other two categories at 36 months of age indicating probable genetical variation among the population Alternatively, these plants might h attained maturity leading to more efficient production of dry matter.

Fig 1



Height Vs GBH of *Eucalyptus* hybrid tree in sample plot at different ages.

Table 5

Componentwise biomass production by tree of different categories of Eucalyptus hybrid plantation at the age of 36 months (kg/ha)

Components	Category			Total	Mean/tree	Details of plantation	Category		
	A	B	C				A	B	C
Wood	15613	4601	5651	25865	4 63	Number of trees	4221	993	373
Bark	5795	1447	1280	8522	1.53	Per cent of trees	75	18	7
Branch	5183	2065	1865	9113	1.63	Per cent contribution of utilizable biomass.	61	19	20
Utilizable biomass	26591	8113	8796	43500	7.79	Per cent contribution of total biomass.	62	20	18
Leaf	4221	1 90	802	6513	1 17	Leaf efficiency	9.8	8 7	15 2
Fruit	85	215	—	300	0 05				
Root	10460	3168	2596	16224	2.90				
Total	41357	12986	12194	66537	11.91				

Table 6

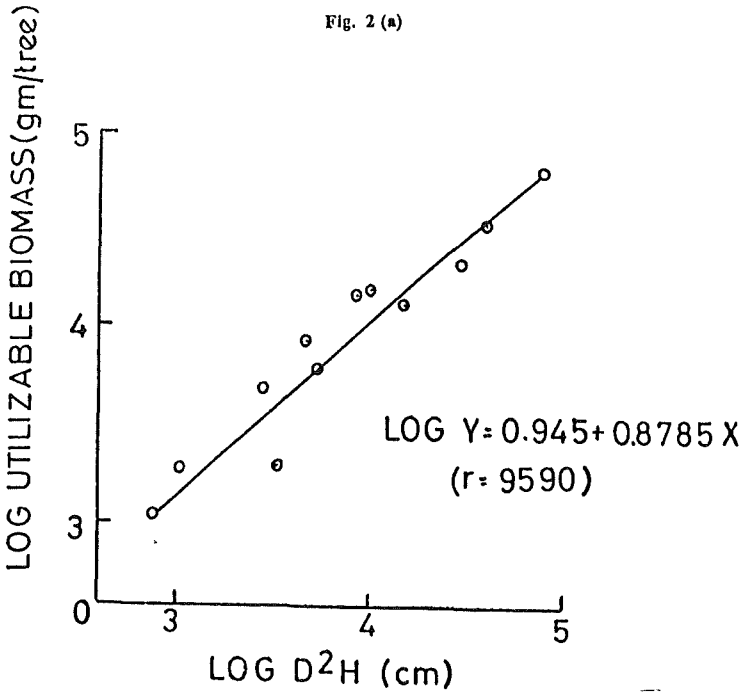
Componentwise biomass production of Eucalyptus hybrid at different age (tonnes/ha)

Components	Age (months)				
	12	18	24	30	36
Wood	1.20 (24.0)	2 92 (21.5)	10 86 (36.9)	12.90 (33.9)	25.87 (38 9)
Bark	0.50 (10.0)	1.34 (9.9)	3 28 (11 2)	4.44 (11.7)	8.52 (12.8)
Branch	0.55 (11.0)	1.65 (12.1)	3 23 (11.0)	7.61 (20.0)	9.11 (13.7)
Utilizable biomass	2.25 (45.0)	5.91 (43.5)	17 37 (59 1)	24 95 (65 6)	43.50 (65 6)
Leaf	1.45 (29.0)	3.43 (25.2)	3 68 (12.5)	4.76 (12 5)	6.52 (9.8)
Fruit	—	—	0.42 (1.4)	0 01 (0 0)	0.30 (0.4)
Root	1.30 (26.0)	4.25 (31.3)	7 95 (27 0)	8 35 (21.9)	16 22 (24.4)
Total biomass	5.00	13.60	29.42	38.07	66.54

Figures in parenthesis indicate per cent of total biomass.

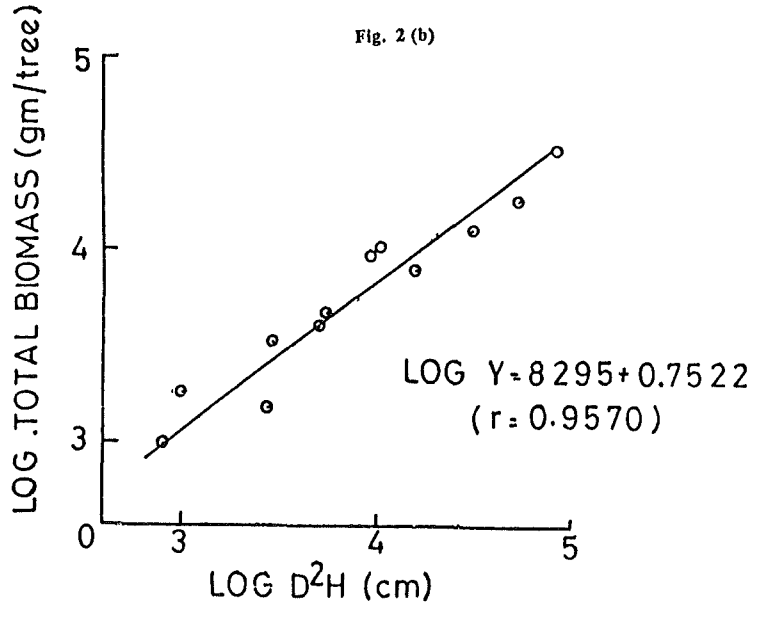
Relationship between D^2H and total dry matter and utilizable dry matter per tree. relationship between square of diameter multiplied by the height (D^2H) and total/ut able dry matter produced by the tree, was worked out using their log values and the re: alongwith the respective regression equation is presented in Fig 2. It was found that value for both D^2H and utilizable dry matter, L^2H and total dry matter worked out to suggesting a linear and positive correlation between these two parameters. It is also c from the Fig. 2 that the observed values of utilizable/total dry matter were fairly close regressed values The results thus suggest that D^2H may be used as parameter for dete ning utilizable and total dry matter production per tree.

Fig. 2 (a)



Regression correlation *Eucalyptus* hybrid

Fig. 2 (b)



Regression correlation *Eucalyptus* hybrid.

Evaluation of growth using various parameters. The data presented in Table 7 repres average total biomass and leaf biomass per tree, which was derived by dividing the t biomass per ha by number of trees per ha. Thus this data represents the average distribu of dry matter per tree in the plantation which was used as basis for calculations of Assimilation Rate (NAR), Leaf Weight Ratio (LWR), Relative Growth Rate (RGR), C Growth Rate (CGR) at 6 monthly intervals. From the data presented in this Table, it clear that the total biomass, leaf biomass, as well as the leaf efficiency in this species incre linearly with age. However, the data presented for NAR, LWR, RGR and CGR in Tab showed a different trend. Thus NAR slightly increased during 12 to 18 months of growth compared to that during 0 to 12 months It showed two peaks one at 18-24 months of gro and another at 30-36 months of growth. Incidentally, it is during these period the w biomass as well as the total biomass production registered sharp increase thus, suggesting the moisture availability influences the growth as during these periods most of the rai occurred in the experimental area. The decline in values of LWR and RGR with age is to the fact that the rate of dry matter accumulation in non-photosynthetic biomass was higher level as compared to that in the photosynthetic biomass. The crop growth showed a fairly close correlation with NAR ($r = 0.76$) RGR was found to be hi correlated with LWR as the value of coefficient of correlation between these factors wo out to 0.88.

Table 7

Growth parameters of Eucalyptus hybrid at different ages.

Parametres	Age (months)					
	0	12	18	24	30	36
Total biomass/tree (kg)	0.005	0.890	2.430	5.270	6 820	11.910
Leaf biomass/tree (kg)	0.002	0 260	0 610	0.660	0.850	1.170
Leaf efficiency	2.50	3.42	3.98	7.98	8.02	10.18

Analysis of growth in Eucalyptus hybrid plantations

Parameters	Time period (months)				
	0-12	12-18	18-24	24-30	30-36
NAR (kg/kg month)	0.563	0 590	0.745	0 342	0.840
LWR (kg/kg/month)	0 293	0.262	0.165	0.125	0 103
RGR (kg/kg/month)	0.165	0.155	0.123	0 043	0.091
CGR (tonnes/month)	0.420	1.430	2 640	1 440	4.7.0

In view of the earlier observations that there exists a periodicity in growth, it considered of interest to determine the energy conversion efficiency between two consec periods and this data is also presented in Table 8. The seasonal energy conversion effici showed two peaks one at 18-24 months of growth and another at 30-36 months of gr resulting in high NAR and biomass production during these periods. The most intere aspect of this data is that periodic energy conversion efficiency is very high, the highest value being 3 16 per cent at 30-36 months of growth, which suggests that forests plants have great capacity for converting the solar energy into dry matter but this capacity is greatly influenced by various environmental pa ameters. In the present study the high levels periodic energy conversion efficiency at 18-24 and 30-36 months of growth is probably due to moisture availability as rainfall occurs during these periods in the experimental area. Even during periods when rainfall was practically negligible (at 12-18 and 24-30 months of growth), the figures for periodic energy conversion efficiency is fairly high as compared to many forest plantations which may be attributed to large number of stems per hectare.

Table 8

Total standing energy content of Eucalyptus hybrid at different ages (× 10^6 kcal)

Components	Age (months)				
	12	18	24	30	36
Wood	4.39	11.6	60.04	67.34	123.44
Bark	1.15	4.7	13.35	15.49	34.18
Branch	2.30	6 66	12.00	33.05	42.20
Energy in utilizable biomass	8.14	22.96	85.39	115.88	199.72
Fruit	—	—	1.57	0.07	1.65
Leaf	5.59	16.43	18 09	21.75	28.79
Root	4.86	18.43	25.27	39.52	76.94
Energy in total biomass	18.59	57.7	130.32	177.22	307.10

Solar energy conversion efficiency by Eucolyptus hybrid (%)

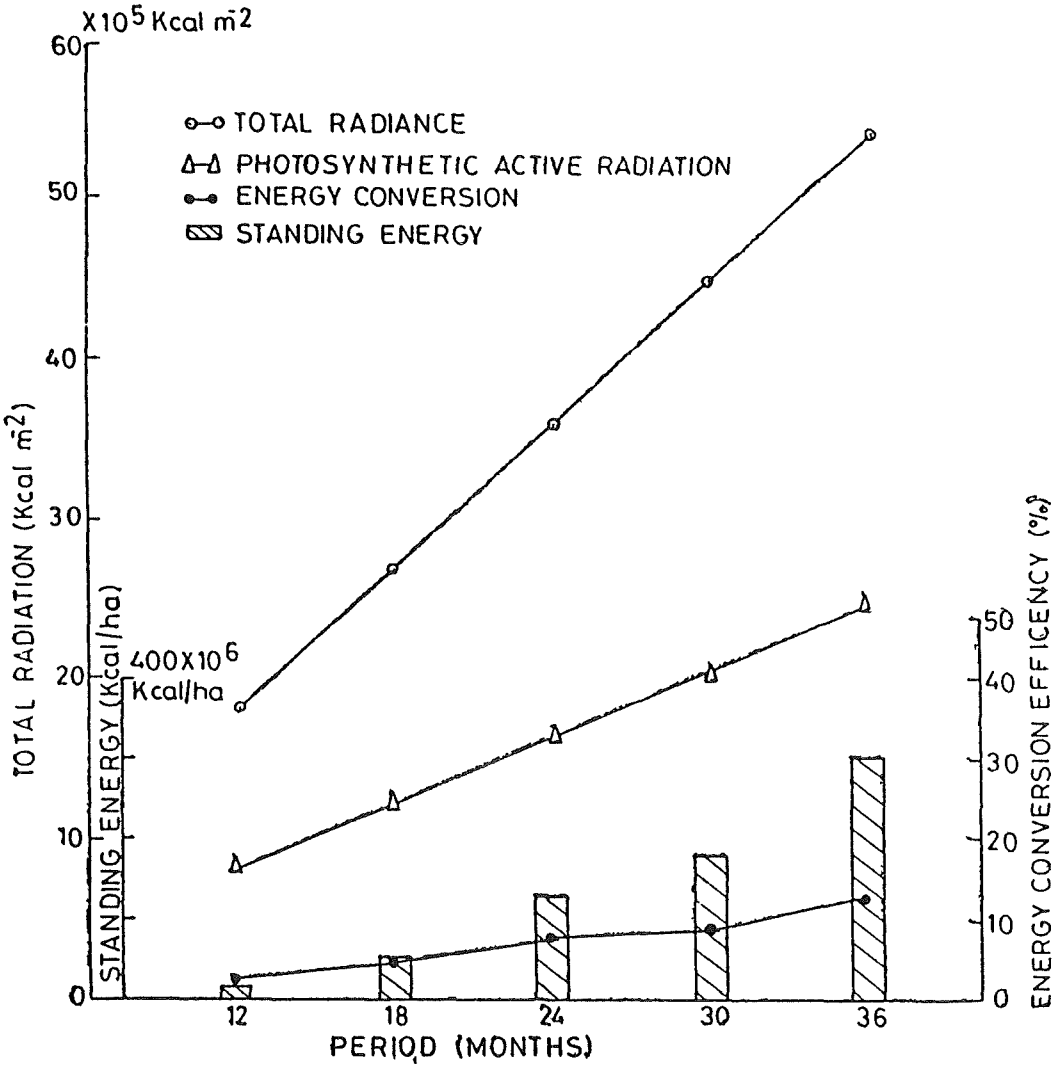
Age (months)				
12	18	24	30	36
0.24	0 48	0.80	0 88	1.26

Seasonal energy conversion efficiency by Eucalyptus hybrid (%)

Time period (months)			
12-18	18-24	24-30	30-36
0.97	1 77	1.17	3.16

Standing energy content and solar energy conversion efficiency. The data on energy cont of various components on hectare basis and energy conversion efficiency at different ag growth as well as the periodic energy conversion efficiency is presented in Table 8 The bul the energy is fixed in wood biomass, the componentwise and total energy levels sho essentially similar trend as that of biomass content. The energy (PAR) conversion effici was found to increase rapidly with age. Which is a reflection of increase in photosytl surface leaf (Fig. 3).

Fig 3



Standing energy and solar energy conversion efficiency of *Eucalyptus* hybrid.

出典

Gurumurti, K , Kimothi, M M et al (1984) Biomass Production and Energy Conversion Efficiency by *Eucalyptus* in Energy Plantations, The Indian Forester 1984 vol 110, No 2,, 150-170

樹種：MYRTACEAE（フトモモ科）
Eucalyptus microtheca　（フラッデッドボックス）
国　：スーダン

データ採取地の立地環境

Reference: Ahmed, 1977

Area Sudan (Gezira)　*Number of sample plots* 70

Stocking Initial N varies from about 1 600 to 1 900 trees/ha, reduced to between 670 and 780 trees/ha by age 12 Many trees multi-stemmed, with average between two and three stems per tree

Volume Stem plus branch volume overbark to 5 cm top, excluding stump

成長・収穫に関する表，図，式など

Quality class I

Age *(years)*	N	h_{dom} *(m)*	$\bar{d}$ *(cm)*	V_b *(m^3)*	MAI_b *(m^3)*	CAI_b *(m^3)*
1	1 610	3 35	2 2	0	0	0
2	1 250	6 00	4 1	3 69	1 85	3 69
3	1 050	8 35	5 8	11 86	3.95	8.17
4	910	10 40	7 4	24 91	6 23	13.05
5	830	12 05	8 8	45 33	9 07	20 42
6	771	13 30	10 2	76 91	12 82	31.58
7	730	14 70	11 5	136 67	19 52	59.76
8	710	15 60	12 6	185 67	23 21	49 00
9	693	16 35	13 6	209 39	23 27	23 72
10	686	16 90	14 4	222 77	22.28	13 38
11	679	17 25	15 1	230.05	20.91	7 28
12	674	17 45	15 6	235 39	19 62	5.34

Quality class I/II

1	1 795	2 60	1.6	0	0	0
2	1 424	4 70	3 0	0	0	0
3	1 219	6 55	4 4	4 71	1 57	4 71
4	1 064	8 15	5 6	13.05	3 26	8.34
5	957	9 60	6 8	25 24	5 05	12 19
6	886	10 30	7 9	43 79	7 30	18 55
7	829	11 90	8 9	69.79	9 97	26 00
8	788	12 80	9 9	107 15	13 39	37 36
9	755	13 55	10 7	126 88	14 10	19 73
10	736	14.15	11 5	137.36	13 74	10 48
11	719	14.60	12 2	142.76	12 98	5 40
12	707	14 90	12 7	146.19	12.18	3 43

Quality class II

1	1 924	1 95	1 2	0	0	0
2	1 605	3 55	2 3	0	0	0
3	1 376	5 60	3 3	0	0	0
4	1 209	6 40	4 2	3 86	0 97	3.86
5	1 110	7 70	5 2	11 86	2 37	8 00
6	1 007	8 80	6 0	22 14	3 69	10.28
7	945	9 80	6 9	35 79	5 11	13 65
8	895	10 60	7 7	51.33	6 42	15 54
9	850	11 30	8 4	61 64	6 85	10 31
10	820	11 80	9 0	67.31	6 73	5.67
11	798	12 28	9 6	70 31	6 39	3 00
12	781	12 40	10.0	71 07	5 92	0.76

出典

Jacobs, M R　Eucalyptus for planting　Species monograph p 394　FAO Rome 1979

樹種：MYRTACEAE(フトモモ科)
Eucalyptus occidentalis
國　：イタリア

データ採取地の立地環境

Reference Ciancio and Hermanin, 1976

Area	Italy (Calabria) *Number of sample plots* 36
Stocking	N = 970/ha
Volume	Stem volume overbark to 5 cm top, excluding stump
Remarks	Sample plots were distributed systematically throughout the plantation area and can therefore be considered as representative of yields to be expected Their distribution between quality classes was. QC I 33%, QC II 50%, QC III 17%.

成長・収穫に関する表，図，式など

Quality class I

Age (years)	$\bar{h}$ (m)	V (m^3)	G (m^2)	$\bar{d}$ (cm)	CAI (m^3)	MAI (m^3)
5	5 93	10 200	3 4371	6 7	7 664	2 040
6	7.24	17 864	5 1115	8 2	8 990	2 977
7	8.42	26 854	6 8218	9 5	9 840	3 836
8	9 48	36 694	8 5095	10 6	9 941	4 587
9	10 40	46.635	10 7578	11 9	9.733	5 182
10	11 20	56 368	11 5326	12 3	8 946	5 637
11	11.87	65.314	12 8005	13 0	7.599	5 938
12	12.40	72 913	13 8380	13 5		6 076

Quality class II

5	4 69	5 059	2 0919	5 2	4 036	1 012
6	5 70	9 095	3 1692	6 4	4 846	1 516
7	6.62	13 941	4.2884	7 5	5 376	1 992
8	7.45	19 317	5 4024	8 4	5 625	2 415
9	8 19	24 942	6 4742	9 2	5 516	2.771
10	8 83	30 458	7 4581	9 9	5 234	3 046
11	9 38	35.692	8 3444	10 5	4 735	3 245
12	9.84	40 427	9 1138	10 9	3 934	3 369
13	10 20	44 361	9 7334	11 3		3 412

Quality class III

6	4 16	3 451	1 5957	4 6	2 020	0 575
7	4 81	5 471	2 2111	5 4	2 288	0 782
8	5 40	7.759	2 8320	6 1	2 441	0 970
9	5 93	10 200	3 4371	6.7	2.534	1 133
10	6 41	12 734	4 0219	7 3	2 476	1 273
11	6 83	15 210	4 5611	7 7	2 452	1 383
12	7 21	17 662	5 0705	8 2	2.153	1 472
13	7 52	19 815	5 5007	8 5	1 987	1 524
14	7 79	21 802	5 8859	8 8	1 541	1 557
15	7 99	23 343	6 1774	9 0		1 556

出典

Jacobs, M R Eucalyptus for planting Species monograph p 394 FAO Rome 1979

樹種：MYRTACEAE(フトモモ科)
Eucalyptus saligna (シドニーブルーガム)
国　：ケニア

データ採取地の立地環境

Yield in different coppice rotations (2)

Locality:	Mugura (Kenya)
Altitude:	2 070 m
Rainfall:	956 mm
Soil:	deep fertile lateritic soil
Data source:	permanent experimental plots
Number of plots:	12
Size of plots:	2 020 m^2

成長・収穫に関する表，図，式など

Age (years) / Locality	5	5	5	7
	Seedling	I Coppice	II Coppice	III Coppice
	..... mean annual increment (m^3/ha)			
Australia	18.5	28.5	21.8	16.9
Kenya	17.9	30.0	23.3	20.0

Comments

In the absence of sufficient growth and yield data, it is not possible to give any definite indication of growth trend. Production seems to maximize in the first coppice rotation and then gradually declines.

出典

(2) Kayumi, S.Y.S 1983 Four rotations of a Eucalyptus fuelwood trial. Commonwealth Forestry Review 62(1)

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MYRTACEAE(フトモモ科)
Eucalyptus saligna (シドニーブルーガム)
国　：ブラジル

データ採取地の立地環境

In spite of the large-scale plantation of the species, published growth and yield data are very scarce. The data from Brazil quoted below are for mixed eucalyptus spp. with E. saligna maximum 32 percent; hence it has limited application.

Locality:	spread over from State of Paraibo to Santa Catarina
Altitude:	0 to 700 m
Data source:	temporary sample plots
Number of plots:	1 075
Plot size:	100 m^2

成長・収穫に関する表，図，式など

MAI (m^3/ha) by site index for two stocking densities

Site index	26	22		18		14	
Stems/ha / Age (years)	1600	1600	1000	1600	1000	1600	1000
	..... mean annual increment (m^3/ha)						
4	33.3	22.8	17.8	15.0	11.8	9.3	7.3
6	56.0	38.2	29.6	25.2	19.7	15.6	12.2
8	66.7	45.5	35.4	30.0	23.4	18.6	14.5
10	70.5	48.0	37.4	31.7	24.7	19.7	15.3
12	70.6	48.2	37.5	31.8	24.8	19.8	15.4
14	69.2	47.1	36.7	31.1	24.2	19.4	15.0
16	-	-	35.4	-	23.4	-	14.6
18	-	-	34.0	-	22.4	-	12.9
20	-	-	32.6	-	21.5	-	12.5

Remarks: Site index has been calculated by the height of the tallest tree per plot at reference age 8 years. Volume is calculated with bark but no indication of measurement limit.

出典

(1) Heinsdijk, D. 1970 Forestry in Southern Brazil, Forest Research Station "De Dorschkamp" Wageningen, Netherlands

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MYRTACEAE（フトモモ科）

Eucalyptus tereticornis　（ユーカリトレッチガム）

国　：インド

データ採取地の立地環境

Locality:	plantation distributed over entire country
Altitude:	0 - 800 m
Rainfall:	1 000 - 2 000 mm
Data source:	permanent sample plots
Number of plots:	124
Measurement specification:	Up to 5 cm top diameter over bark

成長・収穫に関する表，図，式など

(a) Site index equation for a reference age 6 years

$$\log SI = \log Ht + 3.8814897 \left(\frac{1}{A} - \frac{1}{6}\right)$$

with $r^2 = 0.8649$

where: SI = site index
A = age of the crop
Ht = top height in metres of 250 stems/ha with largest diameter

Three site quality classes have been distinguished:

Quality	Site index
I	24 - 18
II	18 - 12
III	12 - 6

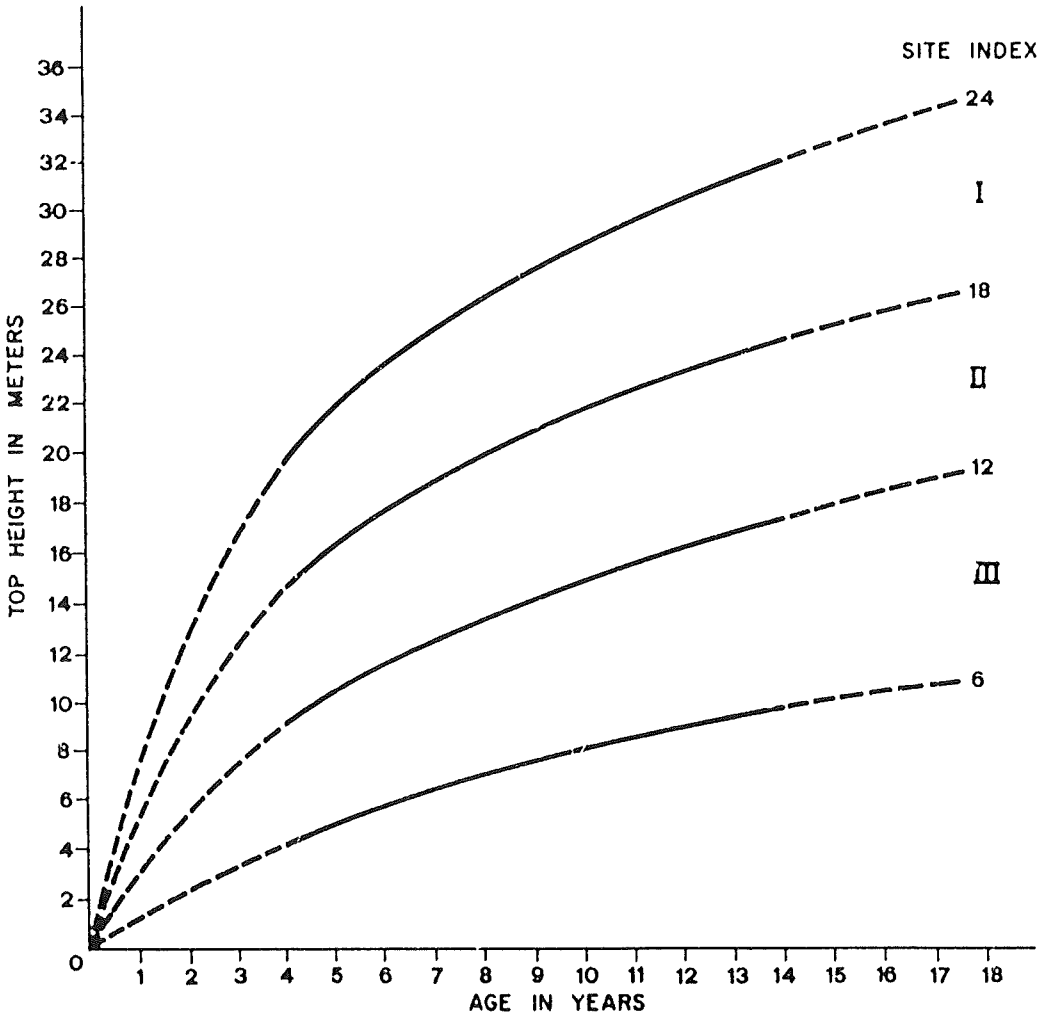
(b) MAI (m^3/ha) by stocking density and site quality

Site quality	I			II		
stems/ha / Age (years)	1200	1800	2900	1200	1800	2900
	..... m^3/ha					
4	12.1	15.5	17.2	3.0	3.3	5.0
5	14.1	18.0	20.1	4.2	4.6	5.6
6	15.1	19.3	21.0	5.0	5.5	5.7
7	15.5	19.8	20.9	5.6	6.1	6.1
8	15.5	19.9	20.4	6.0	6.5	-
9	15.3	19.6	19.6	6.2	6.7	-
10	14.9	19.1	18.8	6.3	6.9	-
11	14.6	18.6	-	6.2	6.9	-
12	14.1	18.0	-	6.2	6.9	-
13	13.7	17.5	-	6.1	6.8	

In India MAI of volume production seems to culminate between 7 to 8 years on better site and between 9 to 12 years on poor sites. Mean annual increment of ± 15.0 m^3/ha could be a reasonable estimate on a favourable site with good stocking between 8 to 10 years.

Eucalyptus tereticornis - India (3)

Site index curves



出典

(3) Sharma, R.P. 1978 Yield tables for Eucalyptus hybrid (plantation) for various levels of stooking. The Indian Forester. Vol. 104 No. 6.

ダイジェストデータ Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：MYRTACEAE(フトモモ科)
Eucalyptus tereticornis (フォレストレッドガム)
国：インド

データ採取地の立地環境

Locality:	plantation distributed over entire country
Altitude:	0 - 800 m
Rainfall:	1 000 - 2 000 mm
Data source:	permanent and temporary sample plots
Number of plots:	164
Measurement specification:	5 cm over bark

成長・収穫に関する表，図，式など

Relationship between MAI, age, basal area and top height:

$$\log_e (MAI) = -4.580245 - 0.996744 \log_e A + 0.628078 \log_e B + 2.466623 \log_e Ht$$

with $r^2 = 0.970636$

where: MAI = mean annual increment in m^3 per ha
A = age of the stand
B = basal area in m^2 per ha
Ht = top height in metres of 250 stems/ha with largest diameter

出典

(1) Chaturvedi, A.N. Rotations in Eucalyptus hybrid plantations. The Indian 1973 Forester. Vol. 99 No. 4.

ダイジェストデータ．Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種、MYRTACEAE(フトモモ科)

Eucalyptus teretiornis (フォレストレッドガム)

国 :インド

成長・収穫に関する表，図，式など

Regression equation (based on actual measurement of 90 trees)

WG = - 6.108778 + 253.23692 D^2H with r^2 = 0.9914

WD = 0.41880 + 312.24714 D^2H with r^2 = 0.9916

WG = 4.3959253 + 1159.3166 V with r^2 = 0.9974

WD = - 2.797625 + 939.677380 V with r^2 = 0.9960

where: WG = green weight in kilograms without bark
WD = dry weight in kilograms
D = diameter of the tree in cm at breast height
H = height of the tree in metres
V = volume in m^3 under bark measured up to 5 cm top diameter

出典

(4) Sharma, R.P. 1978 Weight tables for volume/weight relation for Eucalyptus hybrid. The Indian Forester. Vol. 104 No. 8.

ダイジェストデータ Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：COMBRETACEAE(シクンシ科)
Terminalia ivorensis (ウラミレ)
国　：ナイジェリア

Growth and yield studies of the species seem to be very limited. Only one reference of Nigeria (1) could be traced, which gives data from three localities where it has been planted.

データ採取地の立地環境

成長・収穫に関する表，図，式など

Parameter	Reported information by locality		
	Gambasi	Ogba	Sapoba
Altitude	0-200 m	0-200 m	0-200 m
Rainfall	1200 mm	2200 mm	2200 mm
Soil	-	deep red sandy loam	deep red sandy loam
Data source	P.S.P.	P.S.P.	P.S.P.
No. of plots	one	one	one
MAI (m^3/ha)			
(A1)	-	14.8 (11)[1]	-
(A2)	-	-	17.4 (24)[1]
(A3)	7.8 (31)[1]	-	-
Remark	no record of thinning	thinning included	unthinned

A1, A2, A3 refer to age.
[1] Figures in brackets indicate age in years.

出典

(1) Horne, J.E.M. 1962 Growth rates in the timber plantations of Western Nigeria. Nigerian For. Information Bulletin (N.S.) No. 12.

ダイジェストデータ：Pandrey, D　Growth and yield of plantation species in the tropics, FAO　1983　所収

樹種：COMBRETACEAE(シクンシ科)
Terminalia superba (サンバ)
国　：コートジボアール(象牙海岸)

成長・収穫に関する表，図，式など

MAI in m^3/ha for different site[1] class

Site class / Age (years)	2	5	6
	.....	m^3/ha	.....
23	6.3	1.9	2.4
24	-	3.9	3.2
27	5.8	-	-

[1] Fertility class

Remarks: Measurement specification is 20 cm girth. No other details

出典

(1) Groulez, J. and Wood, P.J. Monograph on Terminalia superba (in press). 1983

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：COMBRETACEAE(シクンシ科)
Terminalia superba (リンバ)
国　：ナイジェリア

データ採取地の立地環境

成長・収穫に関する表，図，式など

Locality:	Olokemeji, Western Nigeria	
Rainfall:	1 150 cm	
Data source:	one sample plot	
Yield:	Age	MAI in m^3/ha
	18	12.4

出典

(2) MacGregor, W.D. Silvicolture of the mixed deciduous forest of Nigeria. 1934 Oxford For. Mem. No. 18.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：RUBIACEAE(アカネ科)
Anthocephalus chinensis (カランバヤン) Syn. *A. cadamba*
國 ：インドネシア

データ採取地の立地環境

10. Anthocephalus cadamba Miq
(JABON)

Data.

Lokasi	Jumlah petak coba/ukur	Jumlah pemeriksaan	Tinggi dari muka laut	Keadaan lapangan/tanah
Indramayu	3	6	± 15	
Tasikmalaya	6	30	150	
Jumlah:	9	36		
Jember	4	21	20 s/d 550	
Kediri	13	22	160	
Jumlah:	17	43		
Jumlah semua:	26	79		

成長・収穫に関する表，図，式など

Umur (Age) (Tahun/Year)	Peninggi (Upper-height) (m)	TEGAKAN TETAP (MAIN STAND) (T.T.) Jumlah pohon/ha (Number of trees/ha) (N)	S %	Rata-rata tinggi (Average height) (m)	Rata-rata diameter (Average diameter) (cm)	Bidang dasar/ha (Basal area/ha) (m^2)	V.kayu tebal/ha (Thick-wood/ha (m3)	Tegakan penjarangan (T.P) (Thinnings) V.kayu tebal/ha (Thick-wood/ha (m3)	Vkt kumulatip/ha (Σ Vtw /ha) (m3)	Jumlah volume (Total volume) (Vol.T.T. + Σ T.P.) (m3/ha)	Riap rata-rata tahunan (Mea. annual increment) (m3/ha)	Riap tahunan berjalan (Current annual increment) (m3/ha)	Umur (Age) (Tahun/Year)
Anthocephalus cadamba Miq.(Jabon) BONITA I (SITE CLASS I)													
3	7,8	1300	38,2	6,6	7,6	5,9	25	2	2	27	9,0	-	3
6	10,6	865	34,4	9,4	10,0	6,8	34	10	12	46	7,7	6,3	6
9	12,4	650	33,9	11,6	12,2	7,6	44	17	29	73	8,1	9,0	9
12	14,2	500	33,9	13,4	14,5	8,2	53	22	51	104	8,7	10,3	12
15	15,8	400	34,0	15,0	16,7	8,8	61	25	76	137	9,1	11,0	15
18	17,2	340	33,9	16,2	18,7	9,4	69	25	101	170	9,4	11,0	18
21	18,3	300	33,9	17,2	20,5	9,9	76	24	125	201	9,6	10,3	21
24	19,2	275	33,7	18,1	21,7	10,2	82	23	145	227	9,5	8,7	24
BONITA II (SITE CLASS II)													
3	10,5	880	34,5	8,8	9,9	6,8	36	11	11	47	15,7	-	3
6	12,8	620	33,7	11,8	12,6	7,7	46	18	29	75	12,5	9,3	6
9	15,0	450	33,8	14,2	15,4	8,4	57	25	54	111	12,3	12,0	9
12	17,0	350	33,8	16,2	18,3	9,2	68	24	78	146	12,2	11,7	12
15	18,8	290	33,6	18,0	20,9	10,0	79	23	101	180	12,0	11,3	15
18	20,3	245	33,8	19,4	23,6	10,7	88	21	122	210	11,7	10,0	18
21	21,4	220	33,8	20,4	25,6	11,3	97	20	142	239	11,4	9,7	21
24	22,3	205	33,7	21,4	26,1	11,8	104	18	160	264	11,0	8,3	24

BONITA III (SITE CLASS III)

3	12,4	650	33,9	11,4	12,2	7,6	44	17	17	61	20,3	-	3
6	15,2	415	34,7	14,2	16,2	8,6	58	24	41	99	16,5	12,7	6
9	17,8	320	33,8	16,7	19,5	9,6	72	25	66	138	15,3	13,0	9
12	20,0	250	34,0	19,0	23,2	10,6	87	23	89	176	14,7	12,6	12
15	21,8	215	33,6	20,8	26,1	11,5	101	19	108	209	13,9	11,0	15
18	23,4	190	33,3	22,5	28,7	12,3	113	17	125	238	13,2	9,7	18
21	24,6	170	33,5	23,7	31,1	12,9	124	15	140	264	12,6	8,7	21
24	25,4	160	33,5	24,4	32,8	13,5	131	14	154	285	11,9	7,0	24

BONITA IV (SITE CLASS IV)

3	14,2	500	33,9	13,2	14,5	8,2	54	23	23	77	25,6	-	3
6	17,5	330	33,9	16,4	19,0	9,4	73	25	48	121	20,2	14,7	6
9	20,5	240	33,8	19,4	23,8	10,7	92	21	69	161	17,9	13,3	9
12	22,8	200	33,3	21,9	27,6	12,0	110	17	86	196	16,3	11,7	12
15	24,8	170	33,2	24,0	31,4	13,2	125	14	100	225	15,0	9,7	15
18	26,4	160	32,2	25,7	33,5	14,1	140	12	112	252	14,0	9,0	18
21	27,6	140	32,9	27,0	36,7	14,8	151	11	123	274	13,0	7,3	21
24	28,5	130	33,1	27,7	38,8	15,4	162	10	133	295	12,3	7,0	24

BONITA V (SITE CLASS V)

3	16,2	390	33,6	15,2	17,0	8,9	63	25	25	88	29,3	-	3
6	20,0	260	33,3	19,2	22,8	10,6	88	22	47	135	22,5	15,7	6
9	23,1	190	33,8	22,2	28,8	12,4	113	17	64	177	19,7	14,0	9
12	25,6	160	33,2	24,8	32,9	13,6	134	13	77	211	17,6	11,3	12
15	27,7	140	34,9	26,9	36,8	14,9	153	10	87	240	16,0	9,7	15
18	29,4	125	32,7	28.6	40,4	16,0	170	8	95	265	14,7	8,3	18
21	30,6	115	32,7	29,9	43,1	16,8	183	7	102	285	13,6	6,7	21
24	31,6	110	32,6	30,8	44,9	17,4	194	5	107	301	12,5	5,3	24

出典

Suharlan, A., Sumerna, K, and Sudiono, Y (1975): Yield table of ten industrial wood specoes Lembaga Penelitian Hutan.

樹種：RUBIACEAE（アカネ科）
Anthocephalus chinensis　（カランバヤン）
国　：インドネシア

成長・収穫に関する表，図，式など

Anthocephalus chinensis 収穫表（抜粋）

地位	林令	本数/ha	平均樹高 (m)	平均胸高直径 (cm)	主林木材積 (m³/ha)	間伐材積 (m³/ha)	年平均生長量 (m³/ha)
(I)	3	1,300	6 6	7 6	25	2	9.0
	6	865	9 4	10 0	34	10	7 7
	9	650	11 6	12 2	44	17	8 1
	12	500	13 4	14 5	53	22	8 7
	15	400	15 0	16 7	61	25	9 1
	18	340	16.2	18 7	69	25	9 4
	21	300	17 2	20 5	76	24	9 6
(III)	3	650	11.4	12 2	44	17	20 3
	6	415	14.2	16 2	58	24	16 5
	9	320	16.7	19 5	72	25	15 3
	12	250	19 0	23.2	87	23	14 7
	15	215	20 8	26 1	101	19	13 9
	18	190	22 5	28 7	113	17	13 2
	21	170	23 7	31 1	124	15	12 6
(V)	3	390	15 2	17.0	63	25	29.3
	6	260	19 2	22 8	88	22	22 5
	9	190	22.2	28 8	113	17	19.7
	12	160	24 8	32 9	134	13	17 6
	15	140	26.9	36 8	153	10	16 0
	18	125	28 6	40.4	170	8	14 7
	21	115	29 9	43 1	183	7	13 6

(Suharlan, Sumarna, & Sudiono, 1975)

出典

浅川澄彦(1983)．熱帯樹種の造林特性（X）．熱帯林業 No 70 · 49-52.

樹種：RUBIACEAE(アカネ科)
Anthocephalus chinensis (カランバヤン)
国　：フィリピン

データ採取地の立地環境

(1) G arborea, A. chinensis

調査林分は，ルソン島中部にあるフィリピン大学マキリン山演習林内の1973年植栽の G arborea 林とA chinensis 林である。これらの林分は標高約 400mに位置し，フタバガキ科の天然林を部分的に伐採した後植栽されたものである。

1983年3月にG. arborea 林と斜面上部のA. chinensis 林に大きさがそれぞれ 400㎡と 300㎡の調査区を，また1984年3月に斜面下部のA. chinensis 林に大きさが 250㎡の調査区を設定し，調査区内の全ての立木の胸高直径と標本木の樹高を1986年2月まで毎年2月か3月に測定した。そして1984年にはG. arborea 林と斜面上部のA. chinensis 林で，1985年には斜面下部のA. chinensis 林で，1986年には全林でサンプル木を各々6本，7本，3本，各々の調査区外から選び，伐倒して，層別刈り取り法と相対生長法および比断面積法によって林分の現存量，生産量を推定した。幹，幹材積については，G arborea 林と斜面上部のA. chinensis 林では1984年と1986年のサンプル木をこみにした相対生長関係式から1983～1986年および1984年～1986年の各林分の幹現存量，幹材積を求めた。また枝現存量，葉現存量および葉面積については各林分で伐採年の1984年，1985年と1986年に，1984年と1985年には相対生長関係式から，1986年にはサンプル数が少なかったので比断面積法によって推定した。

成長・収穫に関する表，図，式など

表1　調査林分の概況と現存量

Anthocephlus chinensis (斜面上部)

調査年	立木密度	平均DBH	平均樹高	現存量					
(年)	(no/ha)	(cm)	(m)	葉量 (ton/ha)	枝量 (ton/ha)	幹量 (ton/ha)	合計 (ton/ha)	葉面積 (m^2/m^2)	材積 (m^3/ha)
1983	1700	14 3	11	—	—	81	—	—	273
1984	1660	14 7	11	0 7	18 7	82	105	0 7	277
1985	1590	15 5	12	—	—	91	—	—	306
1986	1440	16 9	12	4 6	22 4	93	119 6	4 8	312

Anthocephlus chinensis (斜面下部)

調査年	立木密度	平均DBH	平均樹高	現存量					
(年)	(no/ha)	(cm)	(m)	葉量 (ton/ha)	枝量 (ton/ha)	幹量 (ton/ha)	合計 (ton/ha)	葉面積 (m^2/m^2)	材積 (m^3/ha)
1984	1190	18 8	14	—	—	108	—	—	351
1985	1010	21 1	15	0 8	11 3	116	127 8	0 8	377
1986	910	22 9	15	1 6	11 7	117	130 6	1 5	383

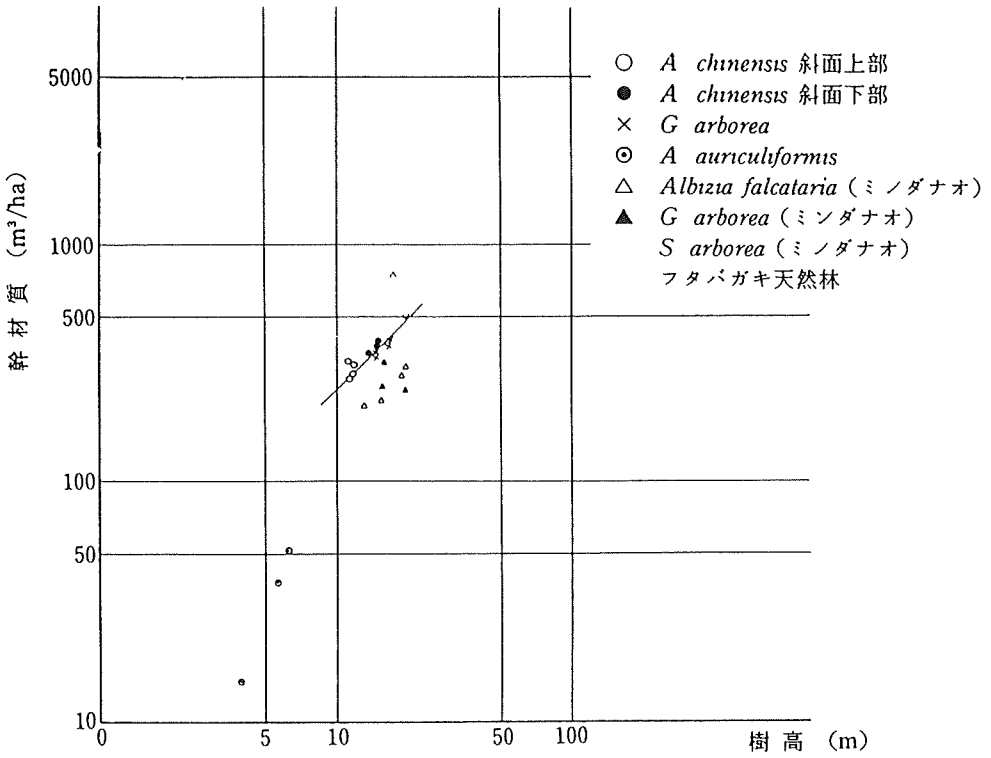


図2　幹材積と樹高との関係

表3　各早生樹種の生長量

Anthocephalus chinensis (斜面上)

期間(年)	年生長量		年平均生長量	
	幹現存量 (ton/ha·year)	幹材積 (m^3/ha·year)	林齢 (年)	幹材積 (m^3/ha·year)
1983－1984	14	49	10	27
1984－1985	87	286	11	25
1985－1986	18	55	12	26
			13	24

Anthocephlus chinensis (斜面上)

期間(年)	年生長量		年平均生長量	
	幹現存量 (ton/ha·year)	幹材積 (m^3/ha·year)	林齢 (年)	幹材積 (m^3/ha·year)
1984－1985	77	26	11	32
1985－1986	16	54	12	31
			13	29

出典

加茂皓一、石塚森吉、大住克博：早生樹種林とマツ林の生長解析、熱帯農業集報　No. 65、65～79．(1989)

樹種：BORAGINACEAE(ムラサキ科)
Cordia alliodora (オオレンケ学)
国　：インド

データ採取地の立地環境

Locality factors of the trial area

Buxa Forest Division is situated between latitude 26°31′ and 26°48′ North and longitude 89°28′ and 89°55′ East

Temperature

The average day temperature varies from 15 5°C to 21°C from November to February, betwen 27° to 32°C from May to September and between 24° to 27°C during rest of the year Frost is not known in the area

Rainfall

Rainfall is from South-west monsoon, which brings rain by the later part of May The rains are very heavy during the month of June, July and August. It subsides from the early September and disappears completely by the first week of October The average rainfall of the place of trial is 3570 mm

Soil

The soil is light, friable loam of varying depth from 15 to 90 cm and contains organic matter 2 to 2 8%, nitrogen 0.30% and pH 5 0 in 0-45 cm layer of soil in trial area

Vegetation

The forest type is 3b/E6 East Himalayan moist deciduous Forest Trial area contained the forest of Sal (*Shorea robusta*) with its usual associates viz, Chilaune (*Schima wallichii*), Champ (*Michelia champaca*), Chikrase (*Chukrasia tabularies*) Bahera (*Terminalia belerica*), Sidha (*Lagerestroemia parviflora*), Tun (*Cedrela toona*) Lali (*Amoora wallichii*), Labasune (*Amoora rohituka*), Semul (*Bombax ceiba*), Parari (*Streospermum chelonoides*) etc

Nursery and planting methods

Randomized block design was followed while laying out nursery beds and planting seedlings of the various provenances

Seeds were put in the nursery bed during February 1980 and transplanted in the polypot when the seedlings are about 10 cm in height and retained till they came of plantable size about 30 cm in height

The planting pits of 45 cm^3 were prepared at a spacing of 2 5 m × 2 5 m About 30 cm high seedlings were planted in pits with the onset of monsoon Three weedings and cleanings were carried out in first year, two in second year and three in third year.

出典

Research Notes. Indian For., 114 (1988) : 51-54.

Table 1

Details of Cordia alliodora provenances

FRI No.	Origin	Latitude	Longitude	Altitude (m)	Rainfall (mm)	Mean temperature °C
794 (i)	Tres Piedras, Honduras Republic	13°02′N	87°04′W	+ 110	1850	27 8
794 (ii)	Finca La Fortuna, Honduras	15°36′N	87°58′W	± 210	1048	25 6
794 (iii)	San Francisco	15°40′N	87°02′W	± 40	2487	23.7
794 (iv)	Esteli, Nicaragua	13°02′N	86°19′W	8-900	—	22 6
794 (v)	Pineda, Nicaragua	12°45′N	86°45′W	± 750	—	23.2
794 (vi)	Finca El Chilero Guatemala	14°23′N	90°28W	13-1400	—	20.44
794 (vii)	Finca Rincon Alegra, Guatemala	14°27′N	91°46′W	120	2901	26 1
794 (viii)	Nueva Guinea Nicaragua	11°43′N	84°26′W	220	—	26 1

成長・収穫に関する表，図，式など

Table 2

Growth of Cordia alliodora and other species.

(Date of measurement 3 4 1987)

Name of species	Provenance	Age (years)	Survival	Average Ht (m)	Growth in girth (cm)	Mahi* (cm)	Magi** (cm)
Cordia alliodora	FRI 794 (i)	6	80	5.20	24 6	0 86	4.1
	,, 794 (ii)	6	86	5 90	24.5	0.98	4.0
	,, 794 (iii)	6	90	5 60	24 6	0.93	4 1
	,, 794 (iv)	6	85	4 60	21.4	0.76	3.51
	,, 794 (v)	6	86	5 00	27 0	0.83	4 5
	,, 794 (vi)	6	85	4.50	21.0	0.75	3 5
	,, 794 (vii)	6	87	5 30	22.2	0.88	3.7
Michelia champaca	Seed stand of S R V K-15	9	100	6 16	36 1	68	4 0
	Seed stand of Mendabari	9	100	7 13	38 7	79	4.3
Gmelina arborea	Local	10	88	17 00	35.7	1 70	3.5
Tectona grandis	Bamanpokri	5	100	5 90	28 0	1 18	5.6
	South Bholka	5	100	5 10	27.0	1 02	5.4

* M a.h i. = Mean annual height increment

** M a g i. = Mean annual girth increment

樹種：VERBENACEAE（クマツヅラ科）
Gmelina arborea（キダチヨウラク、メリナ）
国：フィリピン

データ採取地の立地環境

成長・収穫に関する表，図，式など

(1) G. arborea, A. chinensis

調査林分は，ルソン島中部にあるフィリピン大学マキリン山演習林内の1973年植栽のG arborea林とA. chinensis 林である。これらの林分は標高約 400mに位置し，フタバガキ科の天然林を部分的に伐採した後植栽されたものである。

1983年3月にG. arborea 林と斜面上部のA chinensis 林に大きさがそれぞれ 400㎡と 300㎡の調査区を，また1984年3月に斜面下部のA. chinensis 林に大きさが 250㎡の調査区を設定し，調査区内の全ての立木の胸高直径と標本木の樹高を1986年2月まで毎年2月か3月に測定した。そして1984年にはG arborea林と斜面上部のA. chinensis 林で，1985年には斜面下部のA. chinensis 林で，1986年には全林でサンプル木を各々6本，7本，3本，各々調査区外から選び，伐倒して，層別刈り取り法と相対生長法および比断面積法によって林分の現存量，生産量を推定した。幹，幹材積については，G arborea 林と斜面上部のA. chinensis 林では1984年と1986年のサンプル木をこみにした相対生長関係式から，た斜面下部のA chinensis 林では1985年と1986年のサンプル木をこみにした相対生長関係式から1983～1986年および1984年～1986年の各林分の幹現存量，幹材積を求めた。また枝現存量，葉現存量および葉面積については各林分で伐採年の1984年，1985年と1986年に，1984年と1985年には相対生長関係式から，1986年にはサンプル数が少なかったので比断面積法によって推定した。

表1 調査林分の概況と現存量

Gmelina arborea

調査年 (年)	立木密度 (no/ha)	平均DBH (cm)	平均樹高 (m)	現存量 葉量 (ton/ha)	枝量 (ton/ha)	幹量 (ton/ha)	合計 (ton/ha)	葉面積 (m^2/m^2)	材積 (m^3/ha)
1983	1360	15 9	14	—	—	133	—	—	340
1984	1330	16 6	14	2 8	10 8	140	153	3 4	355
1985	1200	18 8	16	—	—	150	—	—	381
1986	1180	19 5	16	3 3	11 8	153	169	3 6	389

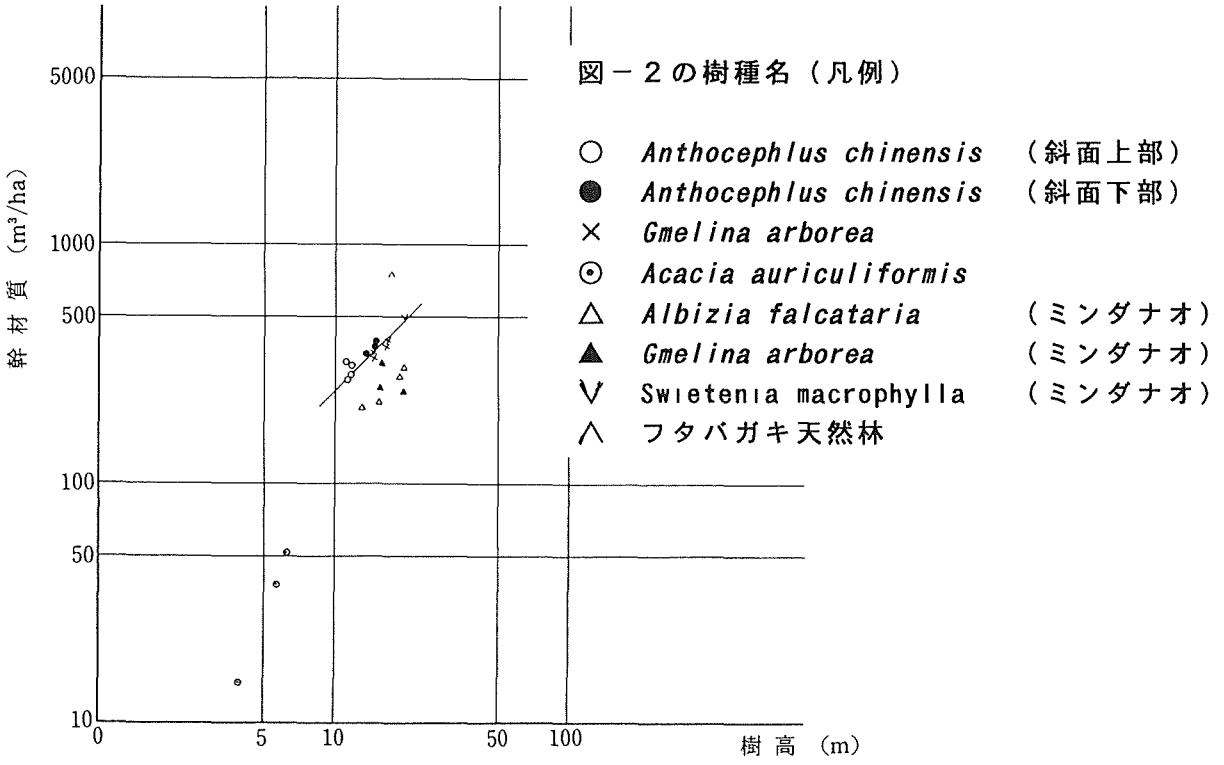


図2　幹材積と樹高との関係

表3　各早生樹種の生長量

Gmelina arborea

期間（年）	年生長量		年平均生長量	
	幹現存量 (ton/ha・year)	幹材積 (m³/ha・year)	林齢 (年)	幹材積 (m³/ha・year)
1983－1984	6 3	15 1	10	34
1984－1985	10 7	25 9	11	32
1985－1986	3 1	7 8	12	32
			13	30

出典

加茂皓一、石塚森吉、大住克博：早生樹種林とマツ林の生長解析、熱帯農業集報　No. 65、65～79．（1989）

樹種：VERBENACEAE(クマツヅラ科)
Gmelina arborea (キダチヨウラク、メリナ)
国　：ガーナ

データ採取地の立地環境

Locality:	Subri River Forest Reserve
Rainfall:	1 200 mm
Soil:	well-drained clayey
Other characters:	tropical rain forest zone, catchment
Data source:	temporary sample plots
Number of plots:	233
Size of plots:	300 m^2

Yield equation:

$$V = -6.5576 + 8.02965 \times G \qquad (r^2 = 0.99)$$

where: V = stand volume in m^3/ha under bark measured up to 5 cm diameter
G = basal area in m^2/ha measured up to 5 cm d.b.h. under bark

成長・収穫に関する表，図，式など

MAI (m^3/ha) by stand density and yield class 1/

Yield class	18		22		26	
Stems/ha / Age (years)	1000	1600	1000	1600	1000	1600
3	24.6	36.9	31.7	47.4	38.8	57.9
4	26.9	40.2	33.5	49.9	39.8	58.2
5	27.5	40.9	33.4	49.6	38.9	57.6
6	27.3	40.5	32.5	48.2	37.1	55.0
7	26.6	39.4	31.2	46.2	35.1	52.0
8	25.7	38.1	29.7	44.8	33.1	49.0
9	24.7	36.6	28.2	41.8	31.1	46.0
10	23.7	35.1	26.8	39.7	29.2	43.3
11	22.7	33.6	25.4	37.6	27.5	40.7
12	21.7	32.2	24.1	35.7	25.9	38.4
13	20.8	30.8	22.9	34.8	24.5	36.2

1/ Yield class refers to maximum MAI attained by crop for a mean stocking of 600 stems/ha.

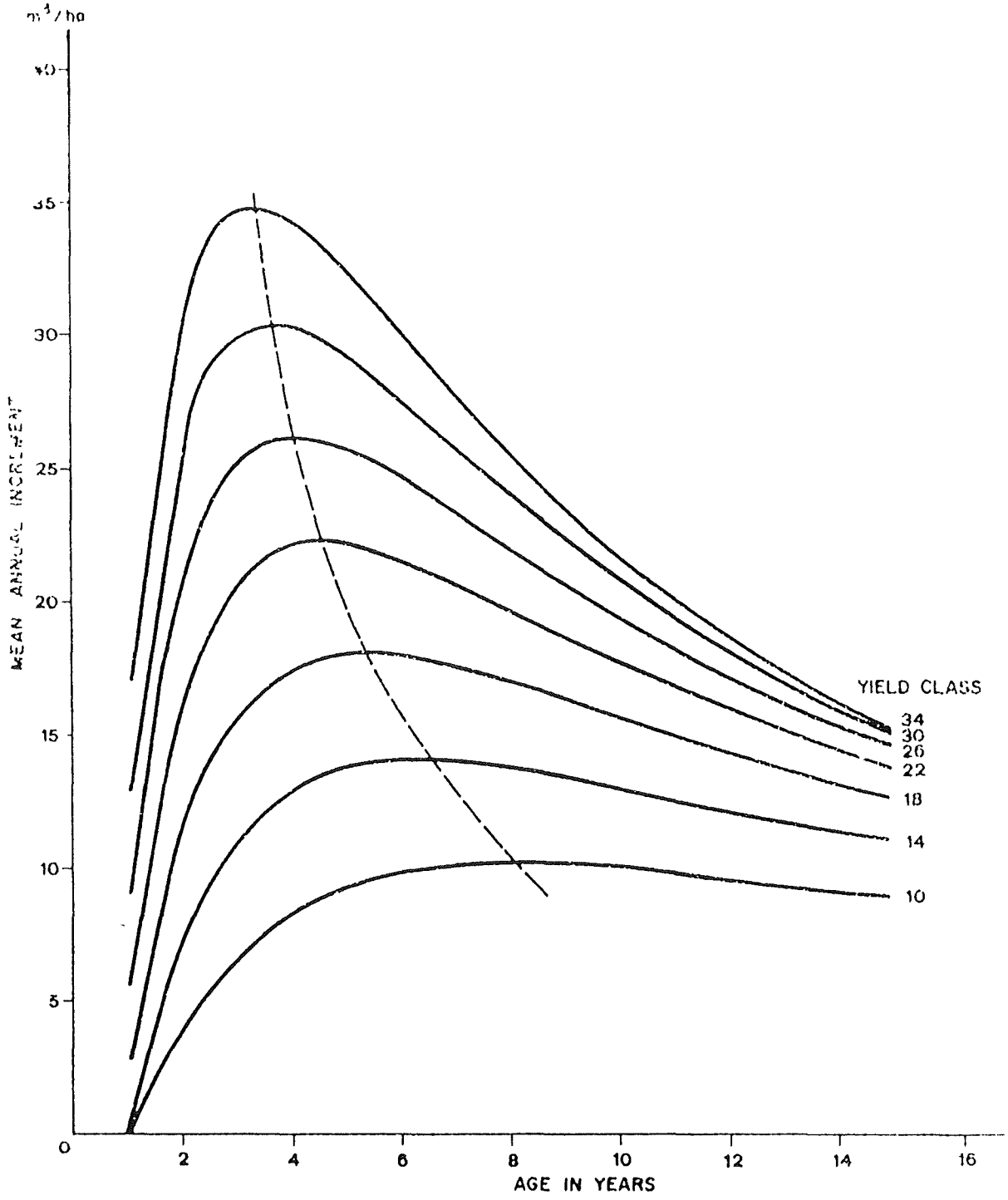
Crop has not been thinned and age of the crop covered in this study was from 1 to 10 years (MAI prediction seems to be on the higher side).

Comments

Variability of growth rate and culmination age of MAI seems to be very high under different site conditions and stand densities. However, the mean annual increment of 25 to 35 m^3/ha on median sites seems to be achieved between 5 to 10 years.

Gmelina arborea - Ghana (8)

MAI curves for different yield classes and stand density 600 stems/ha



出典

(8) UNDP/FAO Project Report No. 18. A provisional yield table for Gmelina arborea plantations in Subri River Forest Reserve (Ghana). May issue. 1982

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：VERBENACEAE(クマツヅラ科)
Gmelina arborea (キダチヨウラク、メリナ)
国　：ナイジェリア

データ採取地の立地環境

成長・収穫に関する表，図，式など

Locality:	Omo and Oluwa
Data source:	temporary sample plots
Number of plots:	359
Size of plots:	400 to 452.4 m^2

(a) Site index equation at reference age 10 years:

$$\log SI = \log Ht + \frac{1.653233}{A} - 0.1653233 \qquad (r^2 = 0.79)$$

SI = site index
Ht = top height (mean height of the 4 largest diameter trees per plot) in m
A = stand age in years

(b) Yield equation:

$$V_7 = 0.289329\ G\ Ht \qquad (r^2 = 0.9988)$$

$$V_{24} = b_1 G\ Ht + b_2 \frac{GHt}{Dg} + b_3 (GHt)^2 + b_4 \frac{(GHt)^2}{Dg^2} \qquad (r^2 = 0.98)$$

where: V_7 = stand volume in m^3/ha above 7 cm diameter (for pulpwood)
V_{24} = stand volume in m^3/ha above 24 cm diameter (for sawn timber)
G = plot basal area m^2/ha
Ht = top height in m
Dg = mean basal area diameter in cm
b_1 = 0.4269762
b_2 = - 7.4875329
b_3 = - 0.0000089
b_4 = 0.3520242

MAI (m^3/ha) by site index and density index[1/] 1000

Age (years) \ Site index	22	26	30
5	23.0	29.5	33.0
6	26.0	32.0	38.0
7	27.5	34.0	39.0
8	29.0	35.0	40.0
9	28.5	34.5	39.5
10	28.0	33.5	39.0
11	27.5	32.0	38.0
12	26.5	31.5	37.0
13	25.0	30.0	35.0
14	24.0	29.0	34.0

1/ Density index has been calculated by:

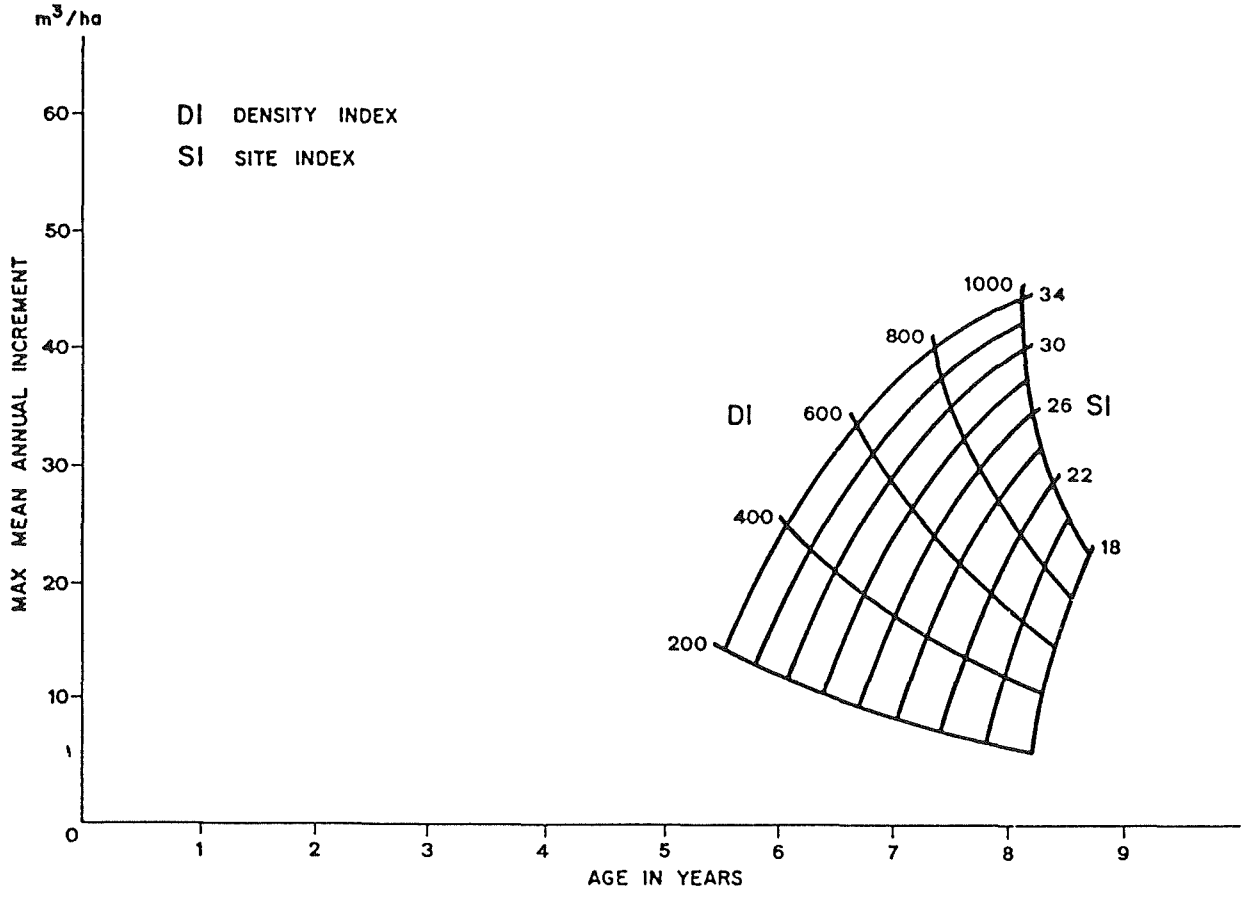
$$\log N = \log DI - 1.317059 (\log Dg - \log 25)$$

where: N = No. of stands/ha lying between 1 370 to 1 730
Dg = diameter in cm corresponding to mean basal area of plot
DI = density index

Remarks Crop has not been thinned and MAI has been calculated for measurement above 7 cm top diameter. The age of the crop covered in this study was between 4.75 to 15.75 years.

Gmelina arborea - Nigeria (6)

Maximum MAI site index and density curves



出典

(6) Sutter, H. 1981 The construction of a tree tariff table and a yield table for Gmelina arborea in the Omo and Oluwa Forest Reserves. UNDP/FAO/ Nigeria Project Working Document No. 10. FO:NIR/77/008.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：VERBENACEAE(クマツヅラ科)
Gmelina arbora (キダチヨウラク、メリナ)
国　：多国籍[マレーシア(マラヤ)、シェラレオネ]

Family　Verbenaceae

Vernacular names　Gumhar, Sewan (Hind.), Gomari (Assam), Shivan (Mar.), Shivani (Kan.), Gumadi (Tamil), Yemani (Burma).

Name used in Exotic Plantations　Gmelina or Yemane

データ採取地の立地環境

Malaysia

Sierra Leone

成長・収穫に関する表，図，式など

5.1　Growth and Yield

Malaya has produced growth data, Freezaillah and Sandrasegaran, (1966), and a yield table Sandrasegaran, (1966). These give total volume including branchwood in the 7 - 11 year old plots in the Bintang Hijan Forest Reserve.

These plots were established after a long period of farming and were very lightly thinned by Sierra Leone standards, consequently the size of the trees is less and the basal area high. The following data is extracted from Table 2 of the first reference.

Plot. No.	Spacing (ft.)	Age (yrs.)	Height (feet)	Stems per acre when cut	Total basal area in sq. feet.	Vol. of stem & branchwood u.b. to 3" diam. cu. ft. (true)	MA.I. cu. ft.
1	2	3	4	5	6	7	8
1	10 x 10	7	77	403	117	3,657	522
2	10 x 10	8	78	387	132	4,472	559
3	10 x 10	9	80	370	137	3,993	444
4	20 x 10	11	84	226	145	4,478	407

Actual figures for sample plots on reasonably good sites in the 120 inch annual rainfall zone of S.E. Sierra Leone are quoted by Fox (1967).

Plot	Age	Stocking No. of stem per acre	Mean girth inches	Basal area per acre sq. ft.	M A I Girth inches	M A I Girth largest 40 per acre inches	Mean height feet	M A I height feet
31/3	3	340	14.0	37.4	4.66	5.93	24	8
45/9	6	140	28.1	60.2	4.68	5.75	44	7.3
45/10	6	170	21.6	44.2	3.60	4.45	42	7
45/11	6	120	26.0	44.4	4.33	4.95	44	7.3
45/5	7	50	39.6	43.0	5.65	5.96	46	6.6
45/2	10	60	40.8	55.2	4.08	4.66	50	5.0

出典

Lamb, A.F.A. (1973). Fast growing timber trees of the lowland tropics No.1. Commonwealth Forestry Institute, Department of Forestry, University of Oxford.

樹種：VERBENACEAE(クマツヅラ科)
Gmelina arborea (キダチヨウラク、メリナ)
国：多国籍[マレーシア、フィリピン、マラウィ、ナイジェリア、アイボリーコースト(象牙海岸)]

データ採取地の立地環境

成長・収穫に関する表，図，式など

Countries / Details	Malaysia		Philippines	Ivory Coast	Nigeria	Malawi
Reference	(2)	(4)	(5)	(3)	(7)	(1)
Locality	Upper Perak	F.R.I. field	-	Bouahe	Nimbia	-
Altitude	150 m	-	500 m	-	580 m	1300 m
Rainfall	2000 mm	-	2200 mm	-	1820 mm	900 mm
Soil	sandy clay	moderately fertile	-	good	loam	good to poor
Other broad characters	foot hills of mt. complex	central lowland	-	semi-deciduous forest	-	-
Data source	T.S.P.	T.S.P.	T.S.P.	T.S.P.	T.S.P.	-
Size of plots	-	400 m^2	2000 m^2	3800 m^2	-	-
No. of plots	4	8	1	1	-	-
Measurement specification	7.5 cm o.b.	6.5 cm o.b.	-	20 cm	-	-
MAI (m^3/ha) (A1)	42.5 (7) 1/	59.5 (4.5) 1/	-	-	-	-
(A2)	45.3 (8)	-	34.1 (8) 1/	-	-	-
(A3)	36.0 (9)	-	-	-	-	30.4 (10) 1/
(A4)	33.0 (11)	-	-	12.0 (15) 1/	23.2 (16) 1/	-
Remark	pulpwood	fuelwood	pulpwood	thinning yield excluded	thinning yield included	

(Ai) stands for age in years.

1/ Figures in brackets indicate age in years.

5.15.4 Under bark/over bark volume relation

Regression equation based on measurement of 164 trees (8):

$$R = a + bD + CD^2 \qquad (r^2 = 0.43)$$

where:
R = volume under bark/volume over bark
D = diameter at breast height in cm
a = 0.469322
b = 0.02271861
c = - 0.0003526147

5.15.5 Relation between volumes measured up to two diameter limits

Regression equation based on measurement of 164 trees (8):

$$R = a + bD + CD^2 \qquad (r^2 = 0.75)$$

where: R = volume measured up to 12 cm diameter/volume measured up to 5 cm diameter

D = diameter at breast height in cm
a = - 0.427486
b = 0.07718335
c = - 0.001113831

出典

(1) Anon 1964 The silviculture of Gmelina arborea. Fmr. For. 6(3)

(2) Freezaillah, B.C.Y., et al. 1966 Growth and yield studies of Yemane (Gmelina arborea Roxb.). Malayan Forester.

(3) Mensbrugge, G. 1964 La fabrication des allumettes en Côte-d'Ivoire. Bois For. Trop. No. 98.

(4) Mitchell, B.A. 1963 Possibilities for forest plantations. Malayan Forester.

(5) Nanagas, F.V. et al. 1970 Preliminary study on the growth and development of Gmelina arborea Linn. in Camp 7, Minglanilla, Cebu. Occasional paper. Bureau of Forestry. Philippines.

(7) FO:SF/NIR 16 1974 Technical report 7. Savanna Forestry Research Station, Nigeria. FAO/UNDP Project.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：VERBENACEAE(クマツヅラ科)
Tectona grandis (チーク)
国：インド

データ採取地の立地環境

INDIA (10)

Locality:	spread over teak plantations in the entire country
Altitude:	0 - 1 000 m
Rainfall:	1 000 - 4 000 mm (most of the plots in 1 000 - 3 000 mm)
Data source:	permanent sample plots
Number of plots:	128
Stocking:	mostly 3 000 stems/ha and partly 750 stems/ha at the initial planting

成長・収穫に関する表，図，式など

Age (years) \ Quality class 1/	I		II		III		IV	
	Av. diam. in cm	MAI (m^3/ha)	Av. diam. in cm	MAI (m^3/ha)	Av. diam. in cm	MAI (m^3/ha)	Av. diam. in cm	MAI (m^3/ha
5	9.1	11.3	7.6	8.8	6.3	6.1	-	-
10	13.2	12.3	11.7	9.4	9.4	6.4	7.6	2.7
15	18.3	11.8	15.7	9.3	12.5	6.2	9.4	2.8
20	23.1	11.3	19.8	9.2	14.7	6.0	11.0	2.8
25	28.0	10.6	23.6	8.8	17.0	5.6	12.2	2.7
30	32.5	10.6	27.4	7.9	19.0	5.3	13.2	2.6
35	36.8	10.5	30.6	7.6	20.8	5.0	14.2	2.4
40	40.6	10.4	34.0	7.4	22.8	4.8	15.3	2.3
45	44.2	10.2	37.0	7.3	24.4	4.6	16.0	2.2
50	47.5	10.0	39.6	7.1	26.4	4.4	17.0	2.2
55	50.3	9.7	42.4	6.9	28.2	4.3	18.0	2.1
60	53.0	9.4	45.0	6.8	30.0	4.2	19.0	2.0
70	57.4	8.8	49.2	6.4	33.2	4.2	21.0	2.0
80	61.7	8.1	53.8	6.2	37.0	4.2	22.9	2.0

Remarks: MAI includes thinning yield and measurement specification is up to 5 cm diameter over bark. Av. diam. means average diameter at breast height(1.37 m).

1/ Quality classes are based on average top heights at 50 years' reference age and classes correspond to heights I ⟶ 30.5-36.6 m; II ⟶ 24.4-30.5 m: III ⟶ 18.3-24.4 m; and IV ⟶ 12.2-18.3 m.

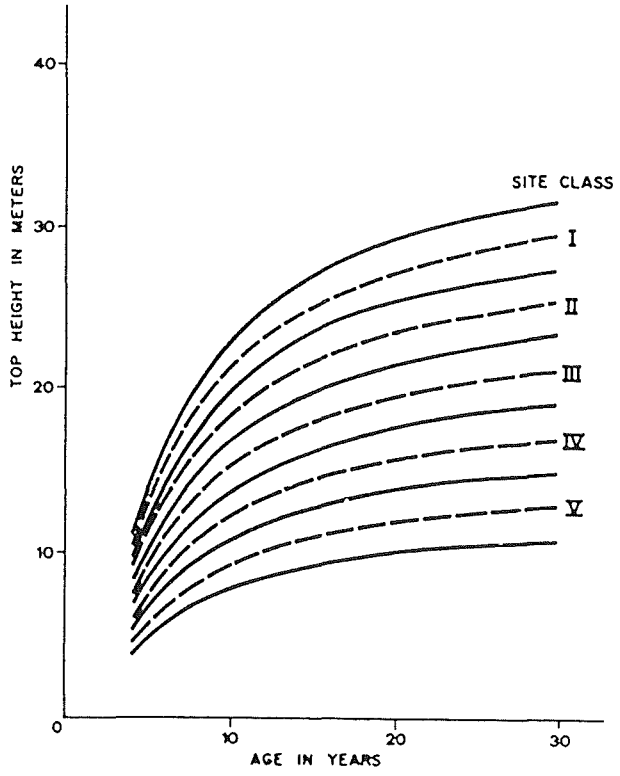
Total yield of stem timber 2/ (m^3/ha) at different rotation age

Age	Q.C. I	Q.C. II	Q.C. III	Q.C. IV
60	417.4	241.8	93.0	15.0
70	465.4	283.4	131.5	29.4
80	501.0	323.0	174.2	46.9

2/ Stem timber is measured volume above 20 cm diameter under bark.

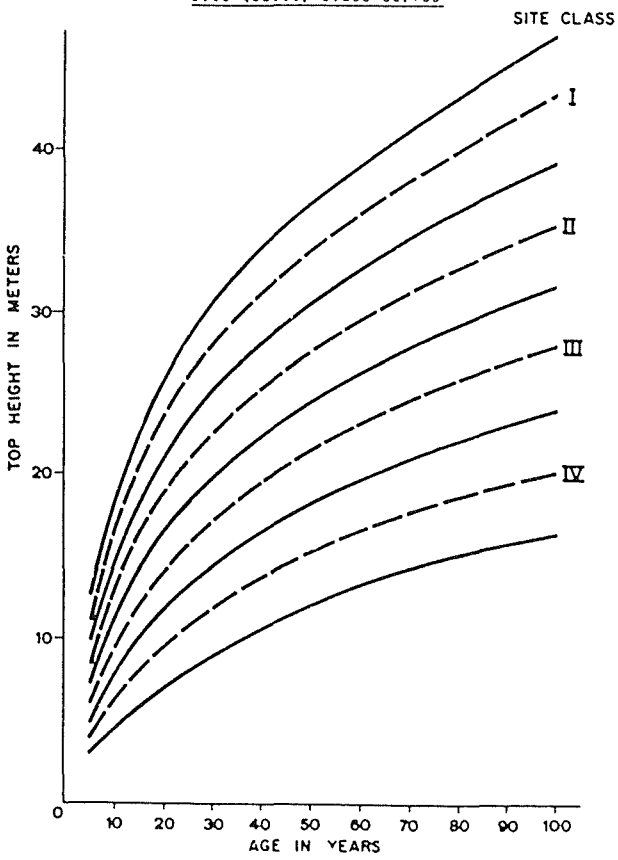
Tectona grandis - Tropical America (2)

Site classes curves



Tectona grandis - India (10)

Site quality class curves



出典

(2) Keogh, R.M. Does teak have a future in tropical America? Unasylva. 1979 Vol. 31 No. 126

(10) 1957 Yield and stand tables for plantation teak (Tectona grandis Linn. f.) Indian Forest Records Vol. 9, No. 4.

タイジェストデータ：Pandrey, D growth and yield of plantation species in the tropics. FAO. 1983 所収.

樹種：VERBENACEAE（クマツヅラ科）
Tectona grandis（チーク）
国：インド

データ採取地の立地環境

Kerala, India

3.2.5 Post-establishment operations in teak plantations

97. In Kerala, post-establishment operations commence in the 4th year when the first thinning is carried out and thinnings repeated in the 8th, 13th, 20th and 44th years. The first two thinnings are systematic (or mechanical) and reduce the crop to 1 250/ha at the first thinning and to 625/ha at the second. All subsequent thinnings are selective and aim at producing an even distribution of the crop, the retention of healthy dominant trees, the removal of all dead or suppressed trees and the felling or pollarding of inferior tree species interfering with the teak. Branches infected by mistletoe (Dendrophtoe falcata) are removed and burned. Thinnings are carried out with reference to the All India Yield Tables and the general 'rule of thumb' is that in the early stages of a plantation, the spacing should be about 1/3 of the average height. For comparison with Trinidad, an Annual Programme (a synthesis for illustration only) for that country is included in Table 2 showing expenditure heads against which the several types of work would be charged.

成長・収穫に関する表，図，式など

98 Thinning yields obtained from plantations in the Konni Division of Kerala are as follows

	Yield (m^3/ha)		
Age (years)	Poles	Timber	Total volume
4	0.439	-	0.439
8	2 646	-	2 646
13	4 381	0.005	4 386
20	6 865	0 180	7 045
30	7 328	1 591	8 919
44	7 808	4 610	12 418
Total	29 467	6 386	35 853

Table 2

Annual Programme for the Year 1963

(Trinidad and Tobago)

Working Plan Central Range Reserve

Working Circle Teak Conversion Felling Series Mount Harris

Coupe	Compartment	Net Area (ha)	Prescription	Rate	Cost
				T & T $	
1955	13	25	No work	-	-
1956	14	25	No work	-	-
1957	15	28	Mark thinnings	18.00	504 00
1958	16	30	Fell thinnings	22.00	660.00
1959	17	35	No work	-	-
1960	18	40	Weed teak	30 00	1 200.00
1961	19	40	Weed teak	35.00	1 400.00
1962	20	40	Weed late in year	40.00	1 600.00
1963	21	40	Fire-trace and burn. Lift teak stumps and plant at 2.5 m x 2.5 m	50.00	2 000.00
1964	22	45	Survey compartment, locate nursery, clear-fell and burn, form seed beds, sow seed and weed in September	-	3 000.00
Other work					
		i)	Fire protection in plantations		2 000.00
		ii)	Purchase and maintenance of tools		1 000.00
		iii)	Maintenance of buildings		2 500.00
Roads					
		i)	Cutlass and maintain inspection paths		600.00
		ii)	Maintain plantation road		2 000.00
		iii)	Extend plantation road by 500 m		4 500.00
				Total	22 964.00

出典

FAO (1985). Intensive multiple-use forest management in the tropics ; Analisis of case studies from India, Africa, Latin America and the Caribbean. FAO Forestry Paper 55.

樹種：VERBENACEAE（クマツヅラ科）
Tectona grandis（チーク）
国　：インド

データ採取地の立地環境

成長・収穫に関する表，図，式など

99. In all Divisions in the study area of Kerala, with one exception, the rotation adopted is 70 years and is aimed at obtaining trees of over 180 cm girth (57.3 cm diameter) although it is only in Site Quality Class I that the maximum number of trees of this size is obtained Table 3 illustrates this point.

Table 3

Crop diameter (cm) and percentage of trees above the exploitable diameter of 57.3 cm
(Kerala)

Age	Site Quality			
	I	II	III	IV
50	55.4 (36)	39.9 (2)	26.4 (0)	17.0 (0)
60	60.7 (59)	45.0 (4)	30.0 (0)	19.0 (0)
70	65.3 (80)	49.3 (8)	33.3 (0)	20.8 (0)
80	69.0 (88)	53.5 (25)	36.8 (0)	22.9 (0)

Source: F.R.I. and Colleges (1970). Figures in parentheses represent the % of stems above exploitable diameter.

Based on total volume, the age of maximum volume production varies from 5 to 15 years depending upon the site quality. Taking stem-wood volume alone, the mean annual increment culminates at age 50 years on Class I sites and age 75 on Class II sites. When the 70-year rotation was fixed, the demand for large size timber was strong and poles were of little value. The situation has changed and poles and small timber earn substantial revenue and one Division has already reduced the rotation to 60 years and a further reduction is possible. The average yield from final fellings in the Konni Division (see paragraph 98 above for intermediate yields) averages 88.86 m^3/ha of timber and 47.79 m^3/ha of billets.

100. The total yield obtained from thinnings and final fellings in the Konni Division averages 172.32 m^3/ha on a rotation of 70 years which gives a mean annual volume of 2.46 m^3/ha. The total yield and MAI shown in the All India Yield Tables for site qualities I to IV are:

Site Quality	Total Volume	MAI (m^3/ha)
I	610 147	8 716
II	450 263	6 432
III	293 178	4 188
IV	141 342	2 019

When the yields from the Konni plantations are compared with the All India Tables they generally fall below Class III. The low yield is primarily due to a low out-turn of thinnings suggesting poor stocking during the establishment phase but when the yield from final fellings alone is considered the out-turn approaches Class III quality.

出典

FAO (1985). Intensive multiple-use forest management in the tropics ; Analisis of case studies from India, Africa, Latin America and the Caribbean. FAO Forestry Paper 55.

樹種：VERBENACEAE（クマツヅラ科）
Tectona grandis（チーク）
国　：インドネシア

データ採取地の立地環境

1. Tectona grandis L.f.
(JATI)

Data.

Lokasi	Jumlah petak coba/ ukur	Jumlah pemeriksaan	Tinggi dari muka laut	Keadaan lapangan/tanah
Bojonegoro	2	10	85	
Ponorogo	2	11	250	
Saradan	3	10	150-200	
Madiun	7	17	±90	
Blitar	9	47	±200	
Pemalang	8	42	±80	
Balapulang	6	24	100	
Kedungjati	2	14	50	
Kendal	5	35	160-220	
Kedunggalar	3	4	300	
Banyumas	3	13	175-200	
Blora	5	29	105-130	
Ngawi	2	12	80	
Purwodadi	4	28	±70	
Cepu	5	24	100	
Pati	19	126	±25-70	
Jawa Barat	5	17	30-130	
Jawa Timur	4	17	30-500	
Jumlah:	94	480	25-500	

成長・収穫に関する表，図，式など

Umur (Age) (Tahun/Year)	Peninggi (Upper-height) (m)	TEGAKAN TETAP (MAIN STAND) (T.T.) Jumlah pohon/ha (Number of trees/ha) (N)	S %	Rata-rata tinggi (Average height) (m)	Rata-rata diameter (Average diameter) (cm)	Bidang dasar/ha (Basal area/ha) (m^2)	V.kayu tebal/ha (Thick-wood/ha (m3)	Tegakan penjarangan (T.P.) (Thinnings) V.kayu tebal/ha (Thick-wood/ha (m3)	Vkt kumulatip/ha (Σ Vtw /ha) (m3)	Jumlah volume (Total volume) (Vol.T.T + Σ T.P.) (m3/ha)	Riap rata-rata tahunan (Mean annual increment) (m3/ha)	Riap tahunan berjalan (Current annual increment) (m3/ha)	Umur (Age) (Tahun/Year)

Tectona grandis L.f. (Jati)

BONITA I (SITE CLASS I)

5	6,3	5700	19,2	5,5	4,3	6,3	-	-	-	-	-	-	5
10	10,7	2770	19,1	8,9	6,2	8,6	26	9	9	35	3,5	-	10
15	12,8	1690	20,4	11,1	8,7	10,0	48	15	24	72	4,8	7,4	15
20	14,4	1270	20,9	12,9	10,5	11,1	64	19	43	107	5,3	7,0	20
25	15,8	1050	20,9	14,3	12,0	11,8	78	23	66	144	5,8	7,4	25
30	16,8	890	21,4	15,5	13,3	12,9	90	25	91	181	6,0	7,4	30
35	17,8	765	21,8	16,6	14,7	12,4	100	27	118	218	6,2	7,4	35
40	18,8	665	22,2	17,5	16,4	13,4	110	29	147	257	6,4	7,8	40
45	19,6	590	22,5	18,4	17,3	13,8	118	31	178	296	6,6	7,8	45
50	20,2	530	23,1	19,1	18,4	14,0	126	33	211	337	6,7	8,2	50
55	21,0	490	23,1	19,9	19,4	14,4	134	34	245	379	6,9	8,4	55
60	21,6	450	23,5	20,5	20,3	14,6	140	35	280	420	7,0	8,2	60
65	22,0	425	23,7	21,0	21,0	14,8	147	36	316	463	7,1	8,6	65
70	22,6	400	23,8	21,6	21,8	15,0	153	37	353	506	7,2	8,6	70
75	23,0	380	24,0	22,0	22,6	15,2	158	38	391	549	7,3	8,6	75
80	23,4	360	23,9	22,4	23,3	15,4	164	39	430	594	7,4	9,0	80
85	23,8	345	24,3	22,8	24,0	15,6	169	39	469	638	7,5	8,8	85
90	24,2	330	24,5	23,2	24,7	15,8	174	40	509	683	7,6	9,0	90
95	24,4	320	24,6	23,5	25,1	15,9	177	40	549	726	7,6	8,6	95
100	24,7	310	24,7	23,8	25,6	16,0	180	40	589	769	7,7	8,6	100
105	25,0	300	24,8	24,1	26,1	16,1	184	41	630	814	7,7	9,0	105
110	25,2	290	25,0	24,3	26,7	16,2	186	41	671	857	7,4	8,6	110

BONITA II (SITE CLASS II)

5	9,4	3810	18,5	7,6	5,1	7,8	13	6	6	19	3,8	-	5
10	13,6	1510	20,4	12,0	9,4	10,4	55	16	22	77	7,7	11,6	10
15	16,4	950	21,3	15,0	12,7	12,1	85	24	46	131	8,7	10,8	15
20	18,6	680	22,2	17,1	15,7	13,2	106	29	75	181	9,0	10,0	20
25	20,2	545	22,8	18,8	18,1	14,1	124	32	107	231	9,2	10,0	25
30	21,4	460	23,4	20,3	20,1	14,6	140	35	142	282	9,4	10,2	30
35	22,6	400	23,8	21,5	21,9	15,1	154	37	179	333	9,5	10,2	35
40	23,6	350	24,3	22,7	23,8	15,6	160	39	218	386	9,6	10,6	40
45	24,6	310	24,8	23,7	25,7	16,1	180	40	258	438	9,7	10,4	45
50	25,4	280	25,3	24,6	27,4	16,5	192	41	299	491	9,8	10,6	50
55	26,2	260	25,4	25,6	28,8	16,9	202	42	341	543	9,9	10,4	55
60	27,0	235	26,0	26,3	30,5	17,2	212	43	384	596	9,9	10,6	60
65	27,6	220	26,2	27,0	31,9	17,6	221	44	428	649	10,0	10,6	65
70	28,2	205	26,6	27,7	33,4	18,0	230	44	472	702	10,0	10,6	70
75	28,9	195	26,6	28,2	34,5	18,2	238	45	517	755	10,1	10,6	75
80	29,4	185	26,9	28,8	35,8	18,6	246	45	562	808	10,1	10,6	80
85	29,9	175	27,2	29,2	37,2	19,0	254	46	608	862	10,1	10,8	85
90	30,3	170	27,2	29,8	37,9	19,2	260	46	654	914	10,2	10,4	90
95	30,7	160	27,7	30,2	39,4	19,5	268	46	750	968	10,2	10,8	95
100	31,0	160	27,4	30,6	39,6	19,7	274	47	747	1021	10,2	10,6	100
105	31,4	150	27,9	31,0	41,1	19,9	280	47	794	1074	10,2	10,6	105
110	31,8	150	27,6	31,3	41,2	20,0	286	47	841	1127	10,2	10,6	110

BONITA III (SITE CLASS III)

5	11,4	2800	17,8	9,7	6,5	9,2	33	12	12	45	9,0	-	5
10	16,6	925	21,3	15,2	12,9	12,0	85	24	36	121	12,1	15,2	10
15	20,0	560	22,7	18,7	17,7	13,8	123	32	68	191	12,7	14,0	15
20	22,5	410	23,6	21,5	21,6	15,1	151	37	105	256	12,8	13,0	20
25	24,4	330	24,3	23,5	24,9	16,0	175	40	145	320	12,8	12,8	25
30	26,0	270	25,2	25,1	28,0	16,7	197	42	187	384	12,8	12,8	30
35	27,2	230	26,0	26,5	31,0	17,4	217	43	230	447	12,8	12,6	35
40	28,5	200	26,7	27,8	33,8	18,0	234	45	275	509	12,7	12,4	40
45	29,6	175	27,4	29,0	37,0	18,8	251	46	321	572	12,7	12,6	45
50	30,6	160	27,8	30,0	39,3	19,4	267	47	368	635	12,7	12,6	50
55	31,6	150	27,8	31,0	41,2	20,0	283	47	415	698	12,7	12,6	55
60	32,4	140	28,0	32,0	43,3	20,6	299	47	462	761	12,7	12,6	60
65	33,2	130	28,4	32,8	45,6	21,2	313	47	509	822	12,6	12,2	65
70	34,0	120	28,8	33,7	48,1	21,8	327	46	555	882	12,6	12,0	70
75	34,7	120	28,3	34,5	48,8	22,4	341	45	600	941	12,5	11,8	75
80	35,4	110	29,1	35,2	51,5	22,9	354	45	645	999	12,5	11,6	80
85	36,0	110	28,6	35,8	52,0	23,4	366	44	689	1055	12,4	11,2	85
90	36,5	110	28,2	36,4	52,2	23,8	378	43	732	1110	12,3	11,0	90
95	37,0	110	27,8	36,8	52,9	24,2	388	43	775	1163	12,2	10,6	95
100	37,5	105	28,0	37,3	54,6	24,6	398	42	817	1215	12,2	10,4	100
105	37,9	105	27,7	37,8	54,9	24,9	407	42	859	1266	12,0	10,2	105
110	38,3	100	28,2	38,2	56,8	25,3	415	41	900	1315	11,9	9,8	110

BONITA IV (SITE CLASS IV)

5	13,4	1515	20,6	11,8	9,4	10,4	54	16	16	70	14,0	-	5
10	19,6	600	22,6	18,1	16,8	13,3	113	30	46	159	15,9	17,8	10
15	23,6	350	24,3	22,1	22,0	15,4	161	34	80	241	16,1	16,4	15
20	26,6	250	25,6	26,0	29,4	17,0	203	43	123	326	16,3	17,0	20
25	28,8	200	26,4	28,2	34,2	18,4	238	45	168	406	16,2	16,0	25
30	30,6	170	26,9	30,1	38,4	19,7	267	46	214	481	16,0	15,0	30
35	32,1	145	27,8	31,8	42,5	20,6	294	47	261	555	15,9	14,8	35
40	33,5	130	28,1	33,2	45,9	21,5	318	47	308	626	15,6	14,2	40
45	34,7	120	28,3	34,6	48,8	22,4	341	46	354	695	15,4	13,8	45
50	35,8	110	28,8	35,7	51,9	23,3	363	45	399	762	15,2	13,4	50
55	36,8	100	29,3	36,8	55,5	24,2	385	44	443	828	15,1	13,2	55
60	37,9	100	28,5	37,8	56,4	25,0	406	42	485	891	14,8	12,6	60
65	38,8	95	28,3	38,8	58,8	25,8	426	40	525	951	14,6	12,0	65
70	39,6	90	28,5	39,7	61,2	26,5	446	38	563	1009	14,4	11,6	70
75	40,4	90	28,0	40,6	62,0	27,2	465	37	600	1065	14,2	11,2	75
80	41,2	85	28,4	41,4	64,6	27,9	482	35	635	1117	14,0	10,4	80
85	41,9	80	28,6	42,0	67,4	28,6	499	34	669	1168	13,7	10,2	85
90	42,6	80	28,2	42,8	68,2	29,2	516	32	701	1217	13,5	9,8	90
95	43,2	80	27,8	43,4	68,9	29,8	531	31	732	1263	13,3	9,2	95
100	43,8	80	27,4	44,0	69,3	30,2	546	30	762	1308	13,1	9,0	100
105	44,3	80	27,1	44,6	70,0	30,8	559	28	790	1349	12,8	8,2	105
110	44,8	80	26,8	45,1	70,6	31,3	570	27	817	1387	12,6	7,6	110

BONITA V (SITE CLASS V)

5	15,4	1110	21,0	14,0	11,6	11,7	73	22	22	95	19,0	-	5
10	22,6	400	23,8	21,0	21,8	14,9	148	37	59	207	20,7	22,4	10
15	27,0	230	26,2	26,1	29,1	15,3	212	44	103	315	21,0	21,6	15
20	30,5	160	27,9	30,1	39,2	19,3	264	46	149	413	20,6	19,6	20
25	33,2	125	29,0	32,9	46,3	21,1	309	47	196	505	20,2	18,4	25
30	35,2	110	29,3	34,9	51,2	22,7	349	46	242	591	19,7	17,2	30
35	36,9	100	29,3	36,7	55,5	24,2	386	44	286	672	19,2	16,2	35
40	38,5	90	29,4	38,3	59,9	25,4	419	42	328	747	18,7	15,0	40
45	39,8	85	29,4	39,8	63,1	26,6	450	38	366	816	18,1	13,8	45
50	41,0	80	29,3	41,2	66,5	27,8	480	35	401	881	17,6	13,0	50
55	42,2	80	28,4	42,4	67,7	28,8	509	32	433	942	17,1	12,2	55
60	43,5	75	28,5	43,6	71,1	30,0	537	30	463	1000	16,7	11,6	60
65	44,6	75	27,8	44,8	72,7	31,1	564	27	490	1054	16,2	10,8	65
70	45,6	75	27,2	45,8	73,8	32,1	590	25	515	1105	15,8	10,2	70
75	46,6	70	27,5	46,9	77,5	33,0	616	22	537	1153	15,4	9,6	75
80	47,4	70	27,0	47,9	78,6	34,0	640	20	557	1197	15,0	8,8	80
85	48,2	70	26,6	48,7	79,5	34,8	663	18	575	1238	14,6	8,2	85
90	49,0	70	26,1	49,5	80,5	35,6	685	16	591	1276	14,2	7,6	90
95	49,7	70	25,8	50,2	81,4	36,4	705	14	605	1310	13,8	6,8	95
100	50,4	70	25,4	50,9	82,2	37,1	724	13	618	1342	13,4	6,4	100
105	50,9	70	25,1	51,6	82,9	37,8	742	11	629	1371	13,0	5,8	105
110	51,4	70	24,9	52,1	83,5	38,3	759	9	638	1397	12,7	5,2	110

出典

Suharlan, A., Sumerna, K, and Sudiono, Y. (1975). Yield table of ten industrial wood specoes. Lembaga Penelitian Hutan.

樹種：VERBENACEAE（クマツヅラ科）
Tectona grandis（チーク）
国：インドネシア

データ採取地の立地環境

Locality:	Kandal, Blitar, Caput, Pati, Pemalang, etc.
Altitude:	25 - 500 m
Rainfall:	1 500 - 3 500 mm
Data source:	permanent sample plots
Number of plots:	94
Measurement specification:	7 cm diameter (other details not indicated)

成長・収穫に関する表，図，式など

MAI (m^3/ha) by site classes

Age (years) \ Site class 1/	I	II	III	IV	No.of stems/ha. 3/
5	19.0	14.0	9.0	3.8	1 515
10	20.7	15.9	12.1	7.7	600
15	21.0	16.1	12.7	8.7	350
20	20.6	16.3	12.8	9.0	250
30	19.7	16.0	12.8	9.4	170
40	18.7	15.6	12.7	9.6	130
50	17.6 (66.5) 2/	15.2 (51.9)	12.7 (39.3)	9.8 (27.4)	110
60	16.7 (71.1)	14.8 (56.4)	12.7 (43.3)	9.9 (30.5)	100
70	15.8 (73.8)	14.4 (61.2)	12.6 (48.1)	10.0 (33.4)	90
80	15.0 (78.6)	14.0 (64.6)	12.5 (51.5)	10.1 (35.8)	85
90	14.2 (80.5)	13.5 (68.2)	12.3 (52.2)	10.2 (37.9)	80

Remarks: MAI includes thinning yield.

1/ Site classes are based on average top height at a reference age of 50 years and they correspond to the heights I ⟶ 41.0 m; II ⟶ 35.8 m; III ⟶ 30.6m; IV ⟶ 25.4 m

2/ Figures in brackets indicate average diameter of the tree in cm.

3/ Number of stems/ha for site class II.

出典

(9) Forest Research Institute. Forestry Department Indonesia.
1975 Yield table for ten industrial wood species.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：VERBENACEAE（クマツヅラ科）
Tectona grandis（チーク）
産地：台湾

データ採取地の立地環境

台湾
サンプルプロット数不明
標準地調査

要因項目 (Item)	適用種頃之範圍 (Category)
土性	砂壌土及粘壌土爲最適宜，礫質土及砂土不適合。
土壌有效深度	適於較深表土之土壌。
地表植物	以軟莖草頃之植物散生之林地。
海拔高	適於海拔 200～400 公尺。
坡度	在 20° 以下林地均可。
林地部位	除山頂嶺上不適合外，餘均可。
方位	適於東或東北向，最不適於西向或南向。
土壌含石量	含石量 11～30% 爲最適合，但要求度不大。
土壌濕潤度	稍乾之林地爲可，但要求度不大。
土壌肥沃度	要求度不大，中庸者較好。

成長・収穫に関する表，図，式など

表 28. 臺灣柚木人工林林分收穫表
Table 28 Yiela table of Teak in Taiwan

齢階 (年)	地位指數 平均	地位指數 範圍	林分平均胸高直徑 (cm) 平均	林分平均胸高直徑 (cm) 範圍	林分高 (m) 平均	林分高 (m) 範圍	每公頃胸高斷面積 (m²) 平均	每公頃胸高斷面積 (m²) 範圍	每公頃立木材積 (m³) 平均	每公頃立木材積 (m³) 範圍	每公頃立木材數 平均	每公頃立木材數 範圍	每公頃立木材積 (m³) 連年生長量	每公頃立木材積 (m³) 定期生長量	每公頃立木材積 (m³) 平均生長量	齢階 (年)
I級																
5	7 68	7 11～ 8 35	8 68	8 44～ 8 86	9 32	8 89～ 9.74	15 84	15.03～16 65	56 37	51 58～ 60.03	1487	1546～1429	11 27	56 37	11 27	5
10	12 37	11 62～13 25	12 56	12 23～12 82	12 32	11 81～12 79	22 68	21 53～23 84	107 95	100.65～113 54	1383	1421～1347	10 32	51 58	10 80	10
15	15 87	14 99～16 91	15 98	15 57～16 30	14 89	14 25～15 32	23 25	24 95～27 55	149 60	140 25～156 75	1150	1179～1122	8 33	41.65	9 97	15
20	18 60	17 62～19.75	18 90	18 43～19 28	16 84	16.23～17 39	23 44	27.07～29.82	183 07	171 93～191 59	940	964～ 917	6 69	33 47	9 15	20
25	20 82	19 74～22 07	21 44	20 91～21 85	18 53	17 93～19 11	29 94	28 52～31 36	210 56	197 79～220 32	793	814～ 773	5 50	27 49	8 42	25
30	23 64	21 49～23 98	23 65	23 07～24 11	19 98	19 34～20 57	31 02	29 57～32 48	233 69	219 43～244 60	669	687～ 651	4 63	23 13	7 79	30
35	24 19	22 97～25 62	25 62	24 99～25 11	21 20	20 54～21 81	31 85	30 37～33 33	253 58	237 91～265 56	575	592～ 559	3 98	19 89	7.25	35
40	25 50	24 00～27 00	27 37	23 70～27 90	22 27	21 60～22 90	32 50	31 00～34 00	271 00	254 00～284.00	505	520～ 490	3 48	17 42	6 78	40
45	26 65	25 31～28 23	28 95	28 24～29 51	23 21	22 52～23 85	33 01	31 50～34 53	286 49	268 23～300 46	448	462～ 434	3 10	15 49	6 37	45
50	27 66	26 20～29 30	30 39	29 63～30 98	24 04	23 33～24 69	33 44	31 92～34 97	300 46	280 98～315 35	402	415～ 389	2 79	13 97	6 01	50
II級																
5	5 90	5 23～ 6 57	7 99	7 69～ 8 29	7 88	7 18～ 8 49	13 43	12 33～14 44	42 14	35 24～ 48 20	1750	1935～1624	8 43	42 14	8 43	5
10	10 03	9 16～10 91	11 59	11 16～12 00	10 66	9 85～11 36	19 25	17 69～20 69	86 25	75 73～ 95 49	1550	1668～1470	8 82	44 11	8 63	10
15	13 13	12 11～14 16	14 79	14 23～15 30	13 00	12 12～13 76	22 40	20 63～24 00	121 82	108 34～133 65	1279	1369～1217	7 11	35 57	8 12	15
20	15 51	14 40～16 69	17 53	16 92～18 11	14 93	14 00～15 74	24 36	22 49～23 06	149 96	133 91～164 00	1046	1121～ 995	5 63	23 14	7.50	20
25	17 48	16 23～18 73	19 90	19 21～20 55	16 53	15 56～17 38	25 72	23 77～27 47	172 63	154 24～188 78	885	949～ 841	4.53	22 67	6 91	25
30	19 06	17 72～20 40	21 97	21 22～22 68	17 90	16 89～18 78	23 70	24 72～23 50	191 31	170 75～209 36	751	808～ 711	3 74	18 68	6 38	30
35	20 38	18 95～21 81	23 80	22 98～24 57	19 06	18 01～19 95	27 45	25 43～29 23	207.02	184 44～226.85	649	701～ 614	3 14	15 71	5 91	35
40	21 50	20 00～23 00	25 42	24 55～26 25	20 07	19 00～21 00	23 05	23 00～29 90	220 50	196 00～242 00	572	620～ 540	2 70	13 48	5 51	40
45	22 46	20 89～24 04	26 88	25 96～27 76	20 96	19 86～21 91	23.52	23 45～30 39	232 23	205 92～255.34	510	554～ 480	2 35	11 73	5.16	45
50	23 30	21 67～24 94	28 20	27 23～29 13	21 74	20 61～22 71	23 91	23 83～30.80	242 60	214 54～267 24	460	502～ 432	2 07	10 37	4 85	50
III級																
5	3.89	3 00～ 4 78	6 70	5 50～ 7 43	5 38	3.84～ 6 66	9 41	7 03～11 46	18 34	3 97～ 30 17	2461	3065～2072	3 67	18 34	3 67	5
10	7 41	6 24～ 8 58	9 75	8 04～10 79	7.78	6.00～ 9 25	13 54	10.16～16 46	49 94	28.03～ 67 99	2002	2385～1755	6.32	31 60	4.99	10
15	10 05	8 68～11.42	12 53	10 43～13 81	9 87	7.94～11.47	15 97	12 17～19 25	75 33	47 28～ 98.44	1626	1920～1436	5 08	25 39	5 02	15
20	12 11	10 58～13.63	14 91	12 49～16.39	11 62	9 58～13 31	17 54	13 51～21.03	94 57	61 14～122 11	1334	1577～1176	3 85	19 24	4 73	20
25	13 72	12 05～15 39	16 97	14 25～18 62	13 06	10 93～14 84	18 65	14 48～22 26	109 18	70.88～140 72	1132	1343～ 997	2 92	14 61	4 37	25
30	15 03	13.24～16 8	18 75	15 77～20 57	14 30	12 08～16.13	19 47	15 20～23 16	120 40	77 60～155 65	971	1158～ 850	2 24	11.22	4.01	30
35	16 11	14 20～18 01	20 3	17 09～22 28	15 34	13 05～17 23	20 10	15 75～23 85	129 13	82 12～167 85	848	1017～ 739	1 75	8 73	3 69	35
40	17 00	15 00～19 0.	21 70	18 25～23 80	16 25	13 90～18 20	20 60	16.20～24 40	136 00	85 00～178 00	755	910～ 655	1 37	6 87	3 40	40
45	17 75	15 65～19 84	22 95	19 27～25 16	17.04	14 64～19 04	21 00	16 56～24 84	141 45	86 66～186 58	679	822～ 587	1 09	5 45	3.14	45
50	18 40	16 22～20 58	24 03	20 17～26 39	17 74	15 28～19 78	21 33	16 86～25 20	145 80	87 37～193 92	618	752～ 532	0 87	4 35	2 92	50

出典

Tzu-Yu Lin (1972). Studies of silviculture and yield for Teak (Edtimation of the productivity woodland and preparation of yield tables for Teak). Technical Bulletion No.102, Dept of Forestry, Collage of Agriculture, National Chung Hsing University, Taiwan.

樹種：VERBENACEAE(クマツヅラ科)
Tectona grandis (チーク)
国　：タイ

データ採取地の立地環境

In order to determine the yield of teak plantation, fifty-nine squared sample plots each of 0.25 rai were laid out in plantations aged 9 - 63 years in northern Thailand. Total height of dominant and codominant trees and breastheight diameter of teaks in the plots were measured. The relationship of age and height from the collected data was set up and a curve was drawn. Using the height at base age 30 years, site index curves were classified for 5 site qualities ; 14, 17, 20, 23, and 26 meters. Using the site indices, the plantation at age 14, 24, 32, and 59 years were classified accordingly to site quality. Then 50 trees from each age-class were sampled. At each 5 meters intervals from ground level to merchantable height and at breastheight, diameter and bark thickness of sample trees were measured. Based on the data, the relationship of breastheight diameter and merchantable volume were expressed as regression equations.

成長・収穫に関する表，図，式など

The result revealed that merchantable volume per tree of teak in plantation could be estimated by the following equations :

site index 14 : $V = 0.00011\ D^{2.39734}$ $(r = 0.99)$

site index 17 : $V = 0.00016\ D^{2.35235}$ $(r = 0.99)$

site index 20 : $V = 0.00018\ D^{2.33497}$ $(r = 0.98)$

site index 23 : $V = 0.00015\ D^{2.4255}$ $(r = 0.99)$

site index 26 : $V = 0.00021\ D^{2.35299}$ $(r = 0.98)$

Where

V = merchantable volume (inner bark), in cubic meters.

D = breastheight diameter (outer bark), in centimeters.

The total volume of 59 sample plots were then determined by the above regression equations. The relationship of yield-, basal area-, number of trees per unit area and average breastheight diameter on age and height can be expressed by the following equations :

$$Y_1 = -9.7457 + 0.2937\ X_1 + 1.1669\ X_2 \quad (R = 0.89)$$

$$Y_2 = 0.1756 + 0.0257\ X_1 + 0.1150\ X_2 \quad (R = 0.79)$$

$$Y_3 = -3.5712 + 0.2044\ X_1 + 0.9371\ X_2 \quad (R = 0.90)$$

$$Y_4 = 4512.7612\ Y_3^{-1.3106} \quad (r = 0.89)$$

Where

Y_1 = merchantable volume (inner bark), in cubic meters per rai.

Y_2 = basal area, in square meters per rai.

Y_3 = average breastheight diameter, in centimeters.

Y_4 = number of trees per rai.

X_1 = age, in years.

X_2 = average height of dominant and codominant trees, in meters.

These equations can be used when age and height of teak in plantation are known. Yield tables for teak plantation classified to 5 site indices for ages 10 to 60 years and volume tables at various breastheight diameters and site indices are presented.

Estimate yield per rai of teak plantation in northern Thailand shows that merchantable volumes (inner bark) at rotation age of 60 years are 25.85, 30.16, 33.90, 37.40, and 41.48 cubic meters for site indices 14, 17, 20, 23, and 26, respectively.

Table 9 Yield table for teak in forest plantation in northern Thailand. (site index 26)

Age (yrs.)	Diameter at breastheight (cm.)	Average height of dominant and codominant trees (m.)	Number of trees (stems/rai)	Basal area (m^2/rai)	Merchantable volume (m^3/rai)
10	15.01	17.0	130	2.39	13.03
15	19.44	20.5	92	2.92	18.58
20	22.90	23.0	75	3.33	22.97
25	25.30	24.5	65	3.64	26.19
30	27.86	26.0	58	3.94	29.40
35	29.85	27.0	53	4.18	32.04
40	31.36	27.5	49	4.37	34.09
45	32.63	27.8	47	4.53	35.41
50	33.89	28.0	45	4.68	37.61
55	35.40	28.5	42	4.87	39.66
60	36.67	28.8	40	5.03	41.48

From : Table 1, 5, 6, 7, and 8.

Table 10 Yield table for teak in forest plantation in northern Thailand. (site index 23)

Age (yrs.)	Diameter at breastheight (cm.)	Average height of dominant and codominant trees (m.)	Number of trees (stems/rai)	Basal area (m^2/rai)	Merchantable volume (m^3/rai)
10	13.07	15.0	155	2.16	10.69
15	16.52	17.5	114	2.57	15.08
20	19.98	20.0	89	2.99	19.47
25	22.46	21.5	76	3.29	22.69
30	24.94	23.0	67	3.59	25.90
35	26.69	23.8	61	3.81	28.31
40	28.44	24.5	56	4.02	30.59
45	29.71	24.8	53	4.18	32.41
50	30.98	25.0	50	4.34	34.11
55	32.14	25.2	48	4.49	35.81
60	33.26	25.3	46	4.63	37.10

From : Table 1, 5, 6, 7, and 8.

Table 11 Yield table for teak in forest plantation in northern Thailand. (site index 20)

Age (yrs.)	Diameter at breastheight (cm.)	Average height of dominant and codominant trees (m.)	Number of trees (stems/rai)	Basal area (m^2/rai)	Merchantable volume (m^3/rai)
10	11.12	13.0	192	1.93	8.36
15	14.58	15.5	135	2.34	12.75
20	17.55	17.5	106	2.70	16.55
25	19.78	18.8	90	2.98	19.53
30	22.02	20.0	78	3.25	22.40
35	23.77	20.8	71	3.47	24.81
40	25.04	21.0	66	3.62	26.51
45	26.55	21.5	63	3.80	28.56
50	27.81	21.8	58	3.97	30.38
55	29.00	22.0	54	4.12	32.03
60	30.34	22.3	52	4.28	33.90

From : Table 1, 5, 6, 7, and 8.

Table 12 Yield table for teak in forest plantation in northern Thailand. (site index 17)

Age (yrs.)	Diameter at breastheight (cm.)	Average height of dominant and codominant trees (m.)	Number of trees (stems/rai)	Basal area (m^2/rai)	Merchantable volume (m^3/rai)
10	9.18	11.0	247	1.70	6.30
15	12.14	13.0	171	2.06	9.83
20	15.11	15.0	129	2.41	13.63
25	17.11	16.0	107	2.66	16.27
30	19.10	17.0	95	2.90	18.90
35	20.85	17.8	84	3.12	21.30
40	22.12	18.0	78	3.27	23.01
45	23.63	18.5	72	3.46	25.06
50	24.89	18.8	67	3.62	26.88
55	26.16	19.0	63	3.77	28.58
60	27.28	19.1	59	3.91	30.16

From : Table 1, 5, 6, 7, and 8.

Table 13 Yield table for teak in forest plantation in northern Thailand. (site index 14)

Age (yrs.)	Diameter at breastheight (cm.)	Average height of dominant and codominant trees (m.)	Number of trees (stems/rai)	Basal area (m^2/rai)	Merchantable volume (m^3/rai)
10	7.23	9.0	338	1.47	3.69
15	10.20	11.0	215	1.83	7.50
20	12.63	12.5	162	2.13	10.71
25	14.43	13.3	136	2.35	13.12
30	16.18	14.0	117	2.56	15.40
35	17.94	14.8	103	2.78	17.80
40	19.20	15.0	94	2.93	19.51
45	20.32	15.1	87	3.07	21.09
50	21.49	15.3	81	3.22	22.79
55	22.61	15.4	76	3.36	24.38
60	23.78	15.5	71	3.50	25.85

From : Table 1, 5, 6, 7, and 8.

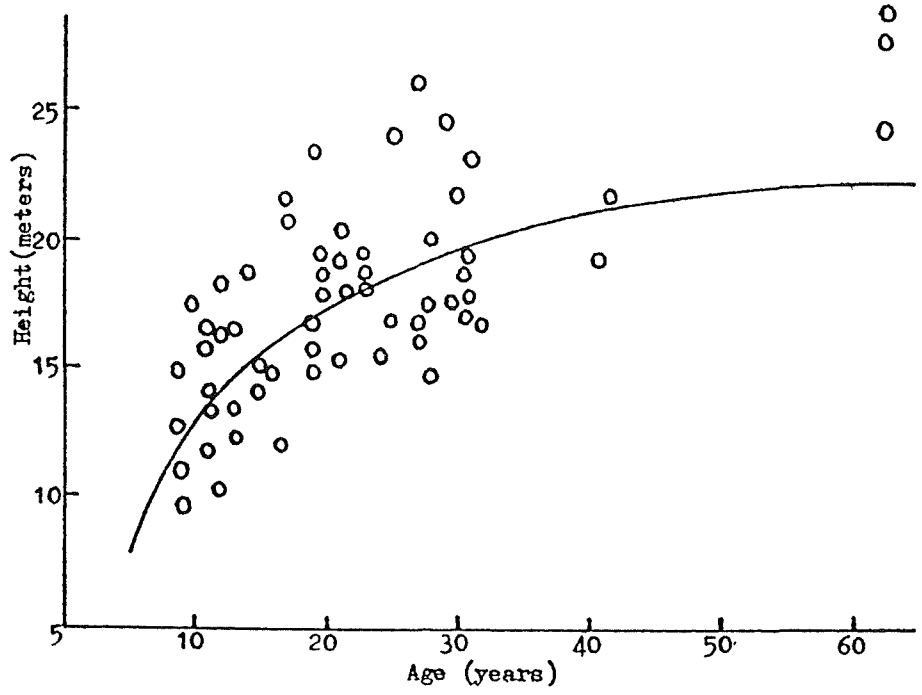


Figure 1 Relationship of height and age of teak in forest plantation in northern Thailand.

(From equation : $\log(\text{height}) = 1.11924 + \frac{0.00525}{(\text{age})}$)

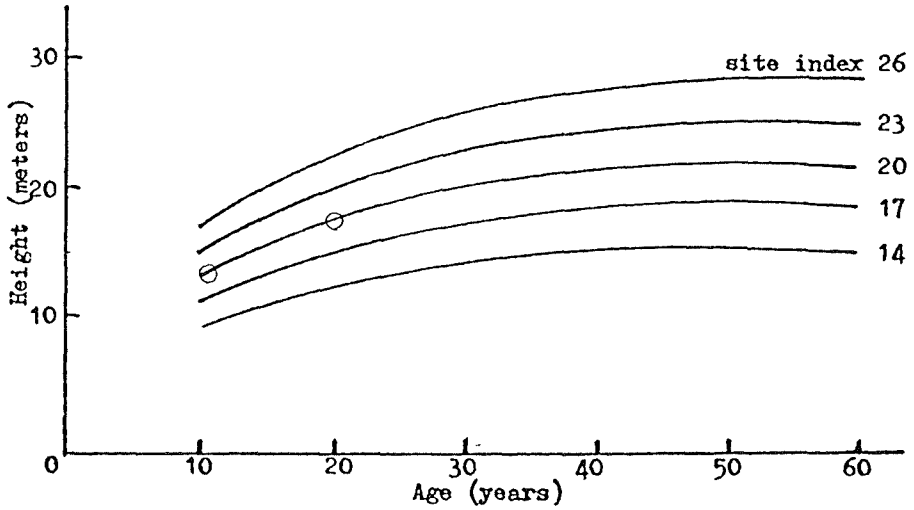


Figure 2 Site index curve for teak plantation in northern Thailand.

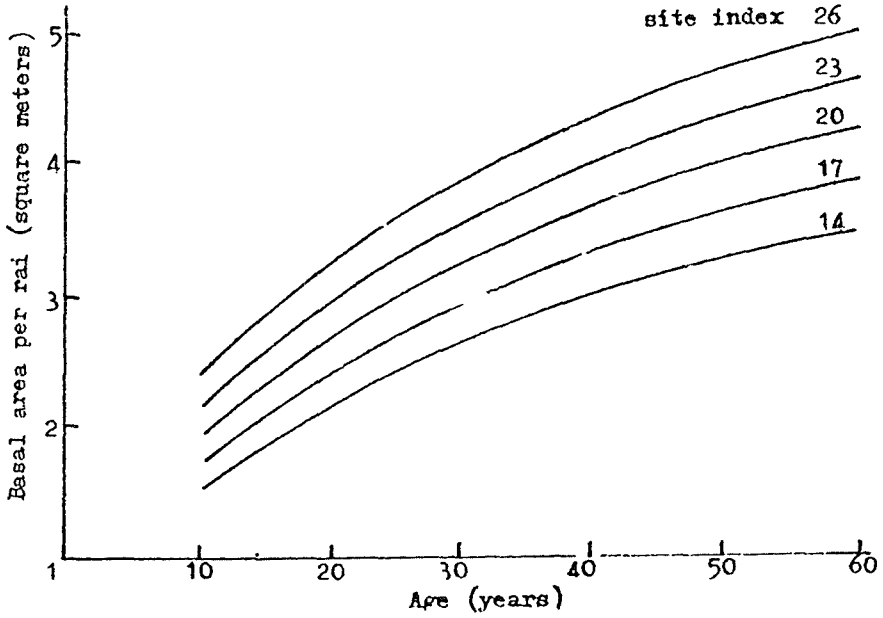


Figure 3 Basal area per rai for plantation teak in northern Thailand.

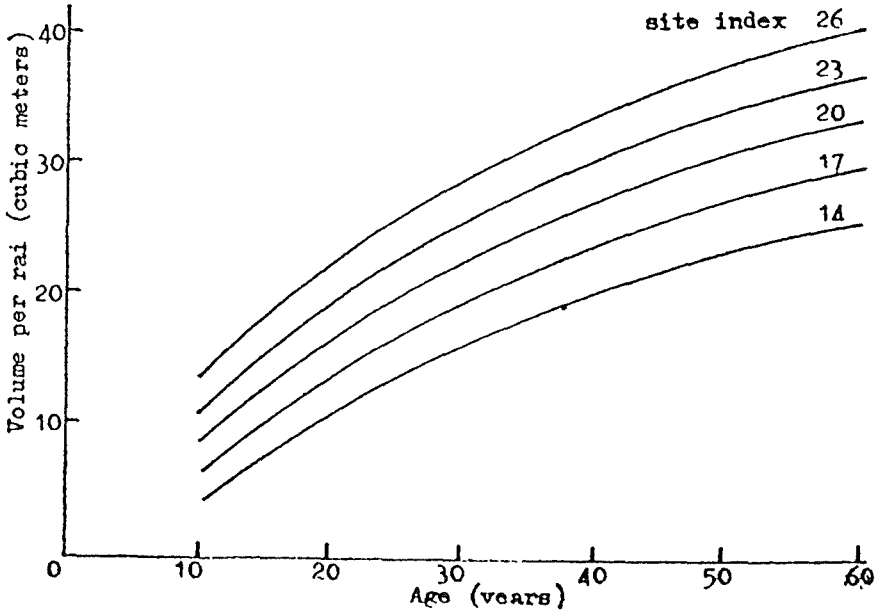


Figure 4 Volume per rai for plantation teak in northern Thailand.

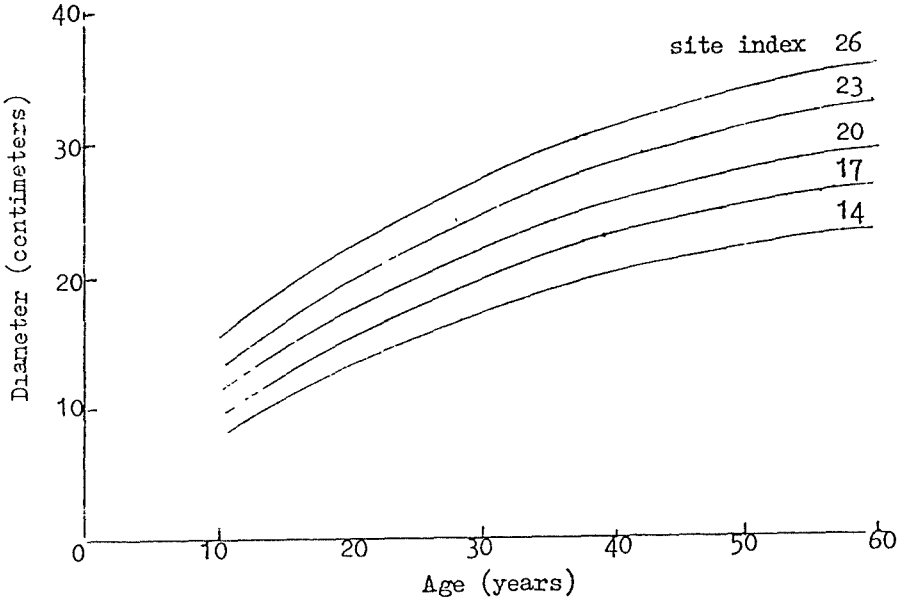


Figure 5 Average breastheight diameter for plantation teak in northern Thailand.

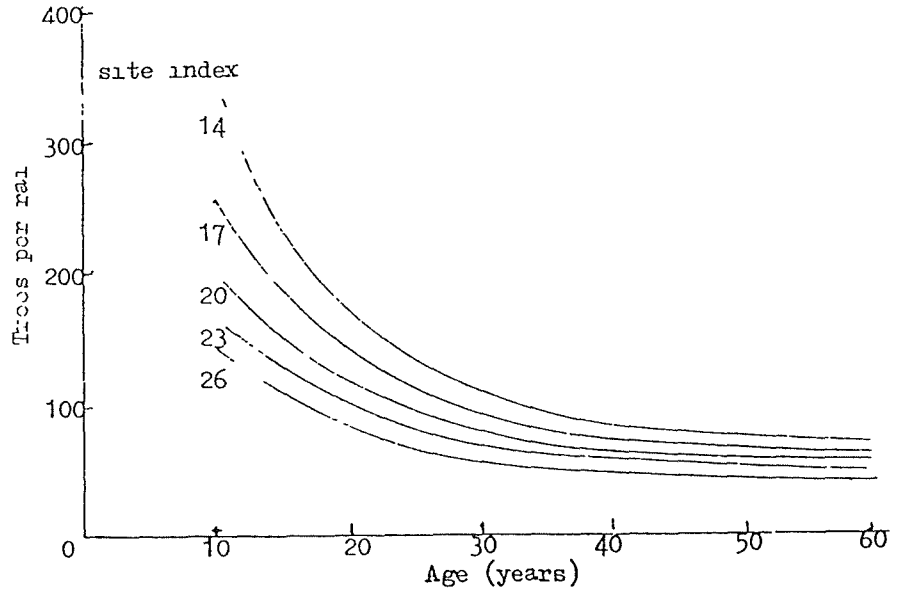


Figure 6 Number of trees per rai for plantation teak in northern Thailand.

出典

Chanpaisaeng, S (1977) Yield of Plantation, the Master theses of Science Degree

樹種：VERBENACEAE(クマツヅラ科)
Tectona grandis (チーク)
國　：タンザニア

データ採取地の立地環境

Tectona grandis
Mtibwa, Tanzania

(2) MATERIALS AND METHODS

All field data were collected from Mtibwa teak plantations.

(1) Site Index data

Due to absence of the permanent sample plots all growth and site index data had to be obtained from temporary sample plots One sample tree was selected from each of 80 randomly located plots Care was taken to ensure that each of the 27 compartments had at least one sample plot. The sample trees were measured for height (to nearest 0.05m) and dbh (to nearest 0 01cm). They were felled and analysed. Growth rings were counted at stump height, at 1.3m (breast height) and at 2m intervals to the top. The base diameter of the top section was recorded. The number of years taken to reach a given height was determined by combining climatic data, plantation records and annual ring counts Height (h) was plotted against age (years).

Two methods of site index calculation were tested viz:

(i) Linear transformed equation

Basic equation $Hd = ax^b$

Transformed to log Hd = Log a + blog x.

Where Hd = dominant height (m)

a,b = regression constant and coefficient respectively

x = Age, years

Separate models were made for each compartment but tests confirmed that there was no significant difference (P=0.01) between the separate models and combined model for the whole forest; as far as the slopes of the curves were concerned. Significant differences were noted of the regression constants. The combined model was adopted.

The same data were subjected to the Deviation method of site index curve modelling (Tveite 1969). In this method all observations were converted to give heights at specified fixed age intervals. These were 4, 8, 12, 16, 20, 24 years. For parallel observations average heights and their standard deviations were calculated at the beginning and at the end of each growth period (4 years) Curves were then drawn passing through selected height indices. Figure 1 shows basic data for site classification. The two methods of site index curve modelling were compared.

成長・収穫に関する表，図，式など

(ii) Volume growth data

400 randomly located circular plots of size 0.03 ha were used. At each of the plots, three trees were selected randomly for growth measurements. Their diameters and heights were measured accurately. An increment core was extracted from each tree at breast height and radial growth (R) for the past 5, 10, 20 years was measured. All the trees on the plot were measured for dbh and recorded in 2 cm diameter classes. Individual tree volumes were obtained from the equation

$$V = b_1 (D)^2 \times b_2(h)^2 + b_3(D)^2h \times \quad (D)(h^2)$$

(Abdelsalaam 1980)

V = volume

D = diameter at breast height

h = height, m

b_1-------b_4 = regression coefficients.

studies of skewness and kurtosis of diameter frequency distributions were made for each compartment.

Table - 1

THINNING SCHEDULE FOR TEAK

Thinning	Age	SPH standing	SPH removed
1st	4	1600	475
2nd	8	1125	250
3rd	12	875	250
4th	16	625	250
5th	20	375	125
Clearfelling	60	250	250

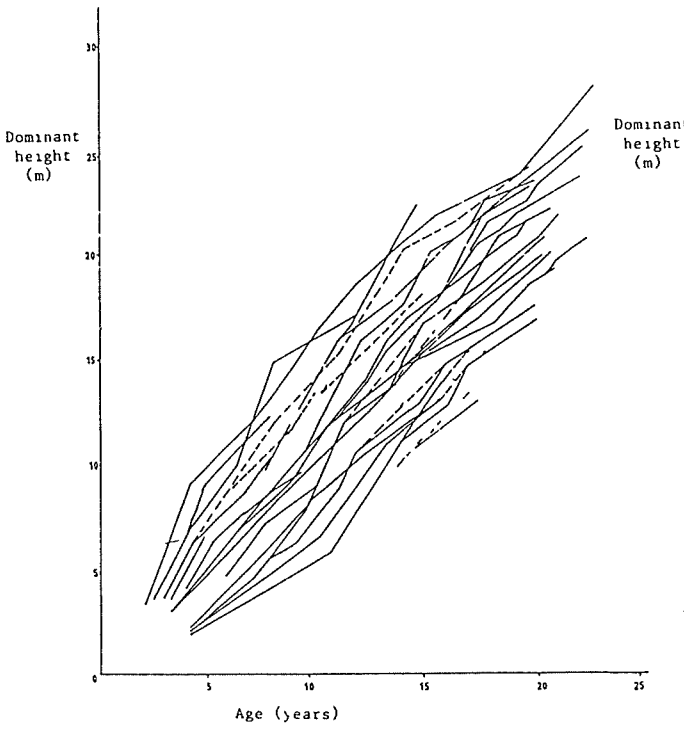


Fig 1 Basic data for site classification

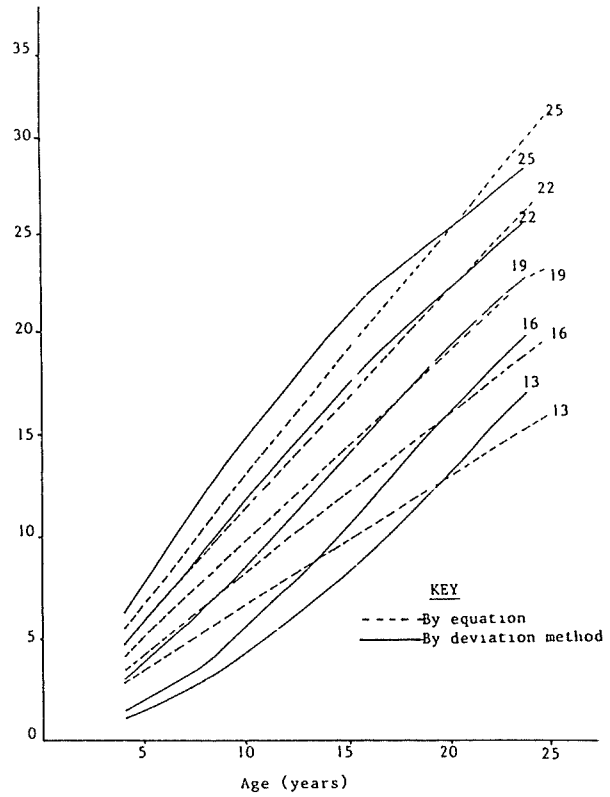


Fig 2 Comparison between site index curves constructed by deviation method and those constructed by equation

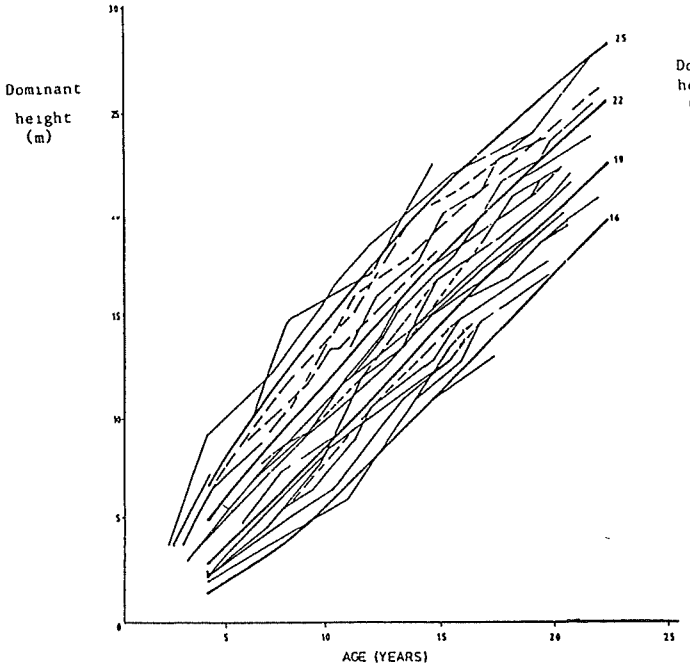


Fig 3 Comparison between the basic data and the site index curves constructed by the deviation method

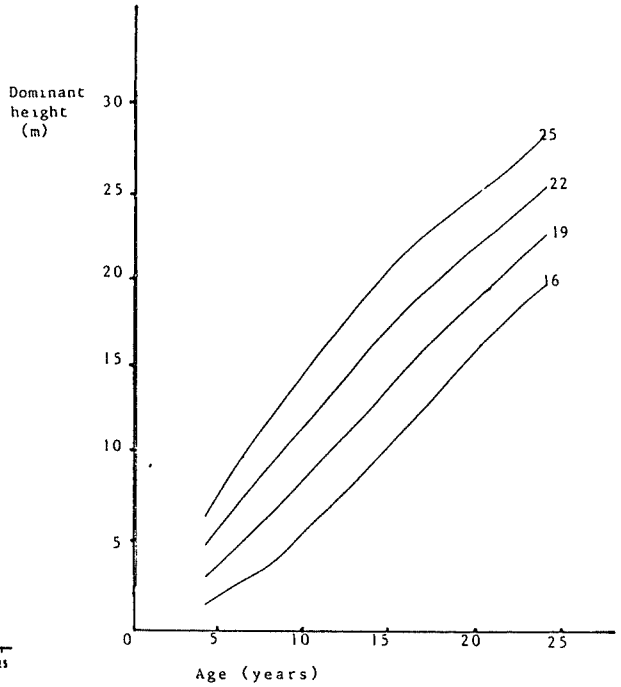


Fig 4 Site index curves for Teak at Mtibwa, Tanzania (constructed by deviation method)

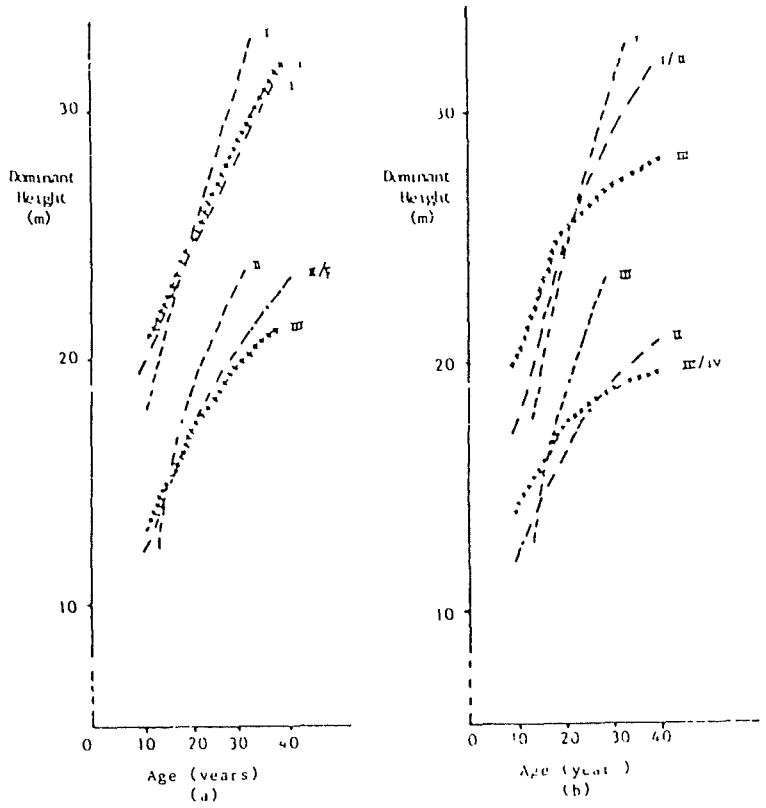


Fig. 5 Comparison of site index curves for Teak

Key to 5 (a)

Tanzania

Java

Nilamber

Key to 5 (b)

Tanzania

Central

Nigeria

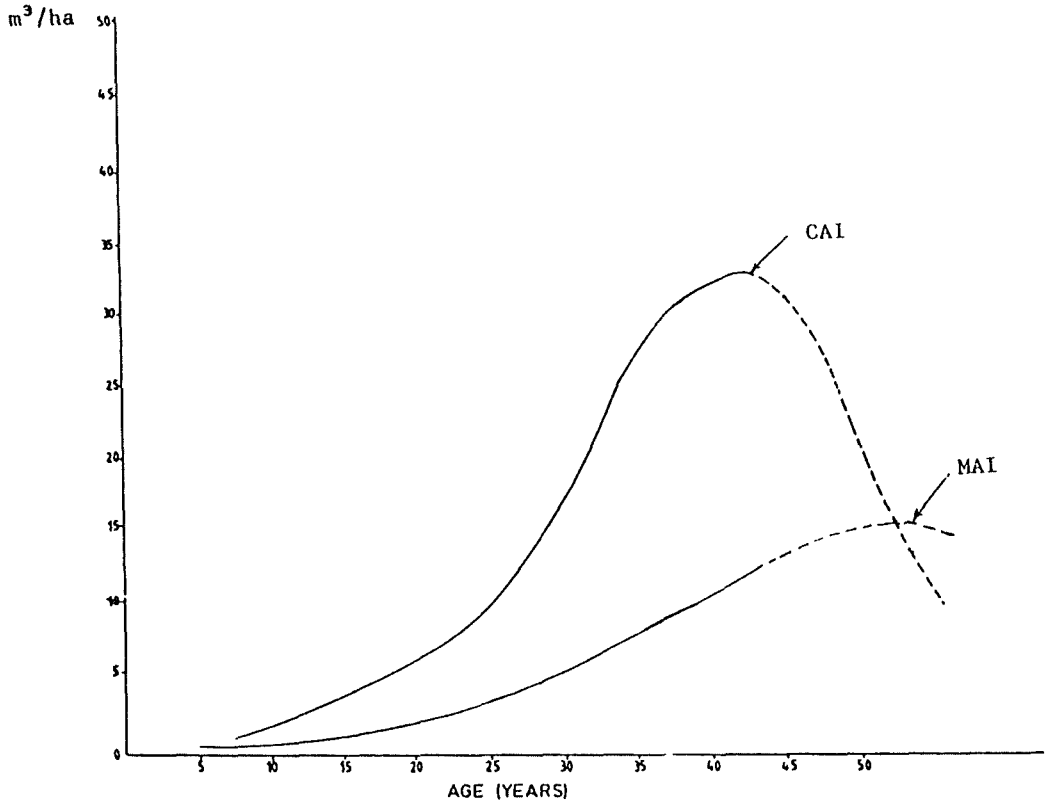


Fig. 6 CAI & MAI for a 51 years old stand.

——— Actual observations

------- Extrapolations.

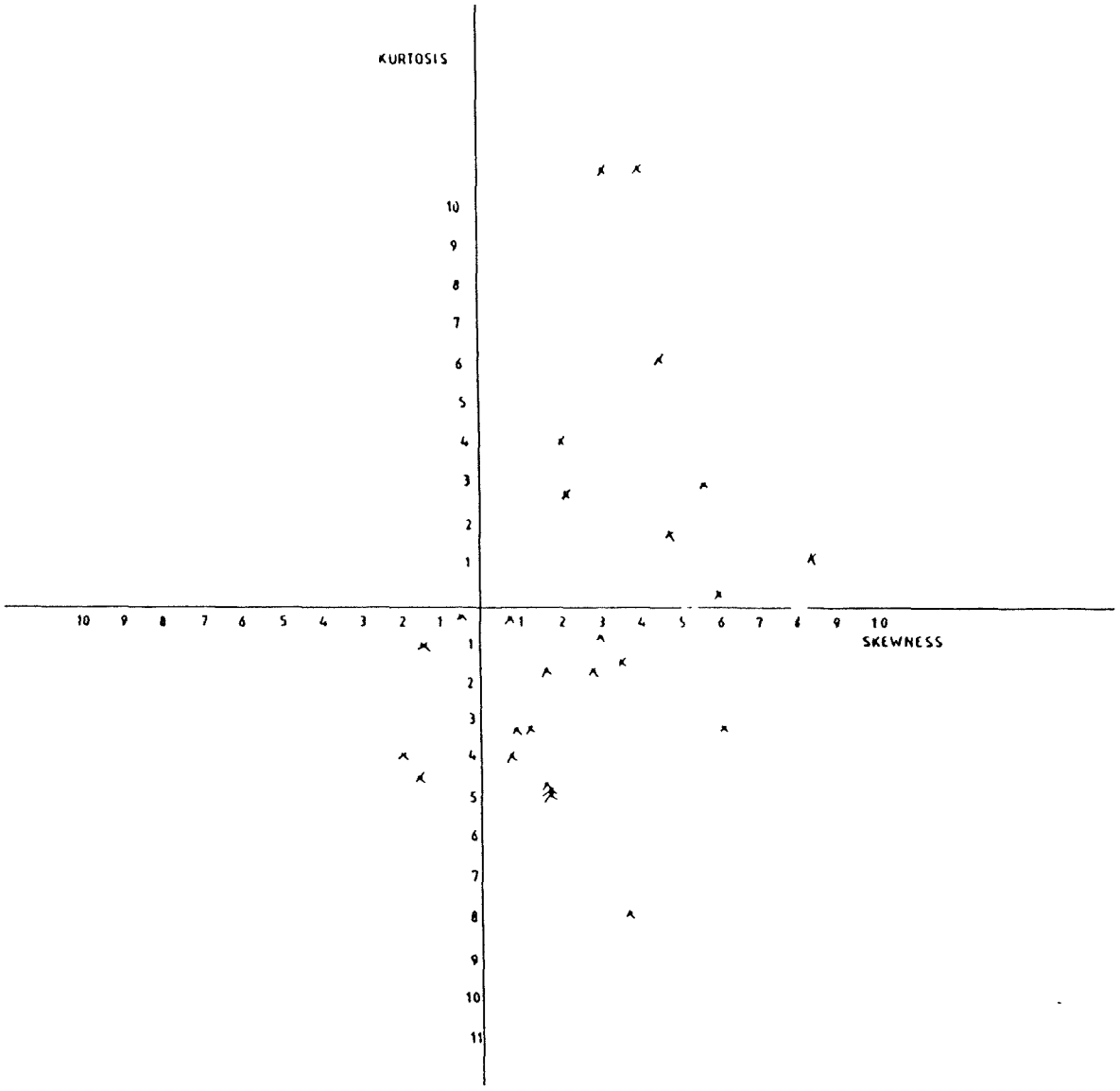


Fig. 7 Distribution of Kurtosis and Skewness values for various compartments

出典

Malende, Y.H. and Temu, A B.(1988) Site index curves and volume growth of Teak (Tectona grandis L.F.) at Mtibwa, Tanzania. Growth and yield in tropical mixed/moist forests (1988). Kuala Lumpur, Malaysia.

樹種：VERBENACEAE(クマツヅラ科)
Tectona grandis (チーク)
国　：トリニダッドトバゴ

データ採取地の立地環境

2.5.1 Regeneration with Teak (Tectona grandis)

41. Teak plantations are formed at a number of locations in Trinidad and the preferred soil is a well-drained clay loam of pH 5.5 to 6.2. The areas are generally undulating and rainfall varies from 1 500 mm/annum to 2 500 mm/annum. A marked dry season is required for successful growth.

47. Working Plans were drawn up for reserves in which teak plantations were to be formed. Generally the reserve was divided into an Exploitation Working Circle in which the yield was controlled by girth limits and a Teak Conversion Working Circle in which the natural forest would be converted to teak during a 60-year rotation. Since the funds available for planting were not assured several years in advance it was prescribed that the Conversion Working Circle would be expanded annually at the expense of the area of the Exploitation Working Circle. When planting was to take place at two or more centres, the Working Circle was divided into the appropriate number of felling series, the management unit within which the compartment was.

48. To encourage maximum exploitation of compartments before conversion, girth limits were removed 18 months before planting. A site for a "flying" nursery was also chosen. The nursery site was clear-felled and burned in the dry season of the year before planting (1 ha of nursery for 40 ha of plantation to be formed) and nursery beds two-metres wide formed between contour drains of 25 cm depth. With the coming of the rains the beds were sown at a spacing of 15 cm x 15 cm. Germination was generally good, the beds were weeded after two months and seedlings thinned to one plant per planting spot. (Teak "seed" are botanically fruits and contain up to four seeds)

49. In the following dry season the remainder of the compartment was under-brushed and felled by the taungya farmers then fire-traced and burned by departmental labour. At the start of the wet season the nursery plants were lifted, "stumped" and planted out at a spacing of approximately 2 m x 2 m by opening a hole in the soil with a sharp-pointed bar, pushing in the stumps to the level of the "collar" then firming the soil around the stumps. The taungya farmers whose areas averaged 0.4 ha kept the teak weeded during the first year, reaped their crops and moved on at the end of the year.

50. Cleaning of the teak was carried out once or twice in the second year and generally once in the third year. Thinning commenced in the 5th year and the schedule for many years was:

Year 5	Reduce teak to 1 250/ha
Year 10	Reduce teak to 625/ha
Year 15	Reduce teak to 310/ha.

Five yearly thinnings continued until the 30th year, the aim being to form an evenly distributed crop with adequate space for crown development for each 5-year period. Beyond the age of 30 years the frequency of thinning depended on the vigour of the crop and indications suggested that on good quality sites the stocking at rotation age would be about 75-90 trees/ha depending on vigour.

51. The prescriptions in the annual programmes included such items as fire protection, maintenance of amenity strips along roadsides, maintenance of offices, buildings and tools, the purchase of materials, the extension of roads, etc. An annual programme (a

synthesis for illustration only) would appear as in Table 1 and information would also be included concerning Expenditure Heads against which the several types of work would be charged.

52. Sample plots were first laid out in the mid 1920's and new plots have been regularly added. Probably the plots have been sited on areas of slightly better than average growth but they provide a good indication of growth over the years. The records of these plots were used between 1966 and 1969 to form provisional yield tables and the information below is derived from this source.

成長・収穫に関する表，図，式など

53. Figure 1 shows the height-age curves into which the investigation divided the crop and from these it is clear that from about the 30th year the height growth flattens rapidly. The total volume of the crop, including thinnings is shown at Figure 2 and the Mean Annual Increments at Figure 3 The results shown by Figures 1 to 3 are now wholly indicative of the crop The more favourable positions of sample plots has already been mentioned and in recent years thinnings have fallen behind schedule although the sample plots have been thinned and measured. Thus, it appears that the sample plot results overestimate the volumes of the surrounding compartments and this excess is probably in the region of 10-15%.

Figure 1

Teak in Trinidad

Height - Age

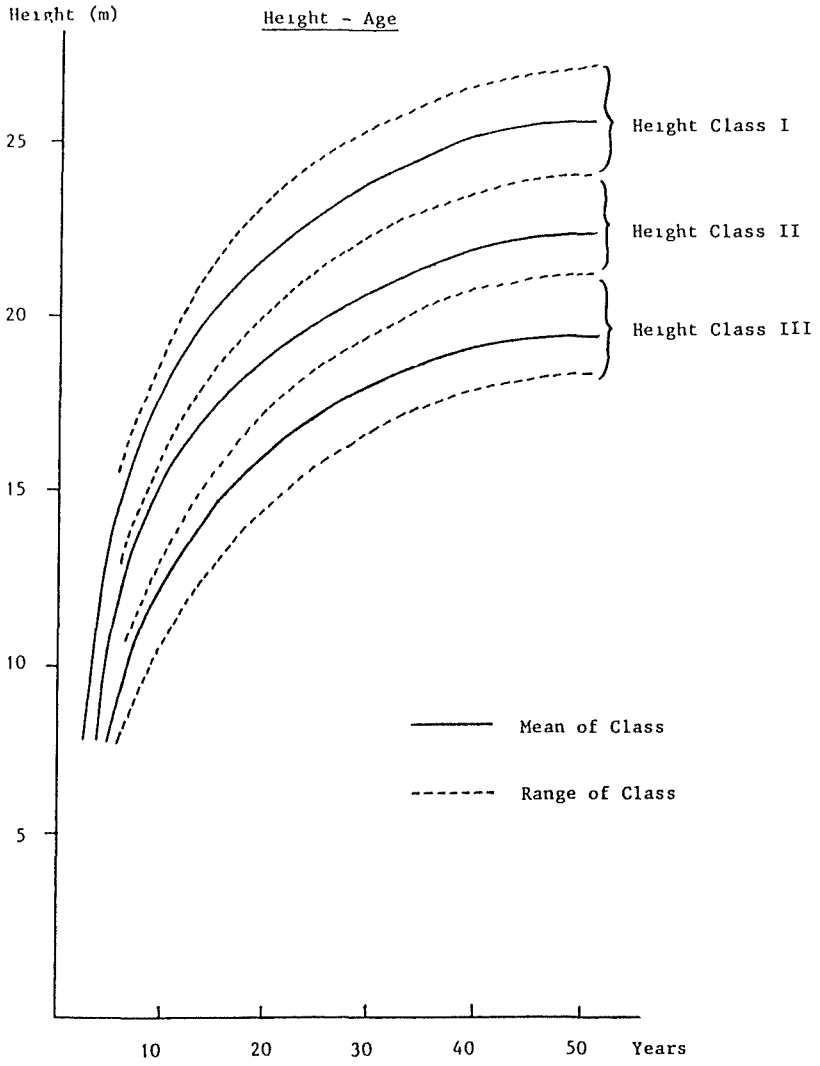


Figure 2

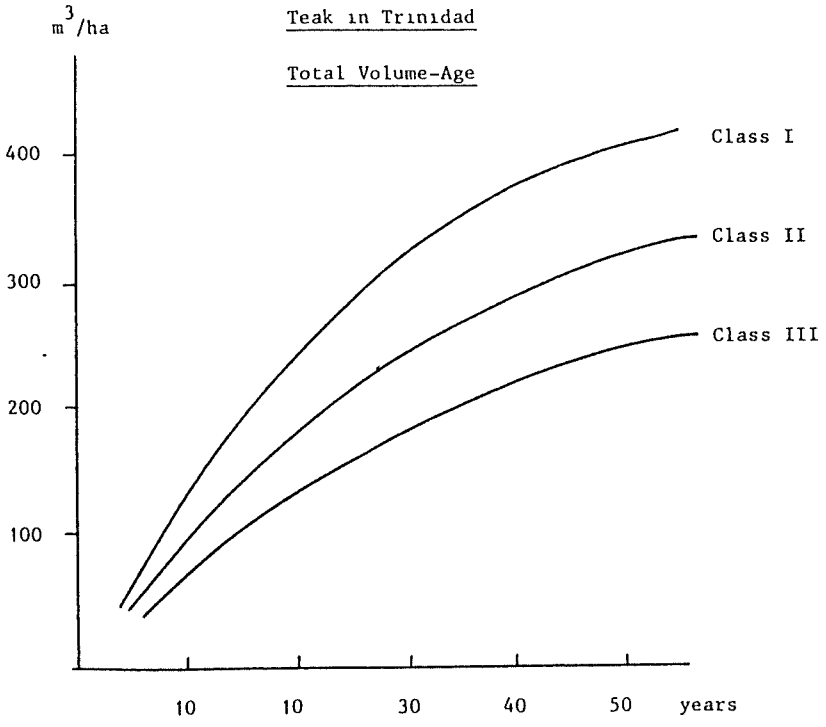
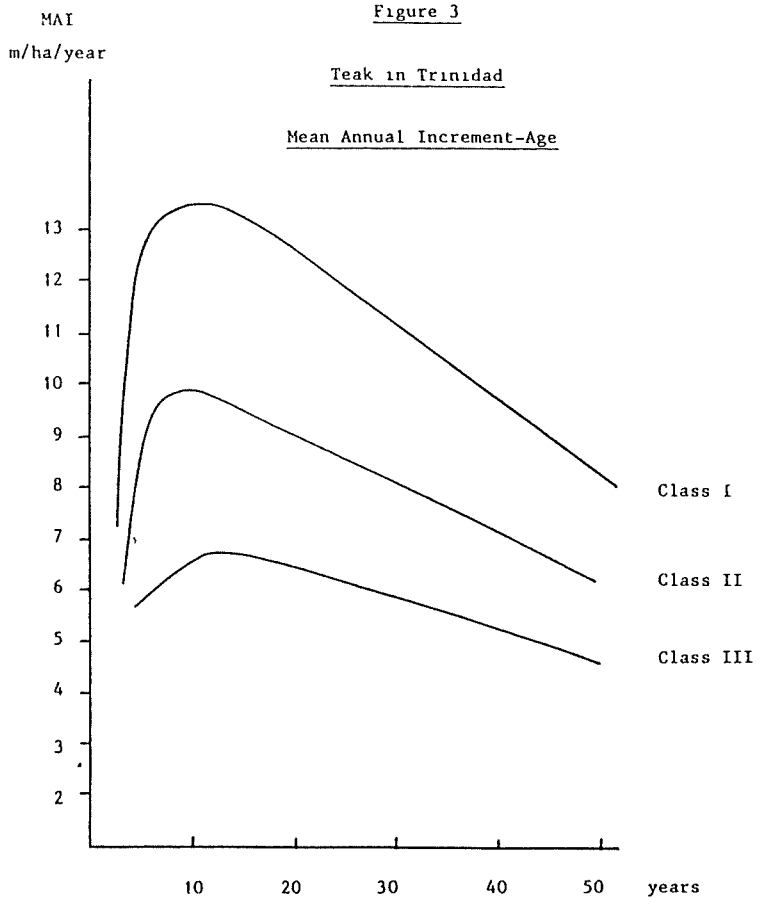


Figure 3



出典

FAO (1985). Intensive multiple-use forest management in the tropics ; Analisis of case studies from India, Africa, Latin America and the Caribbean. FAO Forestry Paper 55.

樹種：VERBENACEAE（クマツヅラ科）
Tectona grandis　（チーク）
図　：トリニダッドトバゴ

データ採取地の立地環境

Locality:	spread over entire teak planta' ns
Altitude:	0 - 300 m
Rainfall:	1 250 - 1 750 mm
Dry season:	5 months
Data source:	permanent sample plots
Number of plots	37
Measurement specification:	8 cm diameter under bark

成長・収穫に関する表、図、式など

Yield data by site class[1/]

Site Class / Age years	I		II		III		No. of stems per ha [2/]
	Av. diam. in cm	MAI (m^3/ha)	Av. diam. in cm	MAI (m^3/ha)	Av. diam. in cm	MAI (m^3/ha)	
7	16.9	10.0	-	-	-	-	1 000
12	24.2	10.2	19.4	7.5	16.9	5.5	500
17	30.2	9.8	24.2	7.2	21.0	5.3	-
25	38.6	9.1	30.7	6.7	27.0	5.0	300
36	48.5	7.9	38.8	6.0	-	-	187
50	55.8	6.5	45.3	5.0	37.2	3.9	120
65	62.2	5.5	48.5	4.2	39.6	3.3	120
80	64.5	4.7	50.9	3.7	40.4	2.8	120

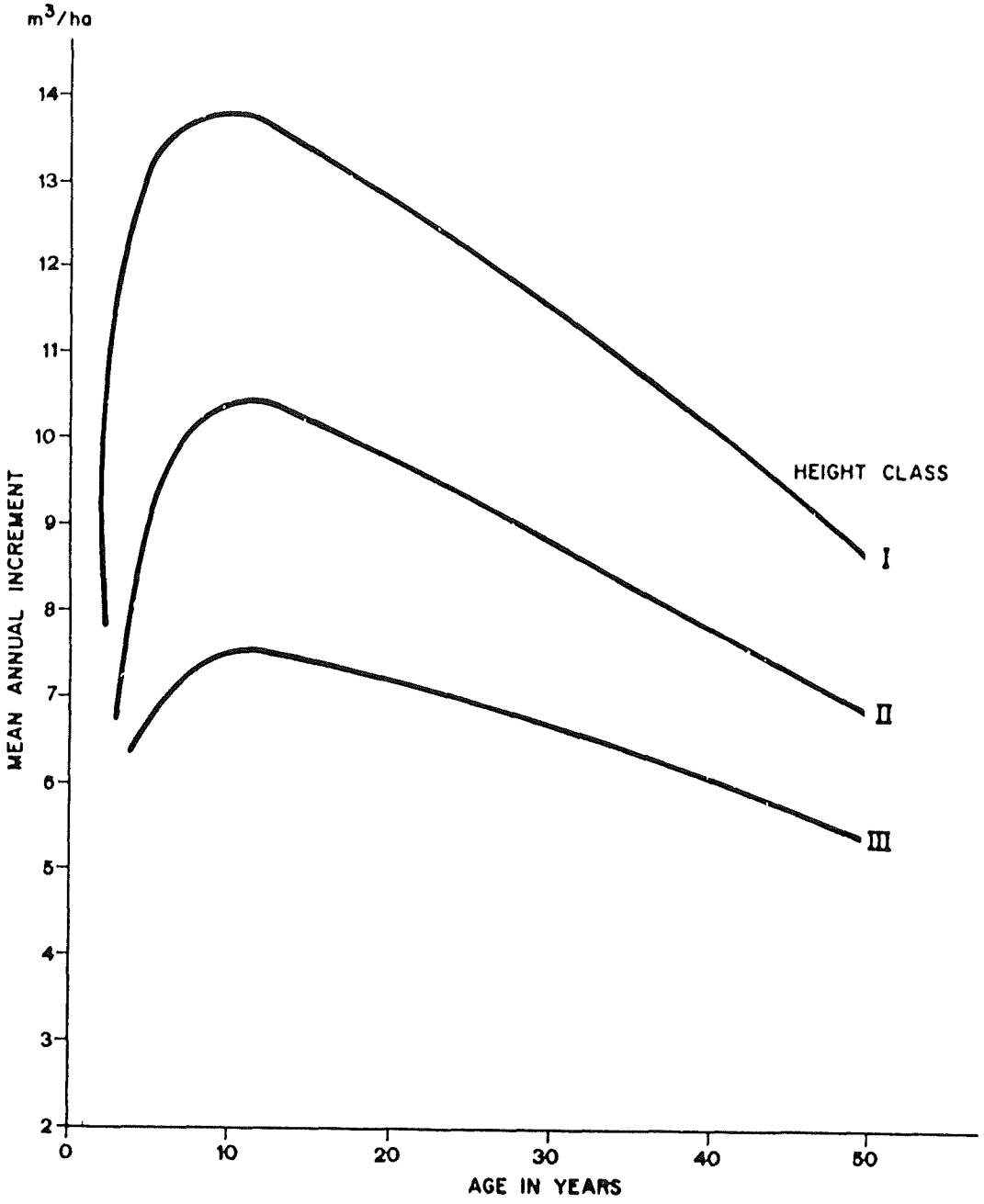
Remarks: Crop has been thinned and thinning yield included in MAI.

1/ Height class based on average height of the crop at reference age 50 years and classes correspond to the heights I ⟶ 24.4-27.4 m; II ⟶ 21.3-24.4 m; and III ⟶ 18.3-21.3 m.

2/ Number of stems/ha for site class II.

Tectona grandis - Trinidad (4)

MAI curves by height classes



出典

(4) Miller, A.D. 1969 Provisional yield table for teak in Trinidad, Trinidad & Tobago (unpublished).

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：VERBENACEAE（クマツヅラ科）
Tectona grandis（チーク）
国　：多国籍（ジャマイカ、エルサルバドル、エクアドル、キューバ、ナイジェリア、バングラデッシュ）

データ採取地の立地環境

成長・収穫に関する表，図，式など

Other studies

Details \ Countries	Jamaica	El Salvador	Ecuador	Cuba	Nigeria	Bangladesh
Reference	(2)	(2)	(6)	(3)	(5)	(8)
Locality	-	-	La Clementina Los Rios	Itabo	Olokemeji and Gambari	Chittagong Hill traits
Altitude (m)	-	-	sea level	-	-	40-100
Rainfall (mm)	-	-	2500	1500	1000	2000-3000
Soil	-	-	abandoned agrioulture	olayey over-calcareous	sandy to clay	sandy loam
Data source	-	-	P.S.P.	P.S.P.	T.S.P.	P.S.T and T.S.P.
No. of plots	-	-	6	5	71	14
Plot size (m^2)	-	-	-	-	400	-
Measurement specification	8 cm u.b.	8 cm u.b.	10 cm	-	7.7 cm o.b.	-
MAI (m^3/ha)						
S.Q. 3/ I (A1) 4/	14.0 (10) 5/	14.0 (10	12.9 (10 5/	16.3 (9-14) 5/	13.6 (9) 5/	4.17 (14) 5/
S.Q. I (A2)	11.0 (20)	12.0 (20)	24.4 (21)	-	14.9 (13)	4.0 (21)
S.Q. I (A3)	9.0 (30)	10.0 (30)	27.3 (30	-	8.6 (57)	3.1 (51)
S.Q. II	7.0 (10)	7.0 (10)	27.7 (40)	11.8 (9-14)	10.9 (9)	1.23 (11)
S.Q. II	7.0 (20)	7.0 (20)	26.5 (50)	-	11.0 (14)	2.74 (16)
S.Q. II	6.0 (30)	6.0 (30)	-	-	6.9 (61)	-
Remark	Thinning inoluded	Thinning inoluded	All MAI figures of S.Q. I and thinning inoluded	-	All plots except old ones unthinned	

3/ S.Q.I refers to best site quality and S.Q.II medium to low.
4/ A1, A2, A3, etc., stand for age of crop.
5/ Figures in brackets indicate age in years.

出典

(2) Keogh, R M　Does teak have a future in tropical America? Unasylva 1979　Vol 31 No 126

(3) Matos, E. 1972　Description and analysis of teak plantation in Itablo experimental station, Marti Matanzas. Revista Forestal Baracoa No. 2.

(5) Renes, G.V.B. 1977　An investigation on yield and profitability of teak plantations in south-west Nigeria. Working Paper UNDP/FAO Forestry Development Project.

(6) Troensegaard, J. 1971 Resultados preliminares del crecimiento de Tectona grandis en el Ecuador. (unpublished).

(8) Vallav, E.; Skoupy, J. 1972 Growing of teak in Bangladesh. Silvicultura tropica et subtropica. Forestry Science Institute, University of Agriculture, Prague, Czechoslovakia.

ダイジェストデータ：Pandrey, D Growth and yield of plantation species in the tropics, FAO 1983 所収

樹種：PINACEAE（マツ科） *Pinus patula, Picea spinulosa, Tsuga dumosa, Abies spectabilis,* *Cupressaceae*（ヒノキ科） *Cupressus cashmeriana*

国　：インド

データ採取地の立地環境

In Darjeeling Himalayas, there are some poorly stocked and blank areas above 2000 m. These areas are reforested with *Pinus patula, Cupressus cashmiriana, Cupressus lusitanica, Abies densa, Tsuga dumosa* etc. Except *Pinus patula* the rate of growth of other species is slow But *Pinus patula* gets affected by snow which is common in the area. So, *Picea spinulosa* (Sikkim spruce) was introduced in the area to study the prospects of the same This species usually occurs between 2600-3350 m elevation in Lachen valley of Sikkim along with *Tsuga dumosa, Abies spectabilies* and *Larix griffithi* The species has tall trees which are well over 60 m in height.

The trial was undertaken in 2500 m altitude in Pankhasari-3 compartment of Kalimpong Special Division during 1979.

Seeds of Sikkim spruce were procured from the Chief Conservator of Forests, Sikkim during 1977.

Nursery technique

Seeds were sown in the nursery at Lava (altitude 2000 m) during April. Seeds were dressed before sowing by Blitox powder for elimination of pregermination blight.

Seed beds were made with course sieved sand, free from calcarious material and fumigated with 40% formaline. In the seed bed, seedlings were irrigated by knapsack sprayer

The seedlings were pricked out by holding the needles only, after the first few needles had come out. The seedlings were then transplanted in 22 cm. × 7 5 cm. polythene tube and retained for about 2½ years, when the seedlings attained a height of 25 to 30 cm.

Site characteristics of trial area

The trial area is having 2500 m. altitude with mean minimum temperature of 2°C and mean maximum temperature of 15°C. Rainfall is 3500 mm , frost heavy with frequent snow-fall during winter. The soil is sandy loam

Observations

Pits of 30 cm^3 were dug at 2m × 2m spacing and seedlings of the same age and almost of same size of *Sikkim spruce, Cupressus, Hemlock, Silver fir* and *Pinus patula* were planted in the trial plot. The regular maintenance operations like weeding, mulching were carried out and survival of seedlings were recorded. The final data on survival, height, collar girth and condition of the plants were collected during April 1986, which is presented in the following Table.

成長・収穫に関する表，図，式など

Table 1

Performance of various species at 2500 m. altitude

Species	Age	Survival p c.	Height in m.	Collar girth in cm.	Remarks
Sikkim spruce	7	90	2.73	27 0	Promising
Hemlock	7	92	2 10	22.1	Promising
Silver fir	7	95	1.26	14 0	Very slow
Pinus patula	7	92	4.20	45.5	Promising but affected by snow
Cupressus cashmiriana	7	85	2.15	22 1	Not healthy

出典

Research Notes. Indian For., 113 (1987) : 150-157.

樹種：ULMACEAE（ニレ科）*Holoptelea integrifolia*（インドエルム），MALVACEAE（アオイ科）*Kydia calycina*. BOMBACACEAE（パンヤ科）*Bombax ceiba*. COMBRETACEAE（シクンシ科）*Anogeissus latifolia*（アクスルウッド），*A. pendula*. SIMAROUBACEAE（ニガキ科）*Ailanthus excelsa*

国：インド

データ採取地の立地環境

成長・収穫に関する表，図，式など

Tree model approach

The number of required sample plots for growth studies could be reduced if instead of crop parameters like crop height, crop diameter, basal area/ha etc. as independent variables, the use is made of parameter related to single tree or a group of trees. This could safely reduce the requirement theoretically to one tenth the number of plots desired by traditional method if sample plot trees are classed into ten groups for the purpose of the study. In practice more plots will be required to compensate for unavoidable irregularity of distribution, stocking etc. The application of "Tree model approach" in growth studies is manageable now on account of computer facility. Growth studies for *kadam* were undertaken by this method (Singh, 1981) and analysis of few other species like *babul, khair* etc. are under way.

Generalised model approach

There are host of other species which cannot be tackled by the above ways because of still lesser data. Even an approximate estimate of their growth would be presently welcomed as laying out sample plot and then their subsequent measurements would take time. To attain this, help has to be taken from certain generalised growth principles/hypothesis deduced from growth trends of different species. One such approach is "Nilsson's Production Scheme".

Nilsson's production scheme

It is based on the concept that relative development over time was very similar for different species, if rotation age for maximum volume yield was used as measurement unit i.e. if the age was expressed as a percentage of the age for maximum volume age. It introduced new concepts and definitions which are as under :

Relative age : Age expressed in per cent of age for maximum volume production.

Relative yield : Accumulated yield as per cent of accumulated total yield at the age of maximum volume production.

Thinning ratio : Accumulated thinings as per cent of accumulated total yield at the age of maximum volume production.

The model originally suggested by Chapman—Richard was used to generalise stand developments, making use of the idea of expressing the stand development in terms of relative yield over relative age. The generalisd function was as follows :

$$Y = a\,(1 - b^{-R/100})^c$$

Y = relative yield, a = 164.16, b = 6.3582, c = 2.8967 and

R = relative age.

(a, b and c are constants which will give 38% of relative yield at 50% of relative age).

$$\text{Relative yield} = 164.16\,(1 - 6.3582^{-(\text{relative age}/100)})^{2.8967}$$

The function yields the following values :

elative age %	10	20	30	40	50	60	70	80	90	100
elative yield %	1 0	5.5	13.8	25.1	38.0	51.5	64.9	77.7	89.4	100.0
lean annual crement	0.127	.315	.496	.649	.771	.862	.926	.967	.991	1.000

From the above function it emerges that at half the rotation age, the forests would ·ld 38% of the total volume yield obtainable at rotation age, irrespective of the species. ıs this steering parameter of relative yield at the relative age of 50 which is important growth studies. Actually Nilsson tested his generalised function for yield table data of '. *deodar*, *chir* and *Eucalyptus* hybrid and observed a very close fit to that of yield table rves (Nilsson, 1978).

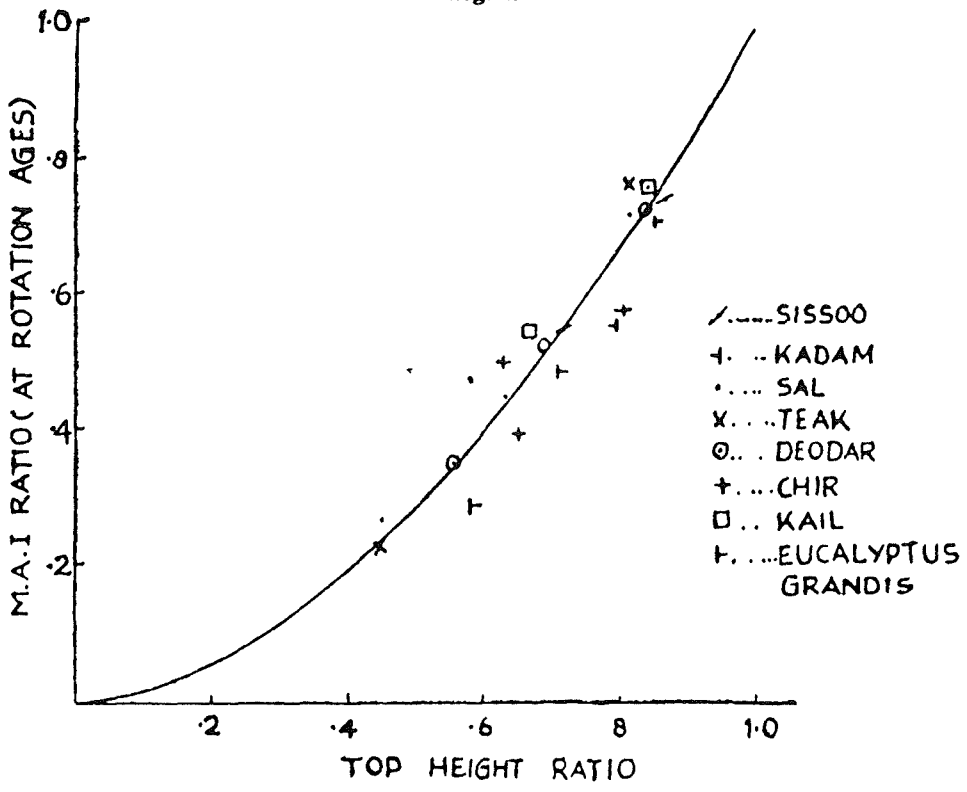
.A.I. ratio (at rotation age)/top height ratio function

Before Nilsson's production scheme can be applied to develop yield curves for different qualities, it is necessary to find out a relationship between yield capacity and ·ductivity sites. From the study of yield tables for different species, it was observed that ıo of M.A.I. at rotation age (R_y) over corresponding site quality ratio (X) relationship s very similar for different species. It is a power curve and the generalised M.A.I. ratio/ ɔ height ratio function came out as under (Diagrammatically shown in Figure 1).

$$R_y = X^{1.78179}$$

: quality ratio	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1
tio of M.A.I. ·otation ages	1.0	.829	.672	.530	.402	.291	.195	.117	.057	.017

Fig. 1



Main approach

The main approach for yield capacity estimation thus is as follows:

1. Values of cumulative volume/ha and top height are plotted separately against stand age.
2. Data trend is discerned and curve for maximum cumulative volume (termed hereunder as yield capacity) and corresponding top height curve are drawn. This top height curve is assigned site quality 1.0.
3. From yield capacity curve, the rotation age and M.A.I. are found.
4. A family of anamorphic curves for site quality .8, .6 etc. are generated. Here .8 site quality curve will have 80% height corresponding to site quality 1.0 curve and so on.
5. M.A.I. and rotation for other site qualities are then calculated from generalised M.A.I./Top height ratio function. For .8 site quality M.A.I. ratio at rotation ages ($R_{.8}$) is obtained, which gives

   M.A.I. for site quality .8 = M.A.I. of site quality 1.0 $XR_{.8}$

   Rotation for site quality .8 = Rotation for site quality 1.0 $\times \frac{.8}{R_{.8}}$ and so on.
6. Yield capacity values for different site qualities are then calculated and tabulated by using Nilsson's generalised production scheme.

Estimates of yield

Age (yrs.)	Site quality					
	1.0		0.8		0.6	
	Top ht. (m)	M.A.I. (m^3)	Top ht. (m)	M.A I. (m^3)	Top ht. (m)	M.A.I. (m^3)
	Species—*Anogeissus pendula*					
10	5.4	.74	4.3	.41	3.2	.17
20	8.4	1.52	6.7	.85	5.0	.42
30	12.0	2.02	9.6	1.21	7.2	.61
40	14.5	2.26	11.6	1.42	8.7	.75
50	16.2	2.34	12.7	1.53	9.7	.85
60	—	—	14.1	1.572	—	—
75	—	—	—	—	11.7	.941

Data pertain to natural forests and are derived from Bharatpur Division S.P. No. 1 & 2, Baran Division S.P. No. 1 & 2, Bundi Division S.P. 1 & 2, Jhalawar Division S.P. No. 1 & 2, Udaipur Division S P. No. 1, Bundelkhand Division S.P. No. 1, 3, 4 & 5. The sample plots of Bundelkhand Division are of coppice origin and as these plots have determined the top trend, so the yield capacity reflects growth in coppice crops.

Age (yrs.)	Site quality					
	1.0		0.8		0.6	
	Top ht. (m)	M.A.I. (m^3)	Top ht. (m)	M.A I. (m^3)	Top ht. (m)	M.A.I. (m^3)
	Species—*Anogeissus latifolia*					
16	4.4	.56	3.5	.31	2.6	.13
32	13.4	1.16	10.7	.65	8.0	.32
48	18.0	1.53	14.4	.92	10.8	.46
64	21.2	1.72	17.0	1.08	12.7	.58
80	24.5	1.78	19.6	1.16	14.7	.64
95	—	—	21.4	1.196	—	—
119	—	—	—	—	17.1	.716

Data pertain to natural forests and are derived from Kolhan Division (Bihar) S.P. No. 6 & 8, Saranda Division (Bihar) S.P. No. 14, 15, 16 and Ramnagar Division (U.P.) S.P. No. 40. As most of the plots were laid out after 70 years of age, hence initial thinning yields are unknown and therefore the estimates are conservative.

Age (yrs.)	Site quality					
	1.0		0.8		0.6	
	Top ht. (m)	M.A.I. (m^3)	Top ht. (m)	M.A.I. (m^3)	Top ht. (m)	M.A I. (m^3)
	Species—*Kydia calycina*					
3	5.5	2.16	4.4	1.61	3.3	.78
7	12.5	4.33	10.0	4.16	7.5	1.96
10	16.0	6.49	12.8	5.61	9.6	2.82
14	19.2	8.66	15.4	6.73	11.5	3.57
17	20.5	10.82	16.0	7.12	12.3	3.92
20	—	—	17.6	7 271	—	—
25	—	—	—	—	14.2	4 350

Data pertain to plantation crops and are derived from Siwalik Division S.P. No. 42, 45 & 50 and Haldwani Division S.P. No. 54.

Age (yrs)	Site quality					
	1.0		0.8		0.6	
	Top ht. (m)	M.A.I. (m^3)	Top ht. (m)	M.A.I. (m^3)	Top ht. (m)	M.A.I. (m^3)
	Species—*Ailanthus excelsa*					
2	4.5	2.21	3.6	1.48	2.7	.73
3	7.0	4.54	5.6	2.33	4.2	1.14
5	9.7	6.03	7.8	3.63	5.8	1.89
6	11.0	6.77	8.8	4.05	6.6	2.17
8	12.5	7.00	10.0	4.12	7.5	2.53
10	—	—	10.8	4.704	—	—
12	—	—	—	—	8.7	2.814

Data pertain to plantation crop and are derived from Siwalik Division S P. No. 54, Ramnagar Division S.P. No. 70 and Nepanagar S.P. No 3.

Age (yrs.)	Site quality					
	1 0		0.8		0.6	
	Top ht. (m)	M.A.I. (m^3)	Top ht. (m)	M.A.I. (m^3)	Top ht. (m)	M.A.I. (m^3)
	Species—*Holoptelea integrifolia*					
13	8.8	—	7.0	.90	5.3	.38
26	16.0	—	12.8	1 88	9.6	.91
39	22.8	—	18.2	2.67	13.7	1.34
52	26.2	—	21.0	3.11	15.7	1.65
65	29.0	5.15	23.2	3.39	17.4	1.86
77	—	—	24.2	3.461	—	—
97	—	—	—	—	18.9	2.070

Data pertain to natural forests and are derived from Ramnagar Division S.P. No. 38 and 39, Haldwani Division S.P. No. 9, 41 & 42. These plots were laid when stands were about 60 years of age and hence initial thinning yields are not included. Therefore M.A.I. figures are rather conservative.

Age (yrs.)	Site quality					
	1.0		0.8		0.6	
	Top ht. (m)	M.A.I. (m^3)	Top ht. (m)	M.A.I. (m^3)	Top ht. (m)	M.A.I. (m^3)
	Species—*Bombax ceiba*					
1	2.5	4.73	2.0	1.84	1.5	.77
3	6.5	9.74	5.2	6.08	3.9	2.99
4	7.4	12.93	5.9	7.77	4.4	3.91
6	10.0	14.50	8.0	9.54	6.0	5.20
7	12.0	15.00	9.6	9.94	7.2	5.58
8	—	—	10.0	10.08	—	—
10	—	—	—		8.1	6 03

Data pertain mostly to plantation crops and are derived from Siwalik Division S.P. No. 41, Tarai Bhabhar Division S.P. No. 4 & 5, Haldwani Division S P. No. 56 and Gorakhpur Division S.P. No. 12.

出典

Singh, S.P and R S. Sharma (1982). Provisional growth estimates of some species of mixed tropical forests. Indian For., 108 : 230-236.

樹種：EUPHORBIACEAE（トウダイグサ科） *Endospermum macrophyllum*（カウブラ）、
MELIACEAE（センダン科） *Swietania macrophylla*（オオバマホガニー）、
RHAMNACEAE（クロウメモドキ科） *Maesopsis eminii*（ムシジ）、
MYRTACEAE（フトモモ科） *Eucalyptus deglupta*（カメレレ）、
RUBIACEAE（アカネ科） *Anthocephalus chinensis*（カランバヤン）、
BORAGINACEAE（ムラサキ科） *Cordia alliodora*（カナレッテ）
国　：フィジー

表の樹種は以下参照

Cadamba　：*Anthocephalus chinensis*（カランバヤン）
Cordia　：*Cordia alliodora*（カナレッテ）
Kauvula　：*Endospermum macrophyllum*（カウブラ）
Deglupta　：*Eucalyptus deglupta*（カメレレ）
Maesopsis　：*Maesopsis eminii*（ムシジ）
Mahogany　：*Swietenia macrophylla*（オオバマホガニー）

データ採取地の立地環境

2－Aは、JICAによるビチレブ島広葉樹造林地森林調査報告書（昭和56年3月）によるものである。この調査はNukurua地区を対象とし、空中写真（1978年6～7月撮影）と0.1haの長方形標準地92か所の実測（1980年9～10月）に基づくものである。表3－4の数値は、これらの資料から各種成長因子ごとに回帰式を求めて修正した推定値である。たたし、表3－4の脚注にも述べてあるように太線までが実測値に基づいて修正されたものであるが、太線以外は回帰式から求めた参考表示である。

2－BはJICAによるビチレブ島広葉樹造林地森林生産力調査報告書（昭和57年3月）によるもので、調査結果は表3－5に示すとおりである。この調査はNukurua地区を対象とし、標本プロット0.05ha（幅20m×長さ25m）、または0.1ha（幅20m×長さ50m）の標準地140か所の実測調査（1981年6～8月）と2－Aの資料とに基づくものである。回帰式を求めて実測値の修正値と将来推定値は2－Aと同じ手法で、それに関する問題点は2－Aで述べたとおりである。

2－Cは政府のForestry Department, Management Divisionの調査によるもので、その調査結果は表3－6に示すとおりである。この調査はNukurua地区とかなり立地条件の異なるGaloa, Nuboutini, Yarawa地区が含まれているので参考となる。

成長・収穫に関する表，図，式など

表３－４　２Ａ：ＪＩＣＡによる造林成績調査（１９８０年）

(1)　Cadamba の造林成績

林齢（年）	本数（本）	全樹高（m）	平均直径（cm）	胸高断面積（m²）	全材積（m³）	MAI（m³）
1	405	82	55	078	157	157
2	341	58	92	214	737	369
3	322	81	124	384	1821	607
4	318	103	154	583	3460	865
5	307	125	182	804	5691	1138
6	304	145	209	1047	8557	1426
7	302	166	234	1309	12048	1720
8	300	185	259	1588	16235	2029
9	298	205	282	1883	21112	2346
10	297	224	305	2193	26704	2670
11	296	242	328	2517	33029	3003
12	295	261	350	2855		
13	295	279	372	3205		
14	294	297	393	3568		
15	294	314	413	3943		
16	293	332	434	4329		
17	293	349	454	4725		
18	293	366	474	5133		
19	292	383	493	5550		
20	292	400	513	5978		

注　太線までは調査資料の回帰式による修正推定値、
　　太線以外は参考表示

(2)　Cardia

林齢（年）	本数（本）	全樹高（m）	平均直径（cm）	胸高断面積（m²）	全材積（m³）	MAI（m³）
1	適合なし	24	31	016	027	027
2		43	55	062	159	080
3		60	78	135	451	150
4		76	100	236	943	236
5		92	121	364	1670	334
6		106	141	518	2665	444
7		121	161	698	3957	565
8		135	181	903	5573	697
9		148	200	1135	7538	838
10		162	219	1392	9876	988
11		175	237	1674	12610	1146
12		188	256			
13		201	274			
14		213	291			
15		226	309			
16		238	327			
17		250	344			
18		262	361			
19		274	378			
20		286	395			

注　(1)に同じ

(3) Kauvula

林齢 (年)	本数 (本)	全樹高 (m)	平均直径 (cm)	胸高断面積 (m²)	全材積 (m³)	MAI (m³)
1	359	13	08	001	842	842
2	291	23	20	008	1585	793
3	271	33	34	024	2295	
4	262	42	50	050	2984	749
5	257	51	67	090	3658	732
6	253	60	85	146	4321	720
7	251	69	105	220	4974	711
8	249	77	125	313	5619	702
9	247	86	146	426	6256	695
10	246	94	167	563	6888	689
11	245	102	190	724	7514	683
12	244	110	213	911	8136	678
13	244	118	234	1125	8753	673
14	243	126	261	1368	9365	669
15	243	133	286	1641	9974	665
16	242	141	312	1946	10579	662
17	242	149	338	2283	11182	658
18	242	156	364	2655	11781	655
19	241	164	391	3062	12377	651
20	241	171	418	3505	12970	649

注 (1)に同じ

(4) Deglupta

林齢 (年)	本数 (本)	全樹高 (m)	平均直径 (cm)	胸高断面積 (m²)	全材積 (m³)	MAI (m³)
1	適合なし	19	18	000	000	000
2		38	40	000	002	001
3		59	63	011	076	025
4		76	88	062	470	118
5		96	113	172	1403	281
6		115	140	338	2911	485
7		135	166	549	4903	700
8		155	194	790	7248	906
9		174	222	1048	9824	1092
10		194	251	1314	12529	1253
11		214	279	1581	15288	1390
12		233	309	1845	18046	1504
13		253	338	2102	20765	1597
14		273	368	2351	23419	1673
15		293	399	2590	25992	1733
16		313	429	2819	28475	1780
17		333	460	3038	30861	1815
18		353	491	3247	33150	1842
19		373	523	3447	35342	1860
20		392	554	3636	37438	1970

注．(1)に同じ

(5) Maesopsis

林齢 (年)	本数 (本)	全樹高 (m)	平均直径 (cm)	胸高断面積 (m²)	全材積 (m³)	MAI (m³)
1	適合なし	0.9	1.5	0.17	0.98	0.98
2		2.5	4.0	0.69	4.08	2.04
3		4.6	7.1	1.56	9.41	3.14
4		7.2	10.7	2.79	17.02	4.26
5		10.1	14.6	4.38	26.96	5.39
6		13.4	18.9	6.32	39.26	6.54
7				8.63	53.94	7.71
8				11.29	71.03	8.88
9					90.54	10.06
10					112.50	11.25
11					136.92	12.45
12					163.81	13.65
13					193.18	14.91
14					225.06	16.08
15					259.44	17.30
16					296.35	18.52
17					335.78	19.75
18					377.76	20.99
19					422.28	22.23
20					469.37	23.47

注 (1)に同じ

(6) Mahogany

林齢 (年)	本数 (本)	全樹高 (m)	平均直径 (cm)	胸高断面積 (m²)	全材積 (m³)	MAI (m³)
1	583	0.4	0.9	0.02	4.23	4.23
2	319	1.5	2.1	0.09	9.06	4.53
3	261	3.3	3.7	0.26	12.66	4.22
4	236	5.7	5.4	0.53	15.33	3.83
5	222	8.7	7.2	0.91	17.36	3.47
6	214	12.4	9.1	1.44	18.94	3.16
7	207		11.2	2.11		
8	203		11.4	2.93		
9	200		15.6	3.93		
10	197		18.0	5.10		
11	194		20.4	6.46		
12	193		22.8	8.02		
13	192		25.4	9.78		
14	190		28.0	11.75		
15	189		30.7	13.95		
16	188		33.4	16.37		
17	187		36.2	19.02		
18	187		39.0	21.92		
19	186		41.9	25.07		
20	185		44.4	28.47		

注 (1)に同し

表３－５　２－Ｂ：ＪＩＣＡによる造林成績調査（１９８２年）

(1)　Cadamba

林齢（年）	全林木平均樹高（m）	上層木平均樹高（m）	優勢木平均樹高（cm）	平均直径（㎡/ha）	胸高断面積（㎥/ha）	材積（㎥/ha）	ＭＡＩ（㎥/ha）	樹冠半径（m）
1	0.4	0.4	2.9	0	0.00	0	0.0	0.40
2	3.2	3.4	6.9	3	0.29	2	1.0	1.41
3	6.9	7.4	10.5	8	1.81	12	4.0	2.15
4	10.2	11.0	13.8	14	4.62	31	7.8	2.65
5	13.1	14.1	16.9	18	8.23	61	12.2	3.00
6	15.6	16.7	19.8	22	12.22	103	17.2	3.26
7	17.7	19.0	22.6	26	16.33	156	22.3	3.46
8	19.6	20.9	25.3	29	20.39	222	27.8	3.62
9	21.3	22.6	27.8	31	24.35	299	33.2	3.75
10	22.7	24.1	30.4	33	28.15	388	38.8	3.85
11	24.1	25.4	32.8	35	31.29			3.94
12	25.3	26.6	35.2	36	35.25			4.02
13	26.4	27.7	37.5	38	38.55			4.08
14	27.4	28.6	39.8	39	41.69			4.14
15	28.4	29.5	42.1	40	44.68			4.19
16	29.3	30.4	44.3	41	47.53			4.23
17	30.1	31.1	46.5	42	50.25			4.27
18	30.9	31.9	48.6	43	52.85			4.31
19	31.6	32.5	50.7	44	55.34			4.34
20	32.3	33.2	52.8	44	57.72			4.37

注　1(1)　全林木平均樹高　Stand（All Trees）Average Height
　　(2)　上層木平均樹高　Upper Trees Average Height
　　(3)　優勢木平均樹高　Dominant Trees Average Height
　　－樹高の高い順を選び、ha当たり４０本をとる。
　　2　大線内か実測範囲、大線外は参考表示
　　3　平均樹高は常に良好な成長を示し、全林木では５年生で１３.１m、１０年生で２２.７m、優勢木では５年生で１６.９m、１０年生で３０.４mとなる。平均直径でも平均樹高とほぼ同様の傾向がみられる。胸高断面積は５年生で急速に増大する。材積は１０年で３８８㎥、ＭＡＩは３８.８㎥と著しく大きい。樹冠半径もきわめて大きく５年生で３mとなる。

(2) Cordia

林齢（年）	全林木平均樹高（m）	上層木平均樹高（m）	優勢木平均樹高（m）	平均直径（cm）	胸高断面積（m²/ha）	全材積（m³/ha）	MAI（m³/ha）	樹冠半径（m）
1	0.4	0.3	0.5	0	0.05	0	0	0.38
2	2.8	2.9	4.3	3	0.40	0	0	1.09
3	5.6	6.2	8.7	6	1.11	3	1	1.58
4	8.0	9.0	12.2	9	2.22	10	2.5	1.92
5	10.0	11.2	14.9	12	3.71	21	4.2	2.18
6	11.6	13.0	16.9	14	5.62	33	5.5	2.38
7	12.9	14.4	18.4	16	7.92	46	6.6	2.54
8	14.0	15.5	19.6	18	10.64	58	7.3	2.67
9	15.0	16.4	20.5	20	13.76	71	7.9	2.78
10	15.8	17.1	21.2	22	17.30	83	8.3	2.88
11	16.5	17.8	21.8	23	21.26	94	8.5	2.96
12	17.2	18.3	22.3	25	25.63	104	8.7	3.04
13	17.7	18.7	22.7	26		114	8.8	3.11
14	18.3	19.1	23.0	27		123	8.8	3.17
15	18.7	19.4	23.3	28		131	8.7	3.22
16	19.2	19.7	23.5	30		139	8.7	3.27
17	19.6	20.0	23.7	31		147	8.6	3.32
18	19.9	20.2	23.8	32		153	8.5	3.36
19	20.3	20.4	23.9	33		160	8.4	3.41
20	20.6	20.6	24.0	34		166	8.3	3.44

注 1 平均樹高 (1)と同じ
2 (1)と同じ
3 初期成長か良く5年生頃まではCadambaに次く成長を示すか、その後の成長は劣るようである。

(3) Kauvula

林齢（年）	全林木平均樹高（m）	上層木平均樹高（m）	優勢木平均樹高（m）	平均直径（cm）	胸高断面積（m²/ha）	全材積（m³/ha）	MAI（m³/ha）	樹冠半径（m）
1	0.7	0.9	2.4	1	0.03	—	—	0.09
2	2.5	2.9	4.5	2	0.15	—	—	0.50
3	4.1	4.5	6.1	4	0.39	1.1	3.7	0.94
4	5.5	5.8	7.4	6	0.77	9	2.3	1.31
5	6.6	6.9	8.6	8	1.28	10	2.0	1.62
6	7.5	7.8	9.6	9	1.95	14	2.3	1.89
7	8.3	8.6	10.6	11	2.28	18	2.6	2.12
8	9.1	9.2	11.5	13	3.76	25	3.1	2.32
9	9.7	9.9	12.4	15	4.92	35	3.9	2.50
10	10.3	10.4	13.2	17	6.26	48	4.8	2.66
11	10.9	10.9	14.0	19	7.77	65	5.9	2.81
12	11.4	11.4	14.7	21	9.46	87	7.3	2.94
13	11.9	11.8	15.4	22	11.35			3.06
14	12.3	12.2	16.1	24	13.42			3.18
15	12.7	12.6	16.8	26	15.69			3.28
16	13.1	12.9	17.5	28	18.15			3.38
17	13.5	13.3	18.1	30	20.82			3.48
18	13.9	13.6	18.7	32	23.69			3.57
19	14.2	13.9	19.3	33	26.76			3.65
20	14.6	14.2	19.9	35	30.05			3.73

注 1 平均樹高は(1)Cadambaと同じ
2 (1)と同じ
3 成長は遅く全林木平均樹高は10年生でCadambaの半分以下である。

(4) Deglupta

林齢（年）	全林木平均樹高（m）	上層木平均樹高（m）	優勢木平均樹高（m）	平均直径（cm）	胸高断面積（m²/ha）	全材積（m³/ha）	MAI（m³/ha）	樹冠半径（m）
1	0.0	0.1	0.2	0	0.00	0		0.03
2	1.2	1.3	2.2	1	0.00	0		0.36
3	3.7	4.2	5.5	3	0.09	1		0.86
4	6.7	7.5	9.1	7	0.53	6		1.35
5	9.7	10.7	12.6	10	1.52	16		1.76
6	12.5	13.7	15.9	13	3.05	30		2.10
7	15.1	16.3	19.0	17	5.02	47		2.39
8	17.4	18.8	21.9	20	7.30	65		2.63
9	19.6	20.9	24.6	24	9.76	84		2.84
10	21.5	22.9	27.2	27	12.31	103		3.02
11	23.4	24.7	29.6	30	14.88	122		3.17
12	25.0	26.3	31.9	33	17.44	140		3.30
13	26.6	27.8	34.0	36	19.94	158		3.42
14	28.0	29.1	36.1	39	22.37	175		3.53
15	29.4	30.4	38.1	42	24.71	191		3.62
16	30.7	31.5	40.0	45	26.96	206		3.71
17	31.9	32.6	41.8	48	29.11	221		3.78
18	33.0	33.7	43.6	50	31.17	235		3.85
19	34.1	34.6	45.3	53	33.14	248		3.92
20	35.1	35.5	46.9	55	35.01	260		3.98

注 1 平均樹高は(1)Cadamba に同じ
2 (1)に同じ
3 初期成長はかなり劣るか、その後急速に伸びてカタンハと同程度の良好な成長を示す。
なお、胸高断面積が5年生で僅かに1.52 m²にすぎないのは、高い枯死率と関係がある。
このことは材積が10年生で103 m³、16年生で206 m³の僅かなことにも影響している。

(5) Mahogany

林齢（年）	全林木平均樹高（m）	上層木上均樹高（m）	優勢木平均樹高（m）	平均直径（cm）	胸高断面積（m²/ha）	全材積（m³/ha）	MAI（m³/ha）	樹冠半径（m）
1	0.0	0.0	0.0	0	0.00	1	1.0	0.05
2	0.7	0.9	1.4	1	0.02	6	3.0	0.23
3	2.7	3.2	4.4	3	0.16	13	4.3	0.46
4	5.6	6.2	7.9	5	0.51	20	5.0	0.70
5	8.6	9.2	11.2	8	1.07	25	5.0	0.95
6	11.5	12.0	14.2	10	1.83	29	4.8	1.19
7	14.0	14.5	16.8	13	2.75	33	4.7	1.42
8	16.3	16.7	19.1	16	3.81			1.66
9	18.4	18.6	21.0	18	4.99			1.89
10	20.2	20.3	22.7	20	6.27			2.12
11	21.9	21.8	24.2	22	7.64			2.34
12	23.3	23.2	25.6	24	9.08			2.56
13	24.6	24.4	26.7	26	10.59			2.79
14	25.8	25.4	27.8	28	12.16			3.00
15	26.9	26.4	28.7	30	13.78			3.22
16	27.9	27.3	29.6	32	15.45			3.43
17	28.8	28.1	30.4	34	17.16			3.65
18	29.6	28.8	31.1	36	18.91			3.86
19	30.3	29.5	31.7	37	20.70			4.07
20	31.0	30.1	32.3	39	22.52			4.27

注 1 平均樹高は(1)Cadamba と同じ
2 (1)と同じ
3 初期成長は最も劣り、全林木平均樹高で3年生時に僅かに2.7 mであるが、その後は順調な成長を示し10年生では20.2 mとなる。
樹冠半径は5年生では1 mにも満たないが着実な成長を続け20年生では4 mを超える。

表３－６　２－Ｃ：

(1)　Mahogany　固定標準地成長成績

Site（個所）	林齢（年）	本数（本／ha）	一本当材積（m³）	全材積（m³／ha）	MAI（m³／ha）	優勢木 Predominent Ht（m）	優勢木 Predominent Htm（m）	優勢木 Predominent 直径（cm）	Crop Ht（m）	Crop Htm（m）	Crop 直径（cm）
Nukurua	11	198	0323	64	58	19	10	35	18	9	25
	11	213	0298	94	85	18	8	32	17	7	24
	12	213	0435	92	77	23	13	38	23	12	30
	12	168	0439	73	61	21	11	37	19	9	30
	14	342	0791	270	193	24	10	43	20	8	28
	14	733	0388	284	203	25	14	23	20	9	20
	15	217	0552	120	80	25	11	48	22	11	31
	15	114	0459	52	35	22	11	41	20	10	31
	15	173	0621	107	91	22	12	45	23	11	32
	16	217	0371	80	50	21	13	35	21	11	26
	16	217	0457	99	62	25	11	40	22	9	30
	16	119	0680	80	50	24	13	47	23	11	36
	17	153	0599	91	54	22	9	46	21	8	33
	17	183	0394	72	42	21	10	36	20	7	27
	17	149	0764	113	66	28	12	47	27	11	34
	17	163	0770	125	74	25	11	48	23	9	39
Tovata／Kalabu	23	183	1000	183	80	32	11	57	29	13	45
	23	188	0995	186	81	30	11	59	27	11	43
	23	243	0808	196	85	29	11	54	25	10	39
	23	287	0665	190	83	29	14	51	25	11	36
Nadarivatu	23	257	0536	137	60	24	11	40	22	9	31
	23	257	0682	175	76	25	12	50	23	13	33
	44	79	1883	148	34	27	13	74	27	14	68

注．Crop＝Size of average Tree

Predominent＝Best 4 trees in every 0.202 ha plot

＝20 stems per ha

資料：Forestry Department－Colo－i－Suva

(J. G. Groome and Associates N. Z.)

(2) 南部フィジーのマホガニー造林地（１９６２～１９６７年植栽）

個所	林齢（年）	植栽本数（本／ha）	現在本数（％）（本／ha）	平均直径（cm）	胸高断面積（m²／ha）	全材積（m³／ha）	MAI（m³／ha）
Galoa	10	318	119 (37)	12.4	2.34	8.4	0.84
	10	443	146 (33)	14.5	4.54	14.36	1.47
	11	322	131 (40)	19.0	5.56	22.38	2.03
	12	440	106 (24)	22.3	9.45	22.8	1.9
	12	367	80 (21)	19.0	6.35	13.7	1.14
	13	342	124 (36)	22.8	7.47	28.0	2.15
	14	337	126 (37)	28.5	11.36	49.0	3.5
	15	313	83 (26)	26.7	9.63	27.5	1.83
	16	377	103 (27)	29.7	13.72	43.5	2.71
Naboutini	12	263	114 (43)	16.7	3.94	14.13	1.18
	13	333	118 (35)	21.3	7.09	27.02	2.18
	14	283	97 (34)	22.2	5.57	23.3	1.66
	15	435	135 (31)	27.8	13.65	53.1	3.54
Yarawa	15	444	104 (23)	29.4	13.31	43.35	2.89
	16	438	103 (23)	30.1	14.66	43.59	2.72
	16	416	109 (26)	32.5	14.27	53.82	3.36
	16.5	389	74 (19)	27.9	10.03	27.98	1.75
	16.5	296	104 (35)	23.5	5.16	29.46	1.78
Nukurua	11	321	155 (48)	22	7.83	35.22	3.2
	11	314	157 (50)	23.1	8.21	38.67	3.52
	11	242	68 (28)	20.1	3.59	12.6	1.15
	11	327	100 (30)	23	5.57	24.57	2.23
	12	350	168 (48)	22.5	8.79	39.82	3.32
	12	388	127 (32)	25.1	8.02	40.4	3.37
	13	301	135 (44)	23.9	9.06	36.36	2.8
	13	461	193 (41)	25.8	13.28	60.35	4.64
	13	331	103 (31)	24.6	7.65	34.49	2.65
	14	414	246 (59)	22.3	13.86	60.19	4.3

注．(1) 林齢は１９７８年の測定時のものである。

(2) 測定値は１９８０年のサイクロンWally前のもので、現在はサイクロンで約２０％か失われている。たたし、Nukurua地区はサイクロンの被害は大きくなかった。

出典－Managemant Division, SUVA, FIJI.

（J G. Groome and Associates, N. Z. より）

(3) NUKURUA 6広葉樹固定標準地資料（１９８０年７月）

林齢 (年生)	本数 (本/ha)	Predominent 優勢木 樹高 (m)	直径 (cm)	Crop 全木 樹高 (m)	直径 (cm)	胸高断面積 (m²/ha)	全材積 (m³/ha)	MAI (m³/ha)	Plot 区 Area (ha)
Anthocephalus chinensis									
25	366	11	17	8	13	49	239	96	005
26	335	13	23	10	15	59	333	128	011,002ha
28	1038	13	20	13	15	196	129	461	009,008ha
28	1,025	12	9	12	15	188	1227	438	010,008ha
31	230	11	17	11	12	28	168	54	017,002ha
48	1,025	16	24	15	17	249	192	400	009
48	1,025	14	22	14	16	230	174	363	010
48	335	17	35	15	23	143	110	229	011
51	230	13	20	13	16	46	326	64	017
56	351	25	36	23	25	185	208	371	005
56	260	22	32	22	28	159	173	309	008,015ha
70	346	28	40	24	28	216	257	367	005
70	180	25	38	25	31	141	170	243	008
917	346	32	46	29	30	254	353	385	005,0202ha
917	180	29	45	28	35	178	244	266	008
Cordia alliodora									
46		12	15	9	10	20	84	18	021,0202
86		17	25	16	17	68	446	52	019,0202
86		19	26	16	17	70	459	53	020,0202
Endospermum macrophyllum									
50	342	12	21	10	16	70			13,0202
50	243	13	21	12	15	47			14
118	327	20	25	18	19	93			13
118	238	18	30	16	21	83			14,0202
155	1,325	16	23	14	17	310			
Eucalyptus deglupta									
66	380	25	32	24	22	147	1501	227	21,0202
66	470	25	30	22	20	154	1475	223	22,0202
108	205	35	46	30	30	149	1828	169	138,02
108	135	18	25	16	16	28	204	19	139,02
108	60	28	33	26	29	404	446	41	140,02
158	190	49	58	43	38	224	3706	235	138
158	125	27	36	24	24	58	507	32	139
158	60	40	49	37	42	871	1432	91	140
Maesopsis eminii									
46	215	13	21	11	14	35	213	46	18,0202
56	260	16	13	23	16	52	336	60	24,0202
Swietenia macrophylla Galoa									
55	153	8	11	6	7	08	20	04	3
55	158	8	9	6	6	06	69	13	4
105	138	18	25	17	18	38	207	20	3
105	123	18	22	17	18	32	174	17	4
115	173	20	29	17	20	56	312	27	1
115	163	18	27	17	19	48	266	23	2
163	138	24	40	22	30	104	615	38	2
165	168	25	46	21	31	127	753	46	1

3－1　Nukurua 地域の造林地と調査地

ヌクレア地区はビチレブ島東南部に位置する。政府は現住民の土地をリースして１９６１年以降天然林を切り開き当初は東側の Kings Road に接する部分から西北方に向けて表３－７に示すとおり造林を進めている。

表３－７　ヌクルア地域の造林概況

番号		造林期間（年）	面　　積（ha）	備　　考
1	マホガニーの	1961-1971	4,372.2	表３－１参照
	列状植栽地	1976-1980	451.2	〃
	小　　計		4,823.4	〃
2	６樹種を主とする	1971-1972	43.7	表３－１参照
	列状植栽地	1974-1980	1,812.8	〃
	小　　計		1,865.5	
3	造林未済地		425.0	JICA（昭57）報告による
	小　　計		425.0	
合　　件			7,104.9	

１９８０年ＪＩＣＡは、表３－７に示すNo.２の６樹種を主として列状植栽した区域を対象として、造林面積の少ないマエソビシスを除く５樹種の人工林生産力を調査し、その調査結果に基づいてNo.３の造林未済地４２５haの適地適木を策定した。

3－2　森林生産力調査概要

① 地形　地区は波状ないし小起伏の地形で、浅いクリークに沿って僅かに開析斜面が発達している。

② 標準地調査　標準プロットの大きさは００５ha（幅２０m×長さ５０m）または０１ha（幅２０m×長さ５０m）の長方形とし、これによって列状植栽の２～３列が入るようにした。プロットは１４０個所を設定し、樹種毎に林齢、樹高、胸高直径、樹冠半径、形質級、枯損原因を調査した。

③ 立地調査　土壌調査は２０カ所以上を調査し、表３－８に示すように腐植ラトルソＡ型、Ｂ型、Ｃ型、Ｄ型及びグライ土に区分した。

表３－８　ヌクレア地区熱帯雨林地域の土壌分類

高次分類	低次分類	地形と堆積様式	土地断面の形態的特徴	要点
	A型 腐植ラトソル	鈍頂峰部 残積土	A層・７５ＹＲ、よく発達した塊状構造 B層・上部－７５ＹＲ～５ＹＲ　弱い塊状構造、埴土 下部－２５ＹＲ～１０Ｒ　重埴土　非常に堅	狭い峯の残積土で、B層上部から赤土壌（２５ＹＲ－１０Ｒ）が発達している。
	B型 退化腐植ラトソル	広い平坦峰部 残積土	A層　７５ＹＲ　弱い塊状構造 B層　上部－７５ＹＲ～５ＹＲ、比較的厚い、ややカベ状、埴土 下部－２５ＹＲ、重埴土	広い峰の残積土でB層下部に赤色土壌（２５ＹＲ－１０Ｒ）が発達している。
	C型 ラトソル土材料からできた土壌	中・急斜地形 匍行土	A層・７５ＹＲ、弱い塊状構造 B層　７５ＹＲ、風化岩混入、埴質 C層・７５ＹＲ、風化岩混入、埴質、カベ状	斜面の匍行上で層位の配列が不規則で、匍行物質を混入する。
	D型 ややクライ土がかった腐植ラトルソ	山脚平坦地 崩積性	A層　７５ＹＲ　弱い塊状構造 B層・７５ＹＲ　重埴土、カベ状 B(g)層　５ＹＲ　２５ＹＲの斑あり、重埴土、カベ状	山脚平坦地の崩積土で、下層に弱いグライ斑がある。
	腐植ラトソルと関連を持ったグライ土	クリーク近くの山脚平坦地 崩積土	A層：７５ＹＲ　弱い塊状構造 B(g)層・２５Ｙ　重埴土、グライ斑および鉄斑、カベ状 G層：７５Ｙ　重埴土、鉄条あり、時々湧水あり	クリーク沿い平坦地の崩積土で、下部にグライ層が発達している

局所地形は尾根部、山腹部、谷部に区分した。傾斜区分は平（０～５°）、緩（６～１０°）、中（１１～２０°）、急（２１°以上）の４区分とした。方位はN、S、E、Wの４区分とした。

④　生産力判定基準の作成　造林地はマホガニー以下はすべて幼齢で標本プロットは３～１０年生に分布するので位置指数の判定には５年生時の平均樹高を採用した。この指数の決定にはFiji政府が作成した地位別樹高の曲線（Hight／Age Graph and Site Class Index）によった。例えばCadambaで、標本プロットの林齢７年の平均樹高が１８ｍの場合は、図３－１の地位別樹高曲線から地位指数として５年生時の平均樹高１３２ｍとしている。なお平均樹高は林分が幼齢のため全林木の平均樹高によっている。

かくて立地要因（Site Factor）として、土壌型と局所地形との間の相関係数は０８と高いので、これをはずして局所的な立地条件に影響する要因として次の４因子とカテゴリーを設定した。

カテゴリー / 要因	1	2	3	4
土　　壌	型 A	型 B	型 C	グライ土
傾　　斜	平	緩	中	急
方　　位	N	S	E	W

⑤　樹種別、カテゴリー組合せ別森林生産力

樹種別、要因別のカテゴリーのスコア変化状況の計笑の結果、次の傾向が見出された。

土壌型：森林生産力からみて、A＜B＜C＜Dの順に生産力の高いことが予想された。カウブラを除いてその傾向があり、とくに成長の早いカダンバ、デグルプタはその傾向が明らかである。

傾斜：森林生産力からみて、平坦地（上）、平担地（下）、緩斜地、中・急斜地の傾向があると予想される。それは、同じ平坦地でも斜面上部では残積的、斜面下部では崩積的土壌が多く、生産力にも関係することが考えられたからである。このような傾向は各樹種に共通して認められた。

方位：各樹種ともS方向の生産力が高い結果を示した。

森林生産力判定基準表は各要因の多変量解析法によって計算されたスコアで表3－9のとおり示された。

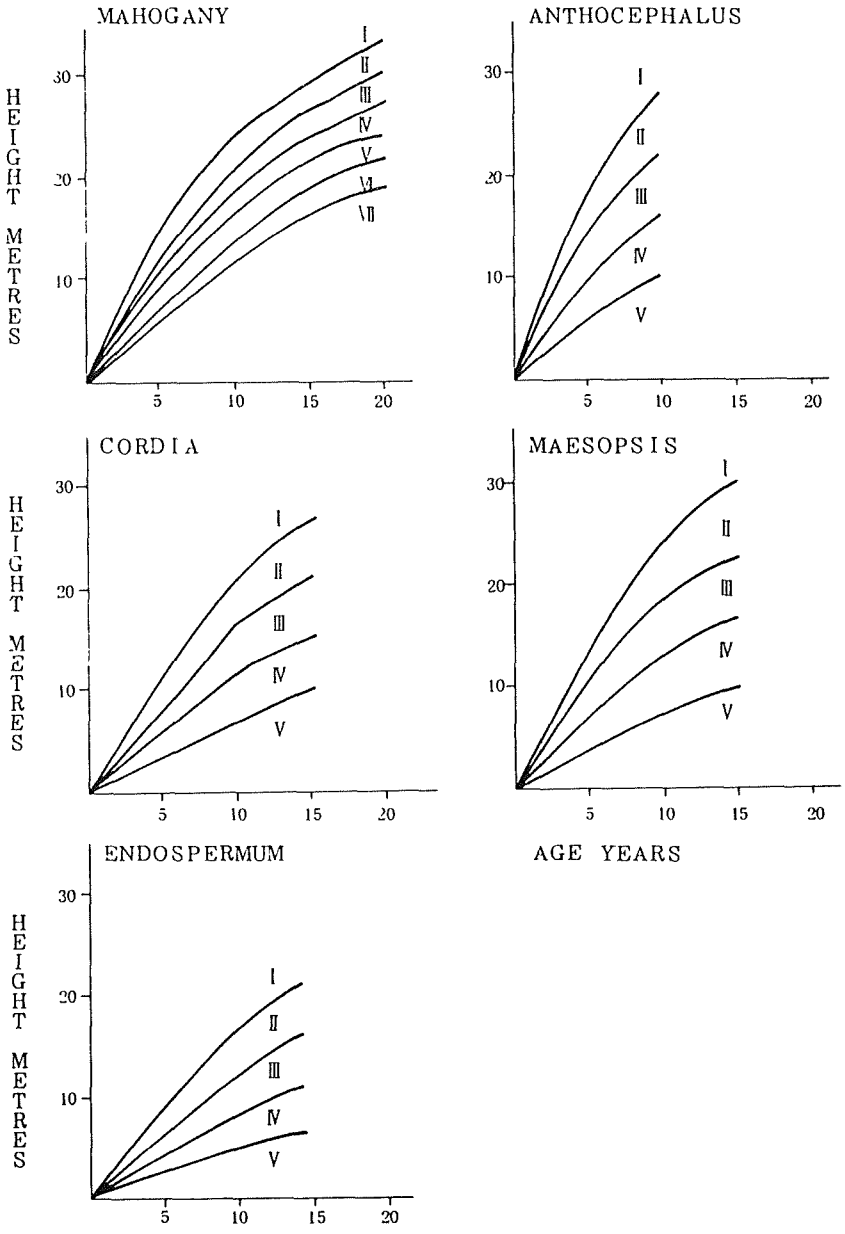
表3－9　森林生産力判定基準表

要因	カテゴリー	No	Cadamba	Deglupta	Cordia	Kauvula	Mahogany
土壌型	A 型	1	-695	623	-094	209	−115
	B 型	2	-375	-623	082	-045	-255
	C 型	3	-257	-354	279	-326	-230
	D 型	4	000	000	000	000	000
傾斜	平(上)	1	-071	-171	016	-403	-330
	平(下)	2	005	-065	198	005	-276
	緩	3	-156	-006	-200	-435	-040
	中・急	4	000	000	000	000	000
方位	N	1	1711	1602	751	1009	980
	S	2	1849	1719	935	1075	1375
	E	3	1499	1524	940	658	1181
	W	4	1642	1015	743	836	1002

この基準表の使い方は生産力を推定しようとする場所について、その立地条件に応じて各立地要因毎の該当カテゴリーのスコア値を引き出し、これを合計することによって平均樹高の推定値を求めるものである。例えばCadambaの立地が土壌型１、傾斜１、方位１のカテゴリーの平均樹高は、－６９５－０７１＋１７１１＝９４５ｍとなる。

森林生産力判定基準表の実用にあたって、属地ごとに上記の加算作用を行う手間を省くため、予じめ全ての組合せによる樹種別の推定平均樹高を計算して作成したのが表３－１０である。

図３－１　FIJI－SITE INDICES



SOUECE - FORESTRY DEPARTMENT, COLO－1－SUVA

表３－１０　樹種別、カテゴリー組合せ別森林生産力計算表

土方傾 壌位斜	CADAMBA	DEGLUPTA	CORDIA	KAUVULA	MAHOGANY
1 1 1	945*m*	808 *m*	673 *m*	815 *m*	535 *m*
1 1 2	1083	925	857	881	930
1 1 3	733	730	862	464	736
1 1 4	876	221	665	642	557
1 2 1	1021	914	855	1223	589
1 2 2	1159	1031	1039	1289	984
1 2 3	809	836	1044	872	790
1 2 4	952	327	847	1050	611
1 3 1	860	973	457	783	825
1 3 2	998	1090	641	849	1220
1 3 3	648	895	646	432	1026
1 3 4	791	386	449	610	847
1 4 1	1016	979	657	1218	865
1 4 2	1154	1096	841	1284	1260
1 4 3	804	901	846	867	1066
1 4 4	947	392	649	1045	887
2 1 1	1265	808	849	561	395
2 1 2	1403	925	1033	627	790
2 1 3	1053	730	1038	210	596
2 1 4	1196	221	841	388	417
2 2 1	1341	914	1031	969	449
2 2 2	1479	1031	1215	1035	844
2 2 3	1129	836	1220	618	650
2 2 4	1272	327	1223	796	471
2 3 1	1180	973	633	529	685
2 3 2	1318	1090	817	595	1080
2 3 3	968	895	822	178	886
2 3 4	1111	386	625	356	707
2 4 1	1336	979	833	964	725
2 4 2	1474	1096	1017	1030	1120
2 4 3	1124	901	1022	613	926
2 4 4	1267	392	825	791	747
3 1 1	1383	1077	1046	280	420
3 1 2	1521	1194	1230	346	815
3 1 3	1171	999	1235	071	621
3 1 4	1314	490	1038	107	442
3 2 1	1459	1183	1228	688	474
3 2 2	1597	1300	1412	754	869
3 2 3	1247	1105	1417	337	675
3 2 4	1390	596	1220	515	496
3 3 1	1298	1242	830	248	710
3 3 2	1436	1359	1014	314	1105
3 3 3	1086	1164	1019	103	911
3 3 4	1229	655	822	075	732
3 4 1	1454	1248	1030	683	750
3 4 2	1592	1365	1214	749	1145
3 4 3	1242	1170	1219	332	951
3 4 4	1385	661	1022	510	772
4 1 1	1640	1431	767	606	650
4 1 2	1778	1548	951	672	1045
4 1 3	1428	1353	956	255	851
4 1 4	1571	844	759	433	672
4 2 1	1716	1537	949	1014	704
4 2 2	1854	1654	1133	1080	1099
4 2 3	1504	1459	1138	663	905
4 2 4	1647	950	941	841	726
4 3 1	1555	1596	551	574	940
4 3 2	1693	1713	735	640	1335
4 3 3	1343	1518	740	223	1141
4 3 4	1486	1009	543	401	962
4 4 1	1711	1602	751	1009	980
4 4 2	1849	1719	935	1075	1375
4 4 3	1499	1524	940	658	1181
4 4 4	1642	1015	743	836	1002

出典

南方造林協会：フィジー国ビチレブ島東南部の林業開発促進に関する調査報告書、南方造林、No．27、（1983）

樹種：DATISCACEAE（ダティスカ科）*Octomeles sumatrana*（エリマ ERIMA），MYRTACEAE（フトモモ科）*Eucalyptus deglupta*（カメレレ KAMERERE），COMBRETACEAE（シタンジ科）*Terminalia brassii*（ブラウンターミナリア TERMINARIA, B.）

国　：パプアニューギニア

データ採取地の立地環境

この地の気温は、年間平均気温26～28℃、降雨量は、3,800 ～4,500M/M年てあり、異常気候（多雨 or 乾季が厳しい）は 5～ 7年間隙にて発生する。

乾季は、 5月～10月、雨季は11～ 4月であるが、この地区の乾季は、通常年の場合は、月間最低雨量は、 100M/M 前後である。 植付けは、雨期に行われるか、通年植林も多少の灌水を行えば、可能である。 病虫害も殆ど無い。

成長・収穫に関する表，図，式など

（イ）成長記録

成長記録の測定の為、1981年よりサンプルプロット(0 5 HA 基準）の設定と開始開始した。

① 植付年別／樹種別サンプルプロット設定状況

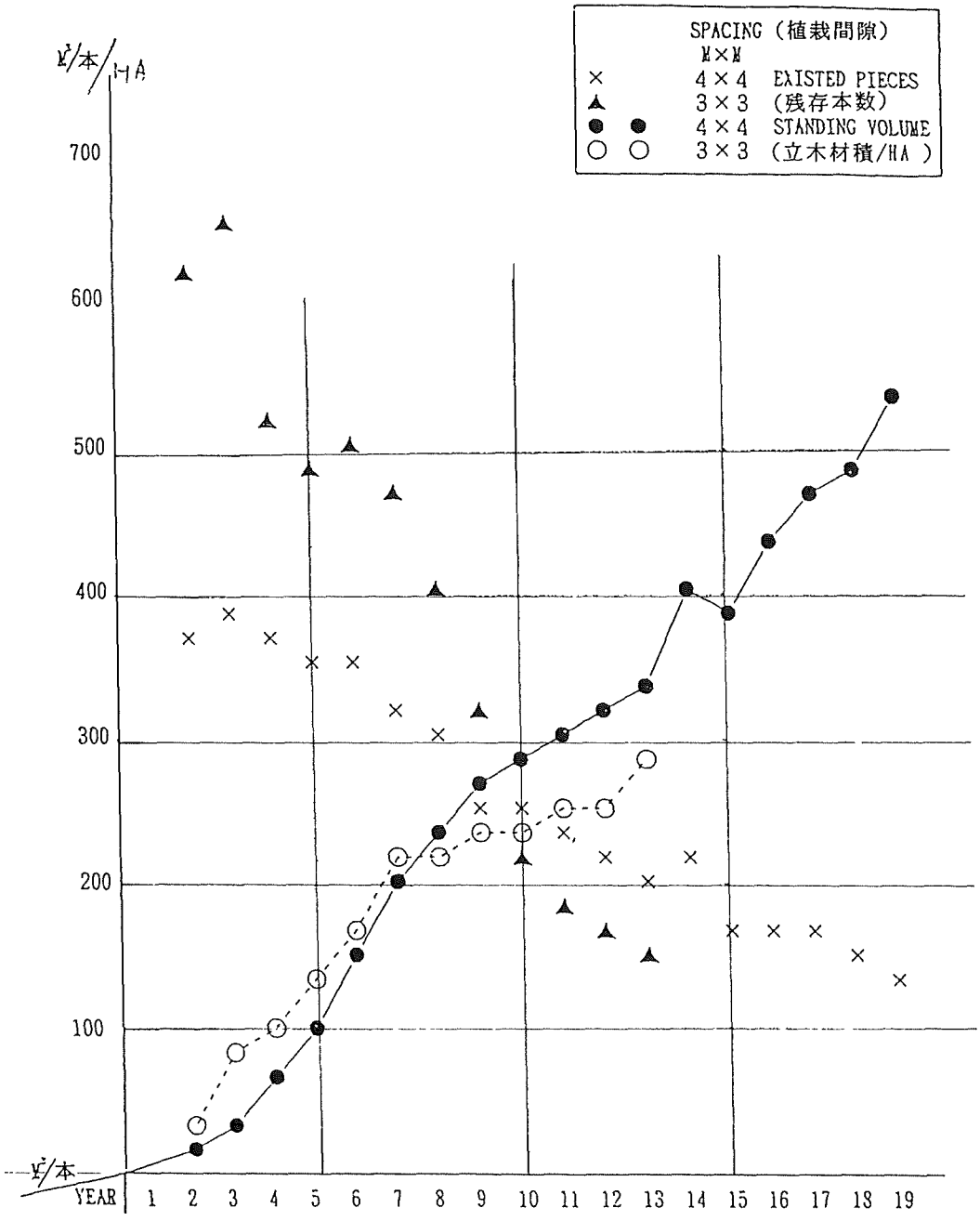
樹種 / 植付年	KAMERERE	ERIMA	TERMINALIA B	合 計
1968	（1）伐採済	－	－	（1）
1978	1	－	－	1
1976	4	－	－	4
1977	2	－	－	2
1978	3	－	－	3
1982	10	2	－	12
1983	－	1	3	4
1984	3	1	－	4
合計	23（1）	4	3	30（1）

② カメレレの成長曲線及び残存本数/HA は次の様になる。

SBLC--(1989)

GLOWTH FIGURE OF REFORESTED KAMARERE

（植林カメレレの成長状況）



上位木 100本/HA と下位木及び平均値対比

（１９８８年調）

プロット No	樹種	樹齢	上位100本				下位木				平均				
			平均径	平均高	単材積	蓄積量	平均径	平均高	単材積	蓄積量	平均径	平均高	単材積	蓄積量	本数
		単位	cm	m	m^3	m^3	cm	m	m^3	m^3	cm	m	m^3	m^3	本
2	カメレレ (4x4)	16	47 5	50 0	3 467	346 7 (82%)	28 2	37 6	0.968	75 5 (18%)	39 0	44 6	2 372	422 2 (100%)	178
3	カメレレ (3x3)	12	39 7	39 3	2 070	207.0 (82%)	25 2	30 3	0.692	81 6 (28%)	32 2	34 9	1 366	288 6 (100%)	216
5	カメレレ (3x3)	12	40 0	39 8	2 117	211 7 (100%)	-	-	-	-	40	39 8	2 117	211 7 (100%)	100
20	カメレレ (4x4)	12	42 2	40 8	2 404	240 8 (82%)	29 5	30 1	0 991	51 5 (28%)	37 8	38 5	1 921	292 (100%)	152
4	カメレレ (4x4)	12	40 8	41 3	2 334	233 4 (73%)	28 8	34 9	0.951	86 6 (27%)	35.1	38 3	1 684	343 7 (100%)	190
6	カメレレ (4x4)	11	40 1	43 2	2 231	223 1 (69%)	27 4	34 9	0 859	104 7 (31%)	33 1	34 6	1 199	- (100%)	222

プロット No	樹種	樹齢	上位100本				下位木				平均				
			平均径	平均高	単材積	蓄積量	平均径	平均高	単材積	蓄積量	平均径	平均高	単材積	蓄積量	本数
		単位	cm	m	m^3	m^3	cm	m	m^3	m^3	cm	m	m^3	m^3	本
7	カメレレ (3x3)	11	35.6	37 5	1.649	164 9 (69%)	36 5	31.6	0 741	72.6 (31%)	31.6	34 6	1.199	237.5 (100%)	198
8	カメレレ (4x4)	6	30 3	28	0 896	89 6 (45%)			0 367	111 1 (55%)	22 5	25 2	0 498	200 7 (100%)	402
22	ターミナリア (4x4)	5	23 6	22 3	0 445	44 4 (32%)			0.236	95.6 (68%)	19 4	20 0	0 278	140.0 (100%)	504
23	ターミナリア (3x3)	5	20.9	22.4	0 345	34.5 (19%)			0.184	146 3 (81%)	16.5	20 5	0.203	180 8 (100%)	892
19	エリマ (5x5)	6	34.3	25 5	1.092	109 2 (46%)			0 455	126 6 (54%)	26 9	21.6	0 624	235 8 (100%)	378
21	エリマ (4x4)	5	30 5	24 8	0 832	83 3 (41%)			0.261	118 8 (59%)	22.5	19 3	0 365	202 0 (100%)	554
26	エリマ (5x5)	6	33 7	25 1	1 041	104 1 (65%)			0 475	56.1 (35%)	29 0	22.9	0 735	160.2	218

出典

森正次：有用早生樹種の植林促進による熱帯林の再生について、㈱日商岩井植林事業促進室（1991）

樹種：MORACEAE（クワ科）*Chlorophora excelsa*（イロコ），　MELIACEAE（センダン科）*Entandrophragma cylindricum*（サペリ），*E. angolense*（ティアマ），*Khaya ivorensis*（アフリカマホガニー），SAPOTACEAE（アカテツ科）*Tieghemella heckelii*（マコレ），RUBIACEAE（アカネ科）*Nauclea diderrichii*（ビランガ）

国　：ガーナ

データ採取地の立地環境

48. In the study area in Ghana covered by the Greater Kakum Working Plan (1963), the total area of the Selection Working Circle amounts to 377 km^2 and this was divided into four felling series, each series corresponding with the total area of a timber harvesting concessionaire. The yield was regulated under a system in which trees of more than 1.5 m girth (48 cm dbh) would give equal annual yields for the period up to the time when the current immature trees attain exploitable girths. Volume tables are unavailable and basal area, which is believed to bear a direct relationship to volume in respect of trees over 3 m girth (95 cm dbh) was used. The time which trees take to pass from 1.5 m girth to exploitable size has been estimated as follows:

Class I a	1.5 - 3 m	60 years
Class I b	1.5 - 3 m	45 years
Class II a	1.5 - 3 m	50 years
Class II b	1.5 - 2 m	30 years

The exploitable yield was calculated (the Kinloch and Jack method) by dividing the total hoppus basal area of all trees above 1.5 m girth by the time of passage. The calculated yield is justified by the forecast method of projecting the growing stock, less the annual yield, to the next felling cycle assuming a 75% survival rate. The felling cycle until 1971 was 25 years and the area of the annual coupe was obtained by dividing the area of the felling series by the period of the cycle. The yield was selected from the upper girth classes downwards until the prescribed yield was reached, minimum girth limits being enforced.

成長・収穫に関する表，図，式など

49. As an example of how this calculation was applied in practice the yield calculation for Class I species in the Gaisie Felling Series of the Greater Kakum Working Plan area was as follows:

Class	Species
Class I Species	Chlorophora excelsa
	Entandrophragma cylindricum
	Entandrophragma angolense
	Khaya ivorensis
	Tieghemella heckelii
	Nauclea diderrichii
Net productive area of F.S.	2 678 ha
Felling Cycle	25 years
Annual Coupe	107 ha

Yield Calculations for Class I Species

Girth (m)	0.91-1.52	1.53-2.14	2.15-2.74	2.75-3.35	3.36-3.96	3.97-4.57	4.58 +
No. of trees on 1 018 ha	439	554	414	325	137	137	32
Basal area (m^2)		147.4	195.8	240.2	145.8	198.5	60.9
Total basal area (m^2)	988.6						

Estimated basal area on F.S. of approx. 2 678 ha $= \frac{988.6 \times 2\,678}{1\,018}\ m^2$

Annual Yield by Kinloch and Jack with 60 divisor (see paragraph 48 above)

$= \frac{988.6 \times 2\,678}{1\,018 \times 60}$

$= 43.34\ m^2$

Apportionment of Yield

Girth (m)	1.53-2 14	2.15-2.74	2.75-3.35	3.36-3.96	3.97-4.57	4.58 +
No of trees per Coupe of 107 ha	58	44	34	14	14	3
Basal area (m^2)	15.49	20.81	25.19	14.90	20.34	5.67
Yield of 43.34 m^2 from			2.43	14.90	20.34	5.67

i.e. all trees of more than 3.36 m girth plus 9.6% of the 2.75-3.35 m Class.

出典

FAO (1985). Intensive multiple-use forest management in the tropics ; Analisis of case studies from India, Africa, Latin America and the Caribbean. FAO Forestry Paper 55.

樹種：STERCULIACEAE（アオギリ科）*Triplochiton scleroxylon*（オベチェ，ワワ，サンバ），
LEGUMINOSAE（マメ科），*Piptadeniastrum africanum*（ダベマ，ダホマ），
MORACEAE（クワ科）*Chlorophora excelsa*（イロコ，オドゥム）
国　：ガーナ

Table 2.の樹種は以下参照
ODUM　：*Chlorophora excelsa*（イロコ，オドゥム）
WAWA　：*Triplochiton scleroxylon*（オベチェ，ワワ，サンバ）
DAHOMA：*Piptadeniastrum africanum*（ダベマ，ダホマ）

データ採取地の立地環境

NATIONAL FOREST INVENTORIES

Three national forest inventories have been undertaken in Ghana since the 1950s The first of its kind was carried out between 1952 and 1970 with a sampling intensity of 3–5% and a sample size of 2 plots per 2 59sq km of productive high forest Since this was the first time and the dynamics of the forest was not well known, some assumptions had to be made which included, the time of passage from one girth class to another, time taken by a tree to reach maturity, and the mortality losses in the various girth classes

In order to obtain more information on the dynamics of the forests for future management, Permanent Sample Plots (P S P s) were started in 1969 The Leading Desirable (LD) concept was used to determine which trees to record in the sample plot A LD was any economic tree or seedling which was likely to be of most value at the next felling cycle

The second national inventory which was under the sponsorship of the Food and Agriculture Organisation and the United Nations Development Programme (FAO/UNDP) had a sample size of just over 150 000ha with a sampling intensity of 5% This was between 1980 and 1983.

Towards the end of the most recent one (1985–1988), the Forest Inventory Project (FIP) which was at a sampling intensity of 0 25% and covered an area of 546,000ha consisting of 43 Forest Reserves, the P S P programme was re-vitalised

This time, the LD concept was considered inappropriate for long-term studies of forest change The main reasons assigned were that, firstly, tree recruitment, mortality and competition can only be fully understood when the entire tree population is monitored, secondly, economic value of tree species is liable to change over time In addition, the very low recovery of LD's meant that the information to be obtained was limited It was therefore decided to measure all trees greater than 10cm diameter at breast height (dbh).

The Forestry Department's P.S P programme has one main and several subsidiary objectives, namely.

to provide the data required for modelling natural forests

and hence·

- predict future yield of specific products; estimate the effect of site, and disturbance, on forest composition and production; and monitor long-term site changes.

Plots have been laid out in proportion to the area of Forest Reserves within each of the major forest types described by Hall and Swaine, 1981, with few modifications to suit local conditions. Within each Forest Management Unit (50,000ha), 10 plots have been randomnly located within a variable number of strata Strata identified to-date are

topographical position,	hill top, upper slope, lower slope, valley bottom, swamp
logging history;	recent logging, no logging

Six hundred plots (350 new and 250 old) believed to be manageable in the long term and sufficient to provide the information required have been established The most significant recent addition to the field procedure is the measurement of a sub-sample within the plot for saplings (trees with dbh in the range of 2–10cm) This was to introduce regeneration surveys in P S P s Times between successive measurements have been set for 5 years

The F I P itself had among others, two main objectives,

(i) static inventory
Under the static inventory estimates of the national stock of commercial log volume within the Forest Reserves of Ghana were found This was done by means of Temporary Sample Plots (T S P s) The need for this was critical as the rehabilitated timber industry was putting ever increasing pressure on the forest The resultant concern was that demand was outstripping supply, and

(ii) dynamic inventory
Under this the objective was to update the Department's system of dynamic inventory by means of Permanent Sample Plots (P S P s)

成長・収穫に関する表，図，式など

Formulation of Individual Species Yield Tables

Yield tables for 3 species selected out of 14 species sampled on the old P S P's are presented in Table 2 For each species, the stocking, from the T S P s is shown by diameter classes Also the median tree volume of each class is known Average increments for each class summarized from P S P.s are given Time of passage through each class is calculated as class width (200mm) divided by mean increment

The growth shown refers to the volume that will grow into a class from the class below It is calculated as the volume of the preceding class, times the average proportion of surviving trees, times the average percentage that will move up into the next class

The AAC is the increment into a class times the total productive forest area, assumed in these table as 1 3 million ha It assumes that the class lower boundary is taken as the felling diameter limit

For example, for Odum, the 120cm class includes trees 110cm and above The average growth into that class is 0 022m³/ha/yr nationally This is the volume that could be felled on a sustained basis to that size limit

Table 2 Yield Tables for 3 selected species, Odum, Wawa, Dahoma

ODUM	Diameter	cm	10–29	30–49	50–69	70–89	90–109	110+
	Tree Vol	m^3	0 38	1 60	3 69	6 69	10 61	15 47
	Stocking	N/ha	0 36	1 17	0 13	0 09	0 07	0 07
	Increment	mm/yr	3 31	3 75	4 86	5 93	5 93	5 86
	Timepass	yrs	60 48	53 39	41 14	31 14	33 70	34 13
	Growth	m^3/ha/yr		0 001	0 004	0 008	0 014	0 022
	AAC	m^3/yr		1395	5059	10503	18068	28650
WAWA	Diameter	cm	10–29	30–49	50–69	70–89	90–109	110+
	Tree Vol	m^3	0 30	1 56	4 08	8 06	13 68	21 06
	Stocking	N/ha	2 03	1 01	0 90	0 76	0 48	0 36
	Increment	mm/yr	9 18	8 54	6 74	6 78	5 50	4 60
	Timepass	yrs	21 78	23 42	29 67	29 49	36 36	43 48
	Growth	m^3/ha/yr		0 014	0 060	0 104	0 131	0 135
	AAC	m^3/yr		18206	77944	135779	170558	
DAHOMA	Diameter	cm	10–29	30–49	50–69	70–89	90–109	110+
	Tree Vol	m^3	0 36	1 47	3 36	6 05	9 54	13 84
	Stocking	N/ha	2 75	0 61	0 44	0 31	0 18	0 12
	Increment	mm yr	5 94	8 98	11 15	8 32	5 82	5 82
	Timepass	yrs	33 66	22 28	17 94	24 04	34 39	34 36

Growth	m^3/ha/yr	0 006	0 029	0 058	0 045	0 033
AAC	m^3/yr	8418	37751	75569	58904	43278

出典

Michael Yaw Poku-Marboah (1992) National inventries serving gloval modeling of forest resources The chanaian experience The Finnish Forest Research Institute, Research Papers 444

その他［単独樹種として分類できなかったもの］ プランテーション
19樹種について、大陸別（Humid Tropics, Tropical High Land, semi-arid areas）に分けて記載。

データ採取地の立地環境

The data on 19 species (see the Table) are based on the yield tables, yield figures, and estimated yield published / unpublished by planting countries. Of the 19 species, seven belong to the humid tropics, four to tropical high lands and eight to semi-arid areas. While indicating yield of the species, a very modest approach has been adopted. The mean annual increment (m^3/ ha / year) mentioned indicates yield only on average sites without using fertilizer and irrigation, and at the rotation age appropriate for the number of stems per hectare commonly planted. Extreme cases (i.e. yield on the best and poorest sites) have been excluded. Information about the major climatic variables where species are being raised has also been provided.

成長・収穫に関する表，図，式など

Yield model

Species	Rotation age (in years)	Wood yield MAI (m^3/ha)	No. of stems per hectare	Climatic variables: Altitudinal range (m)	Climatic variables: Mean annual rainfall (mm)	Climatic variables: No. of dry months
Humid tropics						
Acacia auriculiformis	10-5	8-10	1 000-2 500	0-500	1 300-1 700	4-6
Albizia falcataria	8-10	25-40	800-1 200	0-1 200	2 000-4 000	0-2
Casuarina equisetifolia	7-10	6-10	1 600-2 500	0-1 400	750-1 400	3-4
Eucalyptus tereticornis	8-10	10-12	2 500-3 000	0-1 000	1 000-1 500	3-4
Gmelina arborea	5-10	20-30	1 000-1 600	0-800	1 000-2 500	2-4
Sesbania grandiflora	5-10	20-25	2 500-3 000	0-500	1 000-2 500	few
Syzygium cumini	20-25	6-9	800-1 200	0-500	1 500-2 500	n a
Tropical high land						
Acacia mearnsii	8-10	20-25	1 000-1 500	1 000-2 500	500-1 600	3-4
Eucalyptus globulus	8-12	20-25	1 600-2 500	1 500-3 000	900-1 800	2-3
Eucalyptus grandis	8-10	20-25	1 600-2 500	0-2 100	1 000-4 000	0-2
Grevillea robusta	10-15	10-12	800-1 200	800-2 100	700-1 200	2-6
Semi-arid areas						
Acacia nilotica	15-20	3-5	700-1 000	0-500	250-750	5-8
Acacia tortilis	10-12	[2]2-4[1]	800-1 200	Low land	Upto 1 000	6-10
Albizia lebbek	10-15	5-7	1 100-1 600	0-1 400	500-1 000	2-6
Azadirachta indica	8-10	4-6	1 200-1 600	0-500	450-1 000	5-7

Cassia siamea	7-10	8-10	1 600-2 500	0-1 000	650-950	4-6
Dalbergia sissoo	15-20	5-8	1 100-1 600	0-1 000	750-2 000	3-5
Eucalyptus camaldulensis	10-15	5-8	800-1 200	500-2 000	400-1 000	4-6
Eucalyptus microtheca	8-10	7-10	1 600	0-1 000	250-500	5-7

[1] With reference to the above species the following minimum and maximum temperatures prevail humid tropics, 16-35° C, tropical high lands 4-32° C and semi-arid areas 4-40° C [2] Dried weight in tonnes/ha/yr

出典

Pandey, D (1987) Yield model of plantations in the tropics. Unasylva 157/158, Vol 39

樹種：BAMBUSACEAE(タケ科)
Bamboos
国　：インド

データ採取地の立地環境

Material and Methods

An area of 1.5 ha was cleared in April, 1981 and prepared for planting bamboos at the Van Vigyan Kendra, Chessa. It is surrounded by an elephant proof trench to avoid elephant damage, which was later modified by covering with splitted bamboos and ultimately replaced by an electric power fening system. The rhizomes / offsets of different bamboos were collected from various places of Arunachal Pradesh and elsewhere and were planted in pits of size 45×45×45 cm at spacing of 4 m ×4 m. The details of the source of rhizomes are given in Table 1. The bambusetum was started by the first author and most of the collection were made by him when he was silviculturist, Arunachal Pradesh.

Observations

Studies on phenology, growth, culm initiation, natural regeneration, etc. are being carried out. The following observations were recorded regularly. 1. No. of new shoots, 2. Girth, 3. Height, 4. Flowering, damage etc. Table 2 provides the data recorded at this bambusetum during August, 1988.

Table 1

Name of species	Place of collection	Remarks
1	2	3
Bambusa arundinacea	F.R.I , Dehra Dun	August, 1982
B balcooa	Rampur, Assam	May, 1981
B burmanica	F.R I , Dehra Dun	August, 1982
B. glaucescens	Kalimpong, West Bengal	June, 1983
B longispiculata	Lekabali, A P.	March, 1988
B nutans	Madhupur, Assam	May, 1981
Bambusa sp (Hijo)	Yachuli, A.P.	June, 1982
B pallida	Madhupur, Assam	May, 1981
Bambusa sp	Seijusa, A.P.	May, 1981
B polymorpha	F.R I., Dehra Dun	Aug., 1982
Bambusa sp.(small)	Madhupur, Assam	May, 1981
B tulda (big)	Madhupur, Assam	May, 1981
B vulgaris	Banderdewa, A.P.	Aug., 1982
Bambusa sp. (Routa)	Routa, A.P.	May, 1984
Bambusa sp. (Maithang)	Ziro, A P.	June, 1982
Bambusa sp. (Tapii)	Ziro, A.P.	June, 1982
Bambusa sp.	Chessa, A.P.	Sep., 1984
Cephalostachyum fuchsianum	Tidding, Lohit, A.P.	May, 1986
C pergracile	F.R.I , Dehra Dun	Aug , 1982

C pergracile (Khellong)	Khellong, A P	Sep ,	1984
Dendrocalamus brandisii	F.R I , Dehra Dun	Aug ,	1988
D hamiltonii	Chessa, A.P.	May,	1981
D membranaceus	F.R I , Dehra Dun	Aug ,	1982
D strictus	F.R.I , Dehra Dun	Aug ,	1982
D sikkimensis	Kalaktang, A.P	May,	1985
Dendrocalamus sp.	Selari, A.P.	Sep ,	1984

(*Contd*)

1	2	3	
Dinochloa maclellandii	F R I , Dehra Dun	Aug ,	1982
Gigantochloa macrostachya	Khellong, A P	Sep ,	1984
Melocanna baccifera	F.R I , Dehra Dun	Aug ,	1988
Melocalamus compactiflorus	F R I , Dehra Dun	Aug ,	1988
Oxytenanthera abyssinica	F.R I , Dehra Dun	Aug ,	1982
O albociliata	F R I , Dehra Dun	Aug ,	1982
Oxytenanthera sp (Medang)	Chowkham, A P	July,	1983
Phyllostachys reticulata	F R I Dehra Dun	Aug ,	1982
Pseudosasa japonica	F R I , Dehra Dun	Aug ,	1982
Pseudostachyum polymorphum	Banderdewa, A P	April,	1986
Thyrsostachys oliveri	Chessa, A P (originally from F R I)	May,	1986
Bambusa sp (Nal)	Madhupur, Assam	May,	1981
Bambusa sp (Nal)	Chessa, A P	May,	1982
Bambusa sp. (Nangal)	Madhupur, Assam	May,	1981

In the initial years of establishment intensive care and regular weeding were done following routine Silvicultural practices

成長・収穫に関する表，図，式など

Table 2

Growth data and culm production of the Bamboos in Bambusetum, Van Vigyan Kendra, Chessa

Species	Date of planting	Max. girth of culm (cm)	Min girth of culm (cm)	Average girth of culm (cm)	Max height of culm (m)	Min height of culm (m)	Aver ht. of culm (m)	Total nos of culms per clump
1	2	3	4	5	6	7	8	9
Bambusa arundinacea	Aug '82	32	11	20.5	23	8	15.5	51
B balcooa	May '81	34	9	21 5	30	5	17.5	33
B. burmanica	Aug '82	30	11	20.0	24 6	4.5	14	32
B. glaucescens	Aug '82	5	2	3.5	3 5	1.5	2 5	Numerous
B longispiculata	Mar '88	Recent introduction						
B nutans	May '81	29	6	17 5	26	3	14.5	58

Bambusa sp (Hijo)	Jun '82	26	10	18 0	20 5	5	12 75	50
B pallida	May '81	28	6	17 0	26 5	4	15 5	40
Bambusa sp	May '81	21	4	12 5	21	4	12 5	60
B. polomorpha	Aug '82	23	11 5	17.25	16	6	11 0	80
Bambusa sp (small)	May '81	28	7	17 73	25	4	14 0	73
B tulda (big)	May '81	28	10	18 5	28	6	16.0	66
B vulgaris	Aug '82	18	4	11.0	9	1 5	5 25	6
Bambusa sp. (Routa)	May '84	21	5	13 0	14	2	8 0	59
-do- (Maithang)	Jun '82	17	7	12.0	14.5	5	8 75	80
-do- (Tapu)	Jun '82	21	8	14.5	15	4 5	9 75	70
-do-	Sep '84	18	3	10 5	8	1	4 5	15
Cephalostachyum fuchsianum	May '86	11	4	7.5	4	1 5	2.75	8
C pergracile	Aug '82	18	9.5	13.75	13	7	10 0	38
C. pergracile (Khellong)	Sep '84	20	5	12 5	11	1.5	6 25	20

(*Contd*)

1	2	3	4	5	6	7	8	9
Dendrocalamus brandisii	Aug '88		Recent introduction					
D hamiltonii	May '81	30 5	10	20.75	18 5	7	12 75	36
D membranaceus	Aug '82	26	11	18 0	19	6	12 5	62
D strictus	Aug '82	16	8	12 0	8	3	6 5	68
D. sikkimensis	May '85	25	10	16 5	18	6	13 5	18
Dendrocalamus sp.	Sep '84	14	5	9 5	5	1.5	3 25	6
Dinochloa macellandii	Aug '82	8 5	3	5 75	6	2	4.0	54
Gigantochloa macrostachya	Sep '84	28	6	17.0	13	3	8.0	16
Melocanna baccifera	Aug '88		Recent introduction					
Melocalamus compactiflorus	Aug '88		Recent introduction					
Oxytenanthera abyssinica	Aug '82	19	5	12 0	18	6	12 0	52
O albociliata	Aug '82	19	6	12 5	16	5	10 5	27
Oxytenanthera sp (Madang)	Jul '83	26	6	16 0	12	3	7 5	44
Phyllostachys reticulata	Aug '82	14	2	8 0	8	3	5 5	434
Pseudosasa japanica	Aug '82	3	1	2 0	3	0 5	1 75	Numerous
Pseudostachyum polymorphum	Apr '86	6	3	4 0	4 9	2	3 0	7
Thyosostachys oliveri	May '86	7	2	4 5	7	1	4.0	11
Bambusa sp (Nal)	May '81	14 4	3	8 7	20	3	11 5	85
-do- (Nal)	May '82	11	4	7.5	9	2 5	5 75	64
-do- (Nangal)	May '81	29	5	17.0	19	2 5	10 75	34

出典

Beniwal, B.S. and K. Haridasan (1988). Study of Bamboos Through Establishment of Bambusetum in Arunachal Pradesh. Indian For, 114 : 650-655.

樹種：BAMBUSACEAE(タケ科)
Giganthochloa levis (ボロー)
国　：フィリピン

データ採取地の立地環境

調査の対象としたG levis 竹林はミンダナオ島のダバオ市郊外にあり1970年代の初めに造成されている。この地域の年間降雨量は表1に示すとおり年間2000mm内外であり，はっきりとした乾期がなく年間を通じて適当な降雨に恵まれている。周辺にはバナナやパイナップルの果樹園が多く植物の生育に敵している。他のS lumanpao竹林はフィリピン大学ロスバニオス分校附属植物園内にあり，ほぼ同じ頃に造成されている。この附近の年間降雨量は表2のように年間約1000mmくらいであり比較的少なく，12月～4月には乾期となるが，霧のかかることが多く地下水に恵まれ，植物の生育に適している。

これらの竹林について，前者は1982年10月，後者は1983年5月，生態調査の常法にしたがって現存量や生産力を調べた。すなわち，調査プロット内の全立竹の胸高直径を測定した後，直径階別に9～10本の標本竹を伐倒して枝・幹別に重量を計り，D^2H との相対生長法により地上部現存量を推定した。

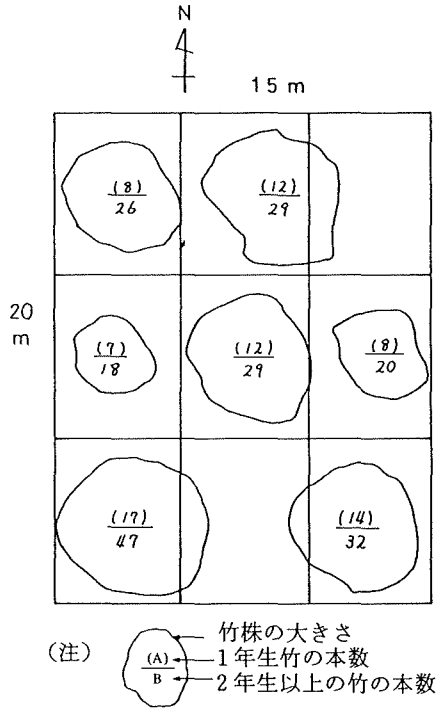


図1　*Giganiochloa levis* 林内の竹株の分布と立竹本数

成長・収穫に関する表，図，式など

表3　調査竹林の林分構成

(per ha)

	本　数	割合(%)	平均胸高直径(cm)	平均竹高(m)	株　数	1株当り平均本数
(*Gigantochloa levis*)						
1　年　生　竹	2597	27 9	6 2	15 3		11 1
2年生以上の竹	6693	72 1	6 7	17 3		28 7
合　　計	9290	100 0	6 5	16 7	233	39 8
(*Schizostachyum lumanpao*)						
1　年　生　竹	10915	28 7	3 7	9 5		4 7
2年生以上の竹	27102	71 3	3 4	8 3		11 7
合　　計	38017	100 0	3 5	8 6	2312	16 4

表4　竹林の地上部現存量

	G levis	*S lumanpao*	*P edulis*	*P puberula*	*P bambusoides*
本　数　1000本/ha	9 3	38 0	8 8	15 2	9 9
平均胸高直径　cm	6 5	3 5	9 2	4 4	7 2
平均竹高　m	16 7	8 6	13 3	9 2	14 1
幹重量　ton/ha	115 8	42 6	87 6	36 6	61 2
枝重量　ton/ha	22 2	9 6	12 5	7 2	13 7
葉重量　ton/ha	8 8	5 8	5 5	4 4	6 0
地上部重量　ton/ha	146 8	58 2	105 6	48 2	80 9
物質密度　kg/m³	0 88	0 67	0 80	0 52	0 57
葉の平均長　cm	30 6	21 9	9 1	9 2	
葉の平均巾　cm	6 1	3 3	1 2	1 1	
葉の平均面積　cm²	142 9	53 4	7 6	7 6	
葉の平均重量　g	0 65	0 31	0 036	0 041	
面積/重量　cm/g	219 8	172 3	211 1	185 4	
葉面積指数　ha/ha	19 4	10 0	11 6	8 1	

出典

鈴木健敬：タケ類の特性と造林技術、熱帯農林集報、No. 65、94～97. (1989)

樹種：BAMBUSACEAE（タケ科）
Schizostachyum lumanpao　（フホーン）
国　：フィリピン

データ採取地の立地環境

調査の対象としたG. levis 竹林はミンタナオ島のダバオ市郊外にあり1970年代の初めに造成されている。この地域の年間降雨量は表１に示すとおり年間2000ｍｍ内外であり，はっきりとした乾期がなく年間を通じて適当な降雨に恵まれている。周辺にはバナナやパイナップルの果樹園が多く植物の生育に敵している。他のS. lumanpao竹林はフィリピン大学ロスバニオス分校附属植物園内にあり，ほぼ同じ頃に造成されている。この附近の年間降雨量は表２のように年間約1000ｍｍくらいであり比較的少なく，12月～４月には乾期となるが，霧のかかることが多く地下水に恵まれ，植物の生育に適している。

これらの竹林について，前者は1982年10月，後者は1983年５月，生態調査の常法にしたがって現存量や生産力を調べた。すなわち，調査プロット内の全立竹の胸高直径を測定した後，直径階別に９～10本の標本竹を伐倒して枝・幹別に重量を計り，D^2H との相対生長法により地上部現存量を推定した。

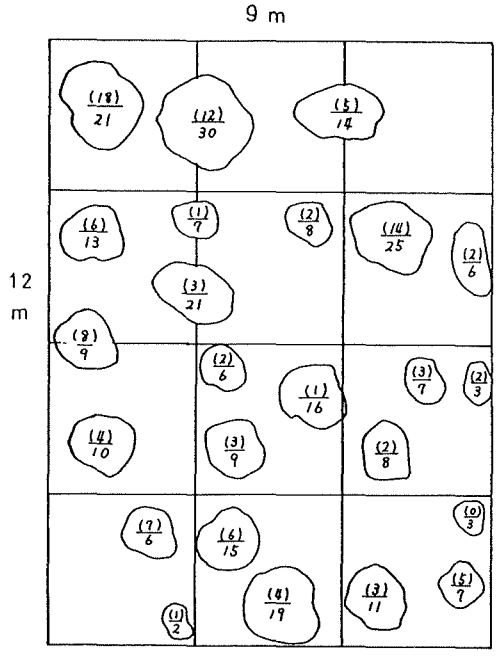


図２　*Schizostachyum lumanpao* 林内の竹株の分布と立竹本数

成長・収穫に関する表，図，式など

表3　調査竹林の林分構成

(per ha)

	本　数	割合(%)	平均胸高直径(cm)	平均竹高(m)	株　数	1株当り平均本数
(*Gigantochloa levis*)						
1　年　生　竹	2597	27 9	6 2	15 3		11 1
2年生以上の竹	6693	72 1	6 7	17 3		28 7
合　　計	9290	100 0	6 5	16 7	233	39 8
(*Schizostachyum lumanpao*)						
1　年　生　竹	10915	28 7	3 7	9 5		4 7
2年生以上の竹	27102	71 3	3 4	8 3		11 7
合　　計	38017	100 0	3 5	8 6	2312	16 4

表4　竹林の地上部現存量

	G levis	*S lumanpao*	*P edulis*	*P pubescula*	*P bambusoides*
本　数　1000本/ha	9 3	38 0	8 8	15 2	9 9
平均胸高直径　cm	6 5	3 5	9 2	4 4	7 2
平均竹高　m	16 7	8 6	13 3	9 2	14 1
幹重量　ton/ha	115 8	42 6	87 6	36 6	61 2
枝重量　ton/ha	22 2	9 6	12 5	7 2	13 7
葉重量　ton/ha	8 8	5 8	5 5	4 4	6 0
地上部重量　ton/ha	146 8	58 2	105 6	48 2	80 9
物質密度　kg/m³	0 88	0 67	0 80	0 52	0 57
葉の平均長　cm	30 6	21 9	9 1	9 2	
葉の平均巾　cm	6 1	3 3	1 2	1 1	
葉の平均面積　cm²	142 9	53 4	7 6	7 6	
葉の平均重量　g	0 65	0 31	0 036	0 041	
面積/重量　cm/g	219 8	172 3	211 1	185 4	
葉面積指数　ha/ha	19 4	10 0	11 6	8 1	

出典

鈴木健敬：タケ類の特性と造林技術、熱帯農林集報、No. 65、94～97．（1989）

樹種：BAMBUSACEAE（タケ科） *B. balcooa*, *B. longispiculata*, *B. tulda*（バイボン），*Bambusa vulgaris*（ダイサンチク），*Melocanna baccifera*（ムーリー）

国　：バングラデシュ

データ採取地の立地環境

Materials and Methods

Twenty-five offsets of *Bambusa vulgaris* Schrad (Lacal name · Barıala, Bashnı, Baızya), *Bambusa balcooa* Roxb (l n Barobans, Barua, Barak, Valku), *Bambusa longispiculata* Gamble ex Brandis (l. n Taıu, Talla), and *Bambusa tulda* (l. n Mıta, Mıtınga, Makla) were collected from different localities of Bangladesh and planted in the central Bambusetum of BFRI, Chittagong in May, 1972 Similarly fifteen part-clumps (a group of 3 offsets jointed by rhizome neck) of *Melocanna baccifera* Roxb (l n : Muli, Paiya) were also collected from the forests of Chittagong Hill Tract and Sylhet during May, 1972 and planted simultaneously in the Bambusetum

The planting site was of small hills with about 30% slope facing east The soil on the slope was sandy loam to clay loam, well drained, acidic with pH around 5 5, overlaying a loose alluvial parent materials The land was under the influence of tropical monsoon climate having mean annual air temperature 10-35°C, soil temperature 20-23°C and total annual rainfall 2500 mm-3000 mm Rainfall is high during the last part of May to August and dry months are from October to March

Studies were carried out on 20 clumps in each of the four *Bambusa* species whereas 10 clumps were taken for *M baccifera* Full grown (FG) culms produced in all the clumps of these five bamboo species were marked every year by different coloured paints for recognizing the age of both culm (year of emergence) and clump Measurements on the number of FG culms produced per clump culm diameter at breast height (DBH) and their length, and annual increase of the girth of each clump were measured one year after (1973) the plantation Data were recorded every year at the end of the growth period (December) and these observations continued for subsequent ten years (from 1973 to 1982) During the study period all the clumps of these five bamboo species were allowed to grow in undisturbed condition and no felling operations were practiced

成長・収穫に関する表，図，式など

Table 1

Annual full grown (FG) clump production and gradual expansion of clump girth upto 10 years of clump age in five bamboo species of Bangladesh*

Mean value ± SE

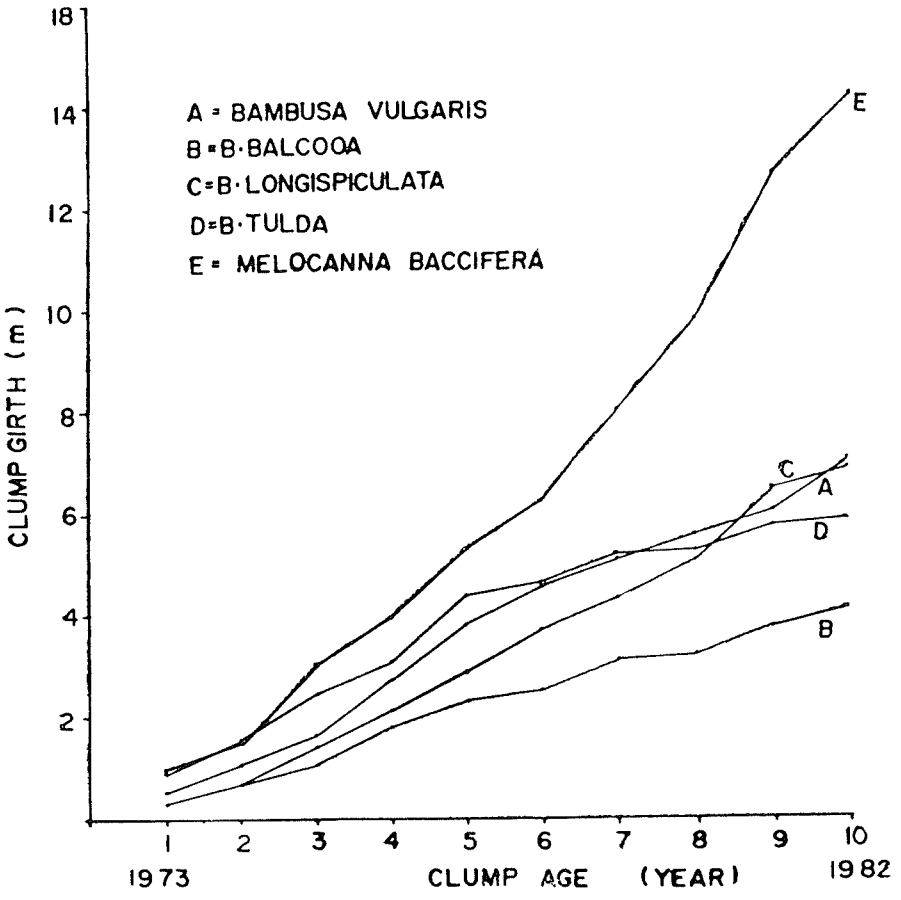
Clump age (year)	*B vulgaris*		*B balcooa*		*B longispiculata*		*B tulda*		*M baccifera*	
	FG culms (Nos)	Clump girth (cm)	FG clums (Nos)	Clump girth (cm)	FG culms (Nos)	Clump girth (cm)	FG culms (Nos)	Clump girth (cm)	FG culms (Nos)	Clump girth (cm)
1	1 6	50 0	1 2	28 5	1 8	30 0	3 0	87 0	2 5	92 2
(1973)	0 2	4 5	0 2	2 0	0 4	5 2	0 5	13 2	0 5	20 5
2	2 8	105 0	2 3	66 3	2 7	66 5	3 8	153 0	5 6	145 9
(1974)	0 3	10 0	0 9	13 5	0 6	13 0	0 4	16 6	1 7	23 2

3	3 2	162 6	1 7	102 0	4 1	140 2	8 2	243 0	12 5	301 0
(1975)	0 7	22 0	0 2	14 0	0 6	16 5	1 3	28 3	2 5	42 0
4	5 3	273.4	2 7	177 0	6 2	222.0	5 7	307 0	16 4	395 4
(1976)	1 2	35 5	0 4	22 6	0 5	24.7	0.9	36 5	4 2	53 3
5	5 2	378 0	3 2	232 0	7 0	286 4	8 8	439 3	23 6	529 3
(1977)	1.7	50 3	0 8	38 0	1 3	20 6	2 3	56 3	7 2	105 6
6	3 6	456 3	2 2	250 0	6 7	372 0	4 5	464 0	25 3	624 3
(1978)	0 8	62 1	0 4	29 4	1.3	28 2	1 0	51 0	4 6	115 2
7	3 2	508 3	2 4	312 5	5 0	430 0	4 9	520 1	26 6	805 4
(1979)	0 6	64 4	0 5	32 5	1 0	35 0	1 2	42 0	8 7	146 1
8	3 2	555.0	1 8	320 5	6 6	507 6	3 7	527 2	25 1	980 6
(1980)	0 6	75 8	0 5	24 0	1 4	66 6	0 3	61 6	6 2	170 5
9	2 6	603 0	2 2	376 0	5 8	648 3	4 8	571 0	31 1	1268 0
(1981)	0 6	58.0	0 5	53 7	1 0	109 6	1 8	57.6	8 0	247 0
10	2 8	705 0	2 2	414 2	5 7	690 0	2 7	586.7	35 7	1432 3
(1982)	0.7	114 5	0 5	58 3	1.6	132 3	0 4	207.8	13.3	281 0

Clump raised through offset planting in 1972 left undisturbed upto 1983.

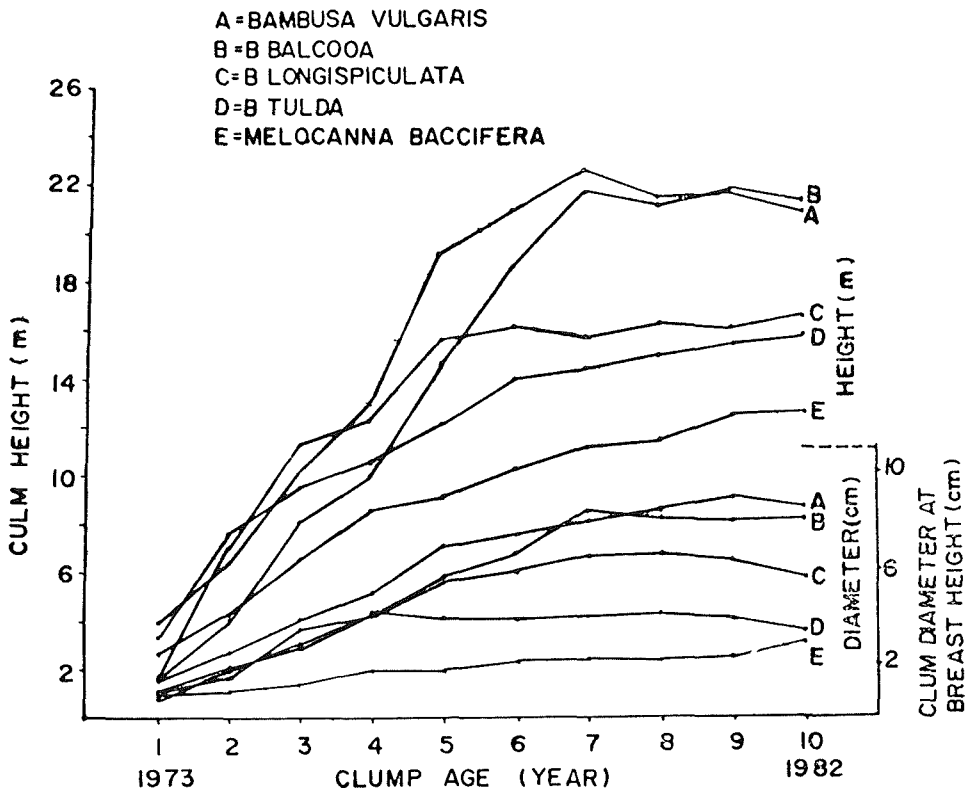
Note : The second row of each year are ± SE.

Fig. 1



Rate and pattern of clump expansion at different age in the five bamboo species of Bangladesh

Fig 2



Growth rate of full grown culm produced at different age in the five bamboo species of Bangladesh.

出典

Banik, Ratan Lal (1988). Investigation on the Culm Production and Clump Expantion Behaviour of Five Bamboo Species of Bangladesh. Indian For., 114 : 576-583.

樹種：BAMBUSACEAE（タケ科） *Bambusa blumeana*（スパイニーバンブー），*B. vulgaris*（ダイサンチク），*Dendrocalamus merrillianus*（バイヨグ），*Gigantochloa levis*（ボロー），*Schizostachyum lima*（アノス）
国　：フィリピン

データ採取地の立地環境

2) 材料と方法

さし木による育苗は1981年6月～12月の約6か月間に，フィリピン大学ロスバニオス分校内の苗畑て行なった。供試した竹種は，*Bambusa blumeana, Bambusa Vulgaris, Dendrocalamus merrillianus, Gigantochloa levis, Schizostachyum lima* の5種類てある。さし付け用の竹幹材料は分校内のマキリン植物園より採取した。さし穂としては，1年生竹の先端部を除き，2節をつけて切断した竹幹を用いた。さし付は苗畑に埋幹の形て水平植えした。半年後に堀り出して，発芽，発根，生存状態などをしらへた。

さらに，上記により育成したタケ苗を立地環境の異なる2か所に植栽した。その一つはフィリピン大学ロスバニオス分校附属演習林てある。植栽地は標高約300 m，土質は粘質壌土てあり，周辺には熱帯降雨林か生育している。年間降雨量は1000 mm内外と少なく，11月～4月は乾期となるが，霧のかかることか多く，地下水にも恵まれ，植物の生育には適している。ここには，*B blumeana, S lima, G levis* の3竹種を1982年4月に植栽し，無施肥区と施肥区に分けた。施肥区には1株当り400 grすつ2回，植栽時と6か月後，計800 grの化成肥料（14　14　14）を施与した。1983年5月，毎竹調査と標本竹の掘出しによる部分量の測定を行なった。他の一か所はルソン島中部のハンタハンカン地域てある。ここは熱帯降雨林が破壊され，消失した後広大な草地となっている所て土地はやせている。年間降雨量は2000 mm内外と前者より多いが，時期的に集中し，雨期には洪水となることがある反面，6カ月以上は極端に乾燥する[9]。現在日比協力による造林プロジェクトが進められており，乾燥や，やせ地に強いアカシア類，マメ類その他か植栽されている。ここには，同しく前述のさし木により育成した5竹種，*B blumeana, B vulgaris, S, lima G levis, D merrillianus,* の竹苗を1982年8月に植栽後，上記の造林プロジェクト要員により生長経過か定期的に調査された。

成長・収穫に関する表，図，式など

表2　マキリン演習林に植栽した3竹種の生長状況

Kauayan tinik (*Bambusa blumeana*)

	N (本)	D (cm)	H (m)	W_S (kg)	W_B (kg)	W_L (kg)	W_T (kg)	Index (W_T)	W_S/W_L
竹　苗	2 1	0 67	1 41						
対照株	4 6	1 44	2 53	1 18	0 64	0 39	2 21	100	3.02
施肥株	8 3	2 26	3 67	5 74	2 90	1 88	10 50	475	3 05

Anos (*Schizostachyum lima*)

竹　苗	4 5	0 38	0 92					
対照株	19 0	0 83	1 62	0 85	0 33	0 64	1 82	100	1 32
施肥株	41 8	1 06	2 19	2 90	1 15	2 18	6 23	342	1 33

Bolo (*Gigantochloa levis*)

竹　苗	3 3	0 72	1 42					
対照株	8 5	1 56	2 78	2 01	1 38	1 19	4 58	100	1.69
施肥株	9 0	2 16	3 70	4 50	3 01	2 53	10 04	219	1 78

W_S 幹重量，W_B 枝重量，W_L 葉重量　$W_T = W_S + W_B + W_L$

表3　パンタハンカンに植栽した5竹種の生長状況

竹　種	*Bambusa blumeana*	*Bambusa vulgaris*	*Schizostachyum lima*	*Dendrocalamus merrillanus*	*Gigantochloa levis*
1株当り平均本数 最小－最大	5 9 4－8	4 6 2－8	9 0 2－23	7 1 3－21	21 2 3－42
平均地際直径 cm 最小－最大	1 63 0 40－4 6	1 62 0.8－3.5	1 12 0 2－3 5	1 38 0 2－3 5	0 74 0.2－1 2
平均竹高 m 最小－最大	1 84 0 64－4 10	1.79 0 60－3 94	1 17 0 28－3 33	1 58 0 56－3 51	0 76 0 37－1 30
N × D^2H	28.8	21 6	13 2	21 4	8 8

出典

鈴木健敬：タケ類の育苗と造林試験、熱帯農業集報、No．65、98～101．（1989）

熱帯林の成長データ集録（その２）

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