Smallholder teak systems – an Overview

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ICRAF, CIFOR, FOERDIA, IPB, ….



Australian Government
Australian Center for International Agricultural Research



Teak Agroforestry Conference

14-18 November 2016 – Luang Prabang, Laos

Outline

- Teak in context of rural development
- Teak in Java and Indonesia
- Smallholder teak systems in Java
- Intercropping
- Silviculture
- Farmer demonstration trials
- Marketing
- Recommendations

World Agroforestry Centre

Australian Government
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Inter CAFÉ

HUTAN RAKYAT LESTARI

Teak – *Tectona grandis*

Native:

- **India, Myanmar, Laos, Thailand**
- **23 million ha (half in Myanmar)**

Timber demand has always been great

Plantation production:

- Indonesia – 13th century (intro 2nd century)
- Sri Lanka – 1680
- India – 1840s
- Myanmar – 1856

- Currently grown in minimum **43 countries**
- South Asia, Southeast Asia, Africa, the Caribbean, Central and South America
- Global teak plantation **min 4.3 million ha**
- ***83% in Asia – India, Indonesia, Myanmar***

Various sources

Teak & Rural Development

When did teak start to influence rural development?

- *rural residents worked as laborers for plantation establishment and management??*

***Taungya* system:** intercropping with annual crops to improve teak seedling establishment and growth (off-set establishment costs). Increased involved of and benefit to *farmers!*

- Myanmar 1856 *
- Indonesia 1856 to 1880s

Smallholder teak plantings

- **well established in Java (Indonesia) in 1960s**
- ***Other countries:*** **Laos, Thailand, Bangladesh, India, the Philippines, the Solomon Island, Nigeria, Togo, Benin, Costa Rica, Panama**

Teak & Rural Development

Smallholder teak plantings (plantations)

Small but important to the global teak estate

- 19% of are in Asia and Africa
- 31% in Central America
- 34% in South America

Kollert and Cherubini, 2012

Beyond Timber and Income from timber

Teak's … other contributions to rural people

- **fuelwood**
- **oil extracts (leaves & wood) skin medicine**
- **leaves used as compress for wounds**
- **dyes (buds and leaves) for clothes**
- **dried leaves as dry season feed for sheep and goats (low concentrations, 5-25%)**
- **dried leaves for roof thatch**
- **bark, leaves, wood pulp, sawdust used in industry …. *collected by rural people?***
- **mushrooms grow on teak wood**
- **caterpillar common on teak … eaten or sold**

Teak Industry & Farmers in Java

- **Java is the focus of Indonesia teak industry**
- **+15,000 teak factories**, employ 170,000 pax (Jepara, C Java -)
- Value teak products is Rp 23.8 trillion/2014 (US$22.7 billion)
  - *1% of global furniture market*
- **Perum Perhutani** (Gov-owned forest enterprise) **largest land manager**
  - 2.6 mil ha – **57% (1.5 mil ha) production forest**
  - 17% limited production forests; 27% forest preserve
- **Plantation production ↓** (as elsewhere), farmer opportunities




Smallholders – main source of teak

- ~1.5 million farm families grow teak on Java (Dep For 2005)
- ~444,000 ha **fallowed ag land (degraded)** mainly teak
- ~3.1 million ha farmland produce teak Indonesia (Kollert et al 2012)
- **80% teak used by SMEs from farms** (dbh <30) (Achidiawan et al 2011)
- SMEs are 90% if Jepara furniture industry (Yovi et al 2013)

Teak log production Central Java (one of the two main teak producing provinces)

Teak cubic m^3	2006	2007	2008	2009
Perhutani	184,521	186,613	163,311	171,329
Smallholders	**248,111**	**201,453**	????? *(4,983,189)*	**200,793**

In Cen. & East Java in 2011, **smallholders produced 14 times more timber (logs of all species) than Perhutani** - 2,080,130 m^3 versus 146,420 m^3 (MOF 2011)

Smallholder have become an dominant source of teak

Smallholder Teak – Indonesia

Profile of Smallholder Teak Systems

Farm size average 1 ha, multiple parcels (3.9), multiple types, teak 56% of trees, teak provide 12% of income, but little management, cut for '$ needs' - *'Tebang butuh'*

- *Pruning: 65% farms, 55% trees – for fuelwood, 10-15 cm stubs*
- *Thinning: 57% thinning (but really harvesting)*
- *72% wildlings, 30% local germ, 20% coppice, **12% improved germ***

Kitren – Upland woodlots (timber gardens)

Tegalan – Upland mixed tree gardens

Pekarangan – Homegardens (mixed tree gardens by house)

Border/line plantings – Trees planted wide spacing

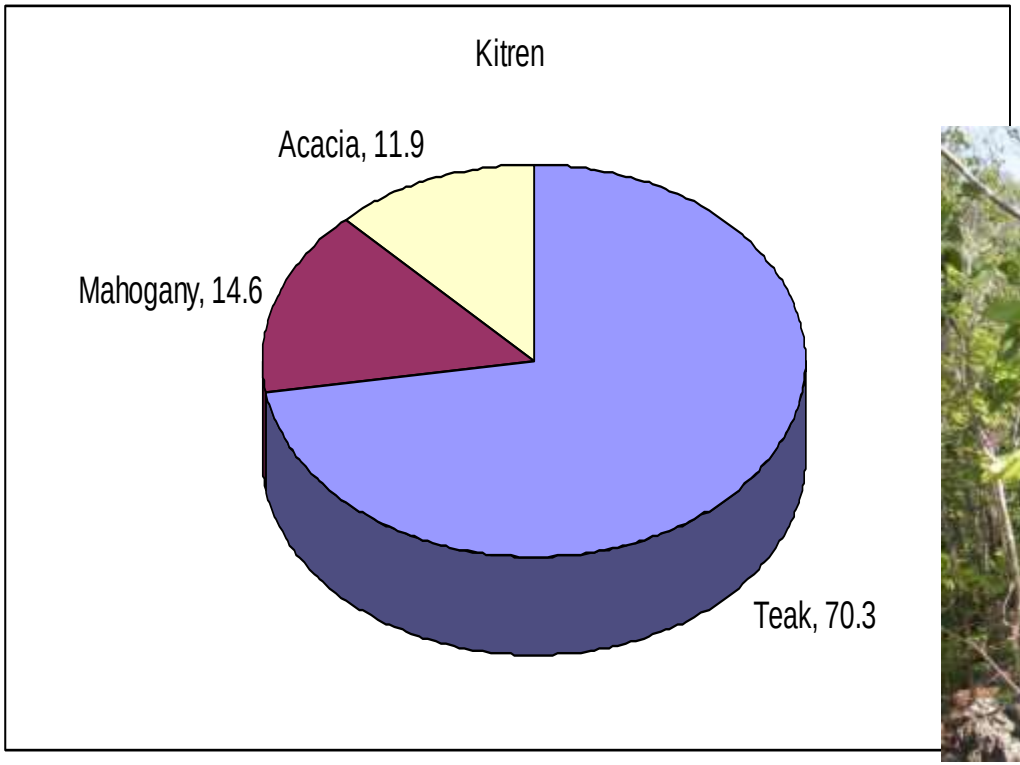
Roshetko et al. 2013

Landuse System	% of systems	Ave size (ha)	% of total land	Trees/ (ha)	Ave species /garden
Kitren	9.1	0.31	8.5	1532	5

Kitren – upland system found 1-1.5 km from home, timber woodlot (semi-monoculture).

11.2 % intercropped

61% pruning and/or thinned

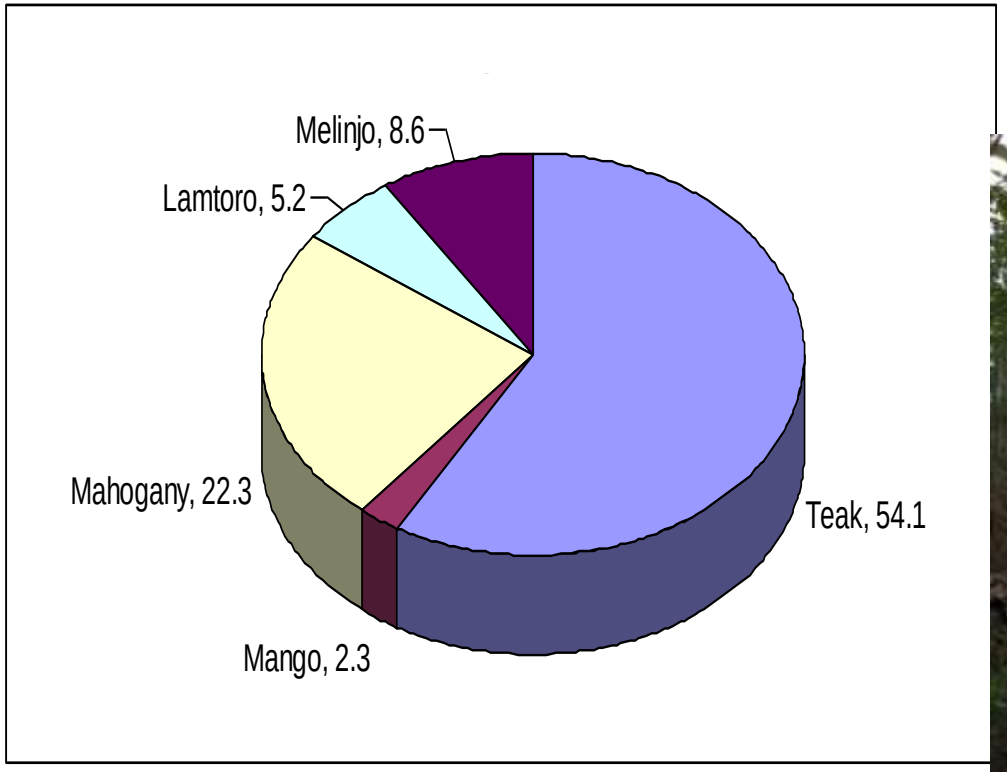


Landuse System	% of systems	Ave size (ha)	% of total land	Trees/ (ha)	Ave species /garden
Tegalan	50.6	0.47	66.5	1072	8

Tegalan – upland system found 1-1.5 km from home, intercropped trees & annuals.

54.4% intercropped

65% pruning and/or thinned

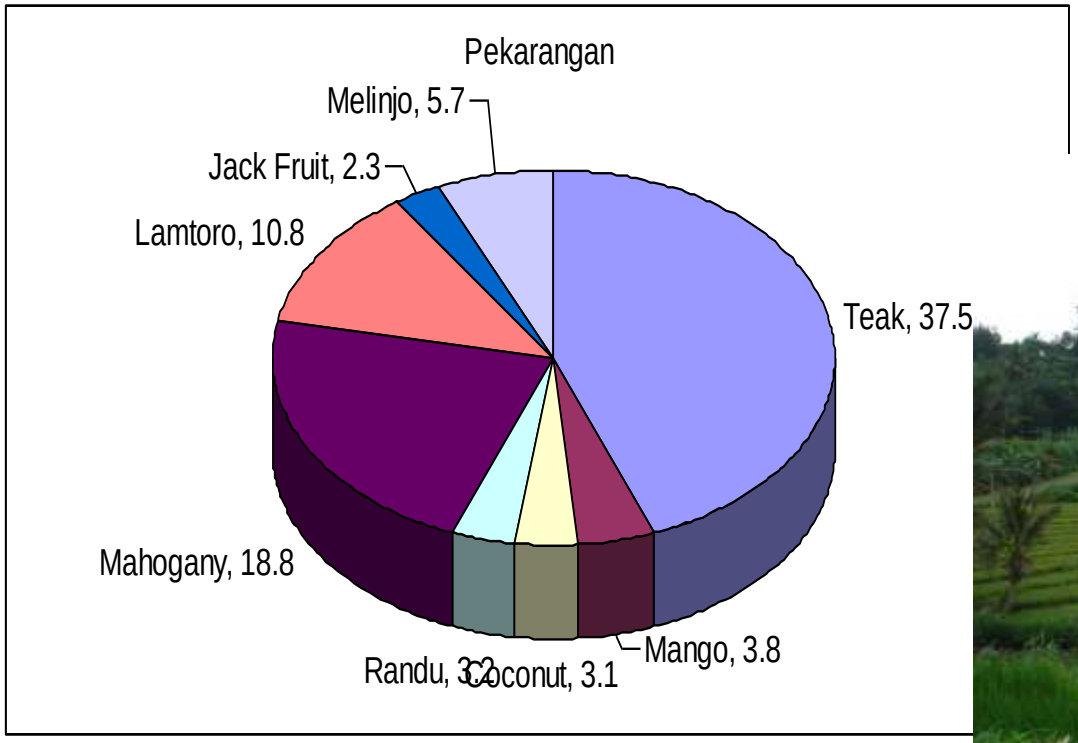


Landuse System	% of systems	Ave size (ha)	% of total land	Trees/ (ha)	Ave species /garden
Pekarangan	23.8	0.24	14.7	1177	13

Pekarangan (homegarden) – near house, trees & annual crops intercropped

34.4% intercropped

61% pruning and/or thinned



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Pekarangan	**23.8**	**0.24**	**14.7**	**1177**	**13**
Border/line	8.5	0.31	7.8	138	7

Hierarchical Cluster Analysis

Based on structure and management tegalan & pekarangan nearly same.

74% of systems & 80% of land

Tegalan-Pekarangan

Economic analysis Kitren vs Tegalan

- **Labor is ~60% of inputs both systems (57 farms – 5 yrs)**
- Tegalan: ***input costs 538%***, total income 133%, food income 24x↑, teak income 13%, profit 21%, ***income/ha 69%, profit/ha 21%*** … compare kitren.
- **Kitren better return to labor, land & investment**
- **Tegalan better total income, food security, & opportunity to generate income from on-farm labor (if no other option).**

	Type	Rp	P-value
Inputs/ha	Kitren	1,859,916	0.007
	Tegalan	10,015,327	
Income/ha	**Kitren**	**19,516,099**	**0.007**
	Tegalan	**13,542,895**	
Profit/ha	Kitren	17,656,184	0.007
	Tegalan	3,639,578	

Rohadi. 2012.

Household labor charged as input

More land, more income … able to manage

Teak Systems & Household Livelihoods

Smallholder Teak Systems

- 82% managed for short- & long-term yield
- food & other products for household

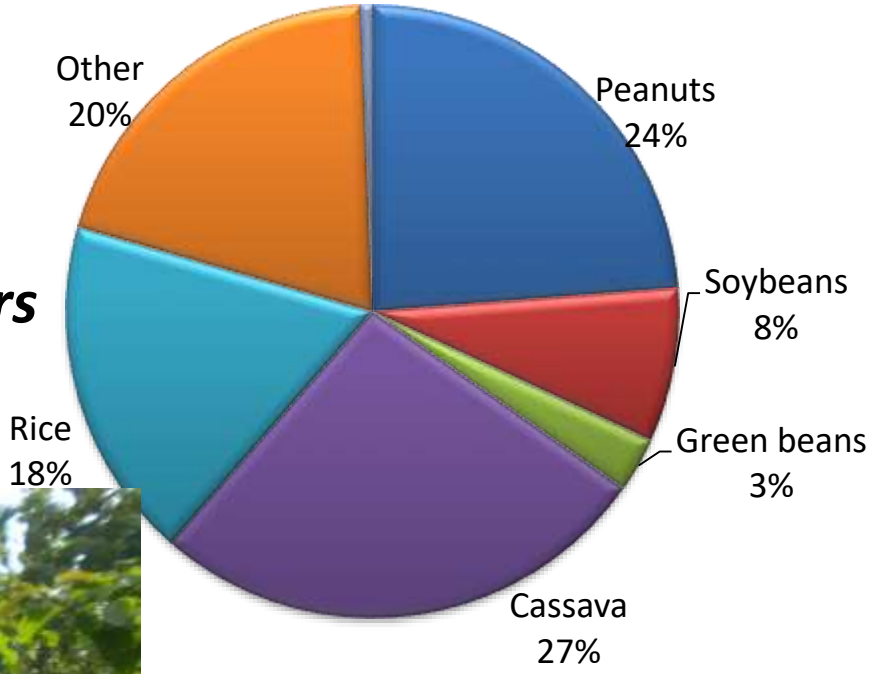
- **40% of family income → teak systems** *
  - ***25% from agricultural products***
  - ***12% from teak timber***
  - ***3% other tree products***

Traditional *tumpangsari* (intercropping)

- not tuangya!!
- tumpangsari not limited to establishment
- provides farmers flexibility to respond to market opportunity
- tegalan and pekarangan more frequently

Intercropping Teak

- 82% farmers intercrop
- 42% land parcels cropped/year
- fert. & weed only if intercropping
- ***cassava, peanuts, rice, soybeans, corn, beans, bananas, vegs, gingers***
- 40% of household income teak sys. (Ag 25%, teak 12%, other tree prod 3%)



- Intercropping **not only at establishment**
- Provides farmers flexibility to respond to market opportunity

Farmer Silviculture

- Regeneration: 72% wildlings, 30% local seedling, 20% coppice, *12% improved germ.*
- Pruning: 65% farms, 55% trees – yield fuelwood, 10-15 cm stub
- Thinning: 57% thinning (but really harvesting)
- Coppice: no thinning
- ***Not management for improving production /growth***

Poor silviculture practices! → Farmers teak systems … overstock, slow growing, low quality, low productivity

Tebang butuh (harvest to meet needs) – *health, education, ceremonies, cash flow …*

Farmer Demo Trials (FDTs)

- ***6 Locations***
- ***Trees 5-6 years old***
- ***FDT Treatments***
  - Thinning: i) control, ii) maximum 40-45% (target 4x4m – 625 trees/ha)
  - Pruning: i) control; ii) 50% total height; & iii) 60% total height
  - Singling: i) control; & ii) 'singling'

Monitoring every 6 months

Results

Rainy season growth increment ↑ thinning & pruning, dry season not

- **Pruning 60%-Thinning: DBH 60% ↑, height 124% ↑**
- **Single Treatment: Thinning versus No Thinning: DBH 45% ↑, height 80% ↑**
- **Good results - Challenging On-Farm conditions**

Market/Marketing

- role of farmer limited to producer
- standing tree standard unit of sale for farm-grown teak
- no clear quality or volume standards exist
- 51% farmers discuss price with neighbors, 31% compare price with multiple traders, 18% are price takers
- regardless of approach – farmers receive price ↓ market rate
- traders ↑ transaction cost; so offer price ↓
- farmers sell small dbh logs (only 14% harvest by dbh class)

Age (year)	DBH (cm)	Price for farmer (US$/standing tree)	Log volume after processing (m^3)	Log price to traders (US$)
10	12 – 18	3 – 6	0.045 - 0.189	3 – 25
15	13 – 31	5 – 30	0.060 - 0.515	6 – 123
20	21 – 45	10 – 265	0.307 - 1.061	57 – 284
25	29 – 49	20 – 296	0.320 - 1.321	54 – 329

Perdana et al. 2012

Ideal - Smallholder Teak Marketing

Awareness Building

- ***Marketing, not just selling***
  - Understanding of market demand … through process of build long-term relationships
- ***Collective marketing***
  - Teak growers work together to build relationships with market and reduce transaction costs
  - *Options:* cooperatives, associations, farmer groups
  - Collaboration with teak processing industry

Reality is different ….

Farmer Reluctances …

- ***Proof of ↑ profits*** **through collective marketing, yes … but management of cooperative / association … poor**
- **Different resources for each household**
  - **Trees of different ages**
  - **Household/farm characteristics …**
- **Different needs for each household**
  - **Tuition fees, marriage, emergencies ….**
  - **Not the first source of income ….**
  - **Working with neighbors … not always easy**

Recommendations

- **Tebang butuh approach is ok, but …**
- Farmer should ↑ management, how?
  - better ***germplasm***
  - manage (thin) coppice → single stem
  - ***thinning*** best option for ↑ production
  - ***pruning*** 60% total height (min. 1 log) for ↑ quality and production
  - ***Fertilizing and weeding (??)***

Farmers busy, do not (afford) manage

- ***encourage intercropping*** … trees benefit fert & weed .. family benefit from ag prod
- intercropping fits ***tegalan-pekarangan***
- …. should increase with ***kitren***
- intercrops … ***gingers & shade tol. crops (***crops of.. ***strong demand, lucrative price)***
- intercropping → justifies ***thinning & pruning***

Recommendations

- Engage in group marketing to ↓ transaction costs for all parties
- Improve market position by accessing information
- Produce larger diameter, better quality logs (know the market)

Closing thought

- *Farmers' opportunistic management provides good returns to limited resources & investment. Minimize risk. Off-farm opportunity may be better than intensive silviculture.*

Terima Kasih. Thank you.

Bioeconomic Trade-off Analysis

(WaNuLCAS simulation model)

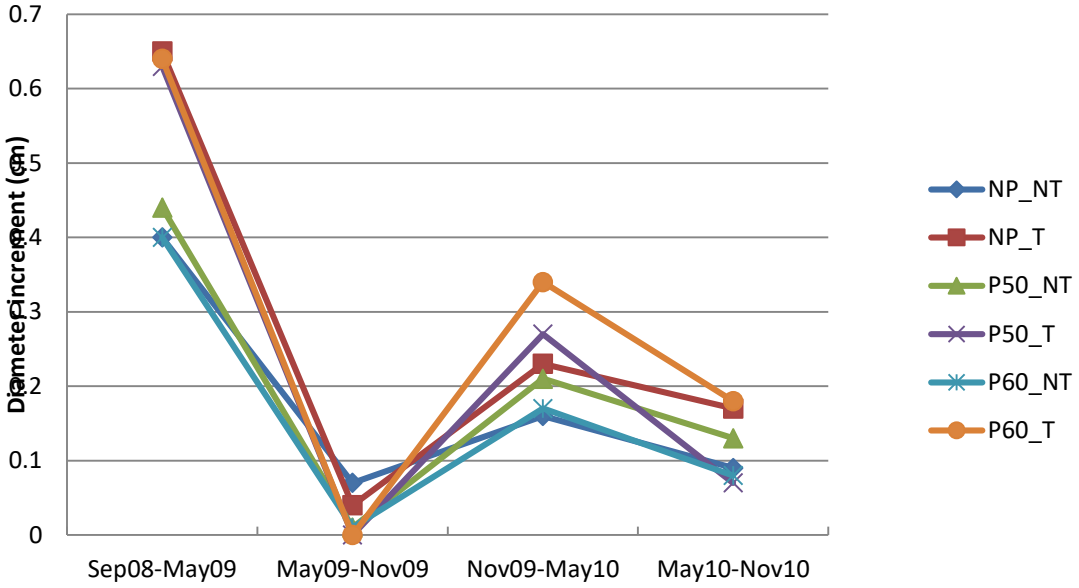
Tree density: 1600 trees ha^{-1} (2.5m × 2.5m); 1111 (3m × 3m); 625 (4m × 4m)
Thinning: light (25%); mod. (50%); heavy (75%) of tree density (var. 5 yr intervals)
Pruning: 40% and 60% of crown biomass (var. 4, 10, and 15 yr intervals)
….. based on trial and market data collected in Gunungkidul

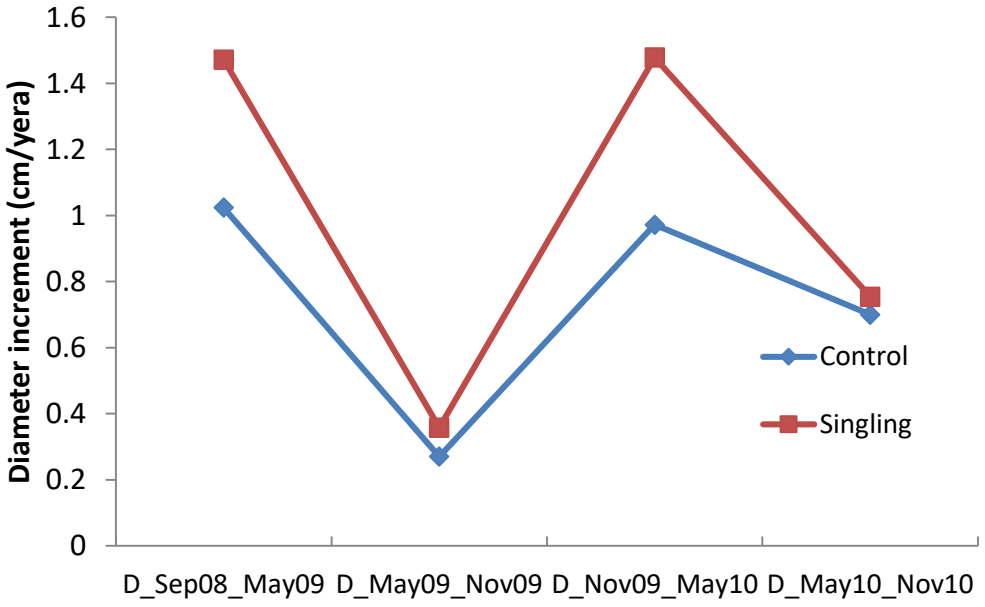
- *Intercropping better than monoculture*
  - **tree growth benefit from fert & weeding**
- **Max volume per hectare …**
  - 625 trees ha^{-1}; Thin 25% Y5 & Y15; Pruning 40% Y4, Y10 & Y15
- **Max volume per tree (dbh) ….****
  - 625 trees ha^{-1}; Thin 50% Y5 & 25% Y15; Pruning 40% Y4, 10 & 15
- **↑ dbh rewarded with ↑ market price ….**

Khasanah et al. 2015 ***(agrees with research* Gmelina *Phil.)***

Results

-Rainy season treatments ↑ effect
- Thinning always good effect
- Pruning good, good for increment, main purpose ↑ quality
- Singling concentrate DBH growth on remaining tree (not always significant, 40% ↑





Recommendations

(FDTs & Surveys)

- Use better quality germplasm
- Thin coppice
- Thinning stands to medium stocking (625 trees / ha)
- Pruning 60% of total height, do not leave branch stubs

- *Unthinned coppice tree quality ↓*
- *Leaving branch stub tree quality ↓*