

# **Breeding of Acacia spp. for timber products and Plant variety registration**

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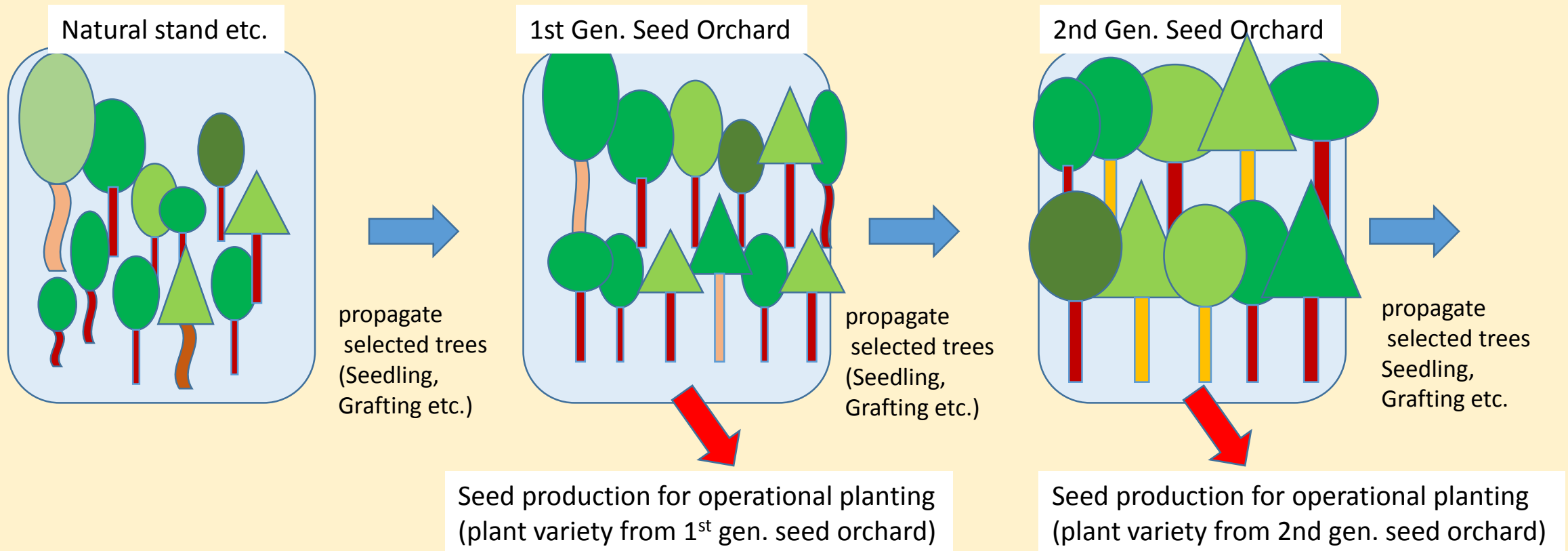
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- Plant variety Registration of hybrid Acacia clones in Sabah Malaysia
  - Background
  - Important characteristic to distinct clone varieties each other

# Distinctive features of breeding for timber products

- Recurrent Mass selection based on population genetics (low heritability)
  - Majority of timber product tree are allogamous species
  - higher yielding (quantitative trait) ,Better quality, better adapted is objective of breeding
- Prefer genetic variation rather than uniformity! except breeding objective



**Difficult to distinct from another population (variety of geographical features, large scale, long life crop)**

# Distinctive features of breeding for timber products

- Example of *Acacia* spp. Breeding by Mass selection

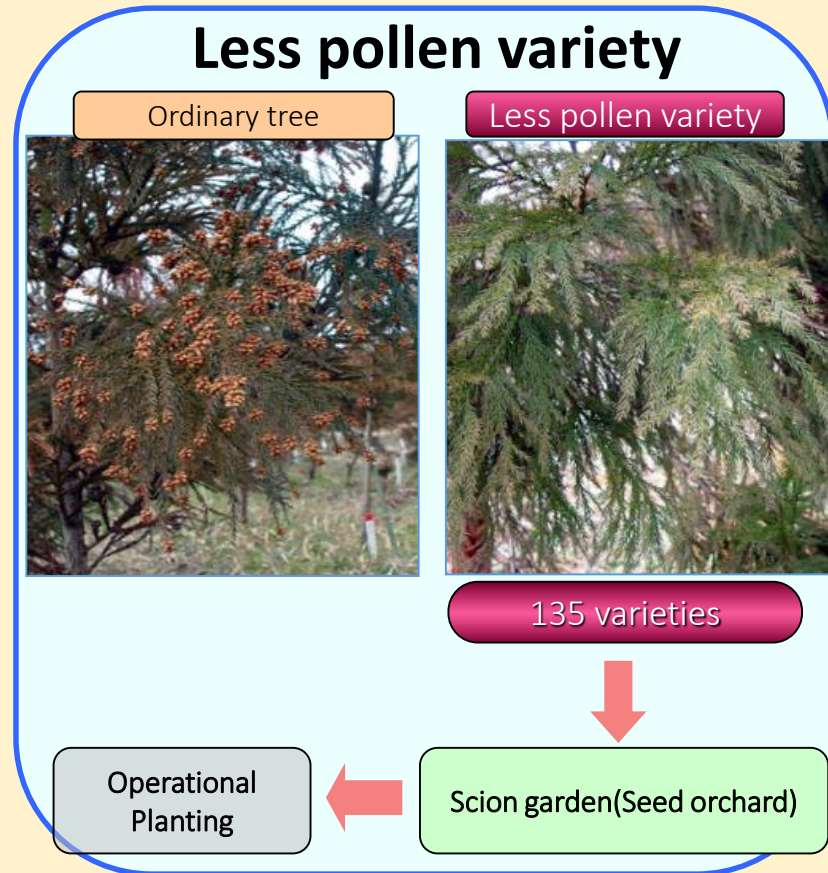


- Seed were corrected from superior tree in natural stand
- Breeding population is consist of several sub-populations
- Each sub-pop. Consist of 30 to 60 families (strain)
- Each fam. Planted in 4 tree Line plot with 6 to 10 replication
- After felling, Best tree in each plot were left for operational seed production
- For most families, Best tree in all replication were selected to collect seed for next generation. Culling inferior fam. At the same time.

1<sup>st</sup> Gen. seedling seed orchard of *Acacia mangium* in Java, INDONESIA

# Distinctive features of breeding for timber products

- Clonal cultivar of Japan cedar ( *Cryptomeria japonica* )



**PICK BEST TREES UP AMONG BREEDING POPULATION  
AND DEVELOP  
NEW PLANT VARIETY AFTER CLONAL TEST**

# Examples of Clonal forest by genetically improved stock (Hybrid Acacia)

- Important trait for interspecific hybrid Acacia and their parent species
- Hybrid Acacia is Reciprocal hybrids between *A.auriculiformis* and *A. mangium*

Features	<i>A. auriculiformis</i>	<i>A. mangium</i>
Growth	Moderate to fast growth	Fast growth
Adaptation to soil	Tolerant to highly acidic and alkaline soils	Good in Acidic to weekly acidic soils
Drought tolerant	4 to 6 month	3 to 4 month
Pest and Disease resistance	pests and diseases damage is minor. <small>root rot damage in India (Ganoderma lucidum)</small>	susceptible to hart rot, root rot and die-back
Stem form	crooked	straight
Wood density	Higher than mangium	
Strength of wood	Stronger than mangium	
Productivity of rooted cutting	Well	Well until 2-3 years

## Breeding objective of Hybrid Acacia

- Fast growing
- Adaptation
- Disease resistance
- Straight stem form
- Wood density
- Wood color
- Strength of wood
- High productivity of scion for rooted cutting
- High success rate of rooted cutting

Legend; table above are created based upon from “characteristic of tropical tree species for reforestation 1 &2”, N. Mori etal, 1996 & 1997

# Examples of Clonal forest by genetically improved stock

- Naturally occur interspecific hybrid Acacia in Sabah, Malaysia
- Natural interspecific hybrid discovered at *A. mangium* stand in Ulu-Kukut, Saba in 1970 , among Mission Beach provenance, Queensland.
- 40 plus trees were selected at the stand.
- 30 plus trees are planted in scion garden ready to operational planting
- Clone trial was established at Karamatoi Saba in 2003 By private company



N.B. ; A part of Information above are summarized from “Seed sources establishment and tree improvement project, Sabah, Malaysia”, 1982, FAO/UNDP-MAL/78/009 consul-tant’s report no 8. FAO, Rome.

# Examples of Clonal forest by genetically improved stock

- Naturally occur interspecific hybrid Acacia in Vietnam
- Occasional hybrid individuals identified in young *A. mangium* plantations in Vietnam in 1992
- Six clones from clonal tests in 1990s, were approved by MARD (Ministry of Agriculture and Rural Development) for commercial use in the year 2000
- Hybrid Acacia plantations was estimated at 232,000 ha in Vietnam in 2009



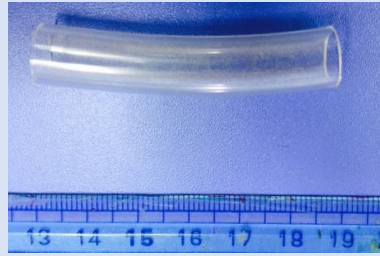


# Examples of Clonal forest by genetically improved stock

- Breeding of interspecific hybrid Acacia by Artificial crossing
- Development of artificial crossing technique



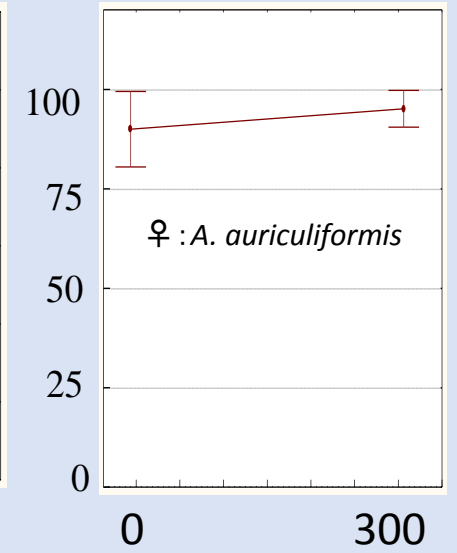
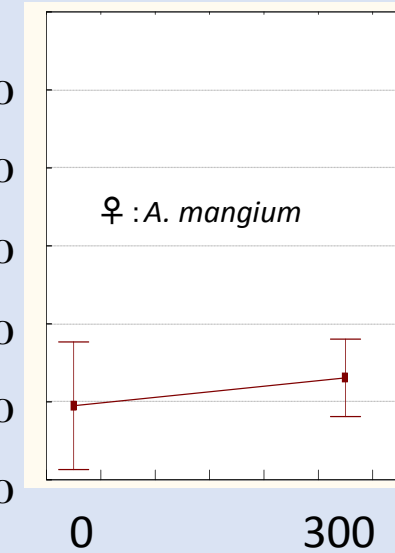
Pollen collection  
&  
artificial pollination



Pollen storage at -20C



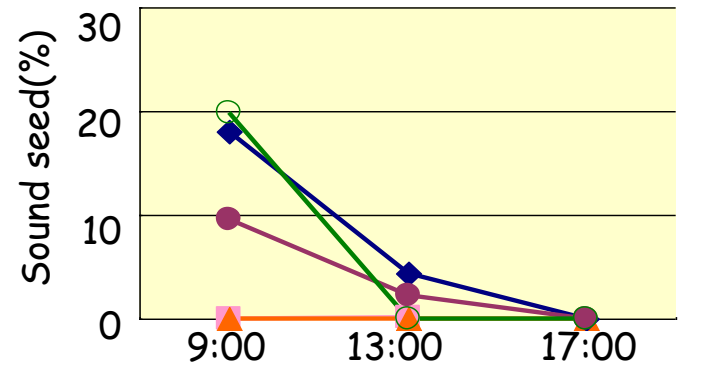
Check pollen viability



Pollen storage period (days)

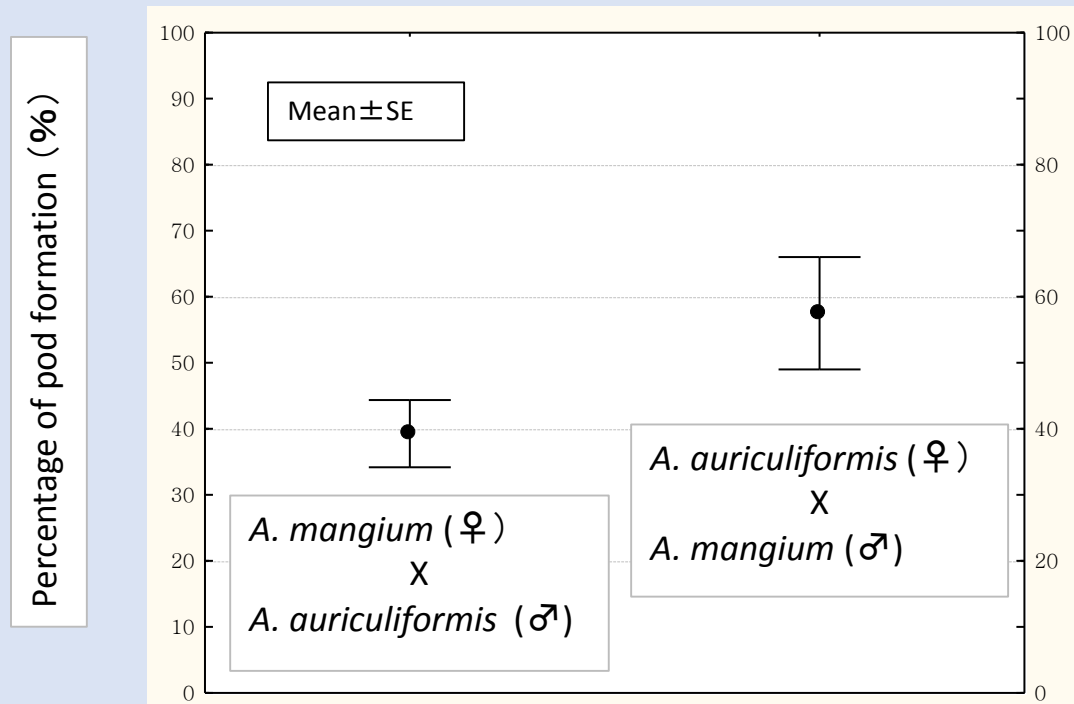
Seed pod formation rate  
In artificial cross (%)

Sound seed rate in different mating time



# Examples of Clonal forest by genetically improved stock

- Breeding of interspecific hybrid Acacia by Artificial crossing
- Development of artificial crossing technique



# Plant variety Registration of hybrid Acacia clones in Sabah Malaysia

- Background
  - SAFODA (Sabah Forest Development Authority) had discovered Natural interspecific hybrid *A. mangium* stand in Ulu-Kukut, Sabah in 1970
  - 30 clones out of 40 plus trees are conserved in scion garden
  - Clone trials of these clone were established in Sabah in 2003 By a private company
  - 19 better performed clone were registered as plant variety of Malaysia by SAFODA in cooperation with the private company and FTBC

N.B. ; A part of Information above are summarized from “Seed sources establishment and tree improvement project, Sabah, Malaysia”, 1982, FAO/UNDP-MAL/78/009 consul-tant’s report no 8. FAO, Rome.

# Plant variety Registration of hybrid Acacia clones in Sabah Malaysia

- Important characteristic to distinct clone varieties each other
  - 23 characteristic could be evaluated out of 40 characteristics
  - “Color of bark” were gave up

Category	Characteristic						
General appearance	Shape of tree crown	Color of tree crown	Geotropism of branches	D.B.H.			
Trunk	Trunk form	Trunk taper	Shape of stem cross section				
Wood	Color of heart-wood	Color of sap-wood	Specific gravity				
Bark	Color of bark	Pattern of tree bark cracks	Thickness of bark				
Branch	Size of branch	Length of branch	Angle of branch	Density of branch			
shoot	Shape of cross section	Edge of cross section					
Phyllode	Length of phyllode	Width of phyllode	Bend of phyllode	Shape of phyllod base	Shape of phyllod tip	fork position of vein	Color of petiole
Pod	Shape of cross section	length of pod	Width of pod	Crookness of pod	Length of stalk	Color of stalk	
Seed	Length of ovule stalk	Color of ovule stalk	Color of seed	Color of flower	Length of inflorescence		
Fructing	quantity of fruit	Age start fructing					
Rooting	Rooting						

# Plant variety Registration of hybrid Acacia clones in Sabah Malaysia

- Important characteristic to distinct clone varieties each other
  - Some characteristic seems difficult to judge subjectively
  - Coincidence ratio between evaluator was quite low in “shape of crown form”

Characteristic		Code correspond to each Characteristics				combination of evaluator		
		1	2	3	4	A-B	A-C	B-C
General appearance	Shape of tree crown	conical	parabological	half globose	umbrella	35	43	45
Trunk	Trunk form	straight	medium	curved		75	80	69
	Shape of stem cross section	circular	elliptical	irregularcircular		69	75	65
Bark	Pattern of tree bark cracks	smooth	mesh	vertical crack	others	100	100	100
Phyllode	Bend of phyllod	less bended	medium	well bended		83		
	Shape of phyllod tip	acuminate	acute	obtuse		90		
	fork position of vein	base	medium	apart from base		68		

Note ; 51 trees were observed as sample

# Plant variety Registration of hybrid Acacia clones in Sabah Malaysia

- Important characteristic to distinct clone varieties each other
  - Data analyzed to estimate repeatability for Part of trait

Category	Characteristic	Repeatability
General appearance	Shape of tree crown	0.00
	Color of tree crown	0.07
	D.B.H.	0.30
Trunk	Trunk form	0.32
	Shape of stem cross section	-0.07
Bark	Pattern of tree bark cracks	0.12
Branch	Angle of branch	0.08
	Density of branch	-0.04
Phyllode	Length/Width of phyllode	0.41
	Bend of phyllode	0.34
	Shape of phyllod base	0.56
	Shape of phyllod tip	0.22
	fork position of vein	0.16



Note ; 51 trees were observed as sample  
5 phyllode from each trees were observed.

Phyllode of *A. mangium*(above) and *A. auriculiformis*(below)  
Continuous variation were observed in Phyllode of Hybrid

# Plant variety Registration of hybrid Acacia clones in Sabah Malaysia

- Important characteristic to distinct clone varieties each other
  - 23 characteristic could be evaluated out of 40 characteristics
  - 7 characteristic is not effective to distinct varieties

Category	Characteristic						
General appearance	<del>Shape of tree crown</del>	<del>Color of tree crown</del>	Geotropism of branches	D.B.H.			
Trunk	Trunk form	Trunk taper	<del>Shape of stem cross section</del>				
Wood	Color of heart-wood	Color of sap-wood	Specific gravity				
Bark	Color of bark	<del>Pattern of tree bark cracks</del>	Thickness of bark				
Branch	Size of branch	Length of branch	<del>Angle of branch</del>	<del>Density of branch</del>			
shoot	Shape of cross section	Edge of cross section					
Phyllode	Length of phyllode	Width of phyllode	Bend of phyllode	Shape of phyllod base	Shape of phyllod tip	fork position of vein	Color of petiole
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