Conversion of a Progeny Trial of *Acacia mangium* to a Seedling Seed Orchard Considering Gain and Fertility

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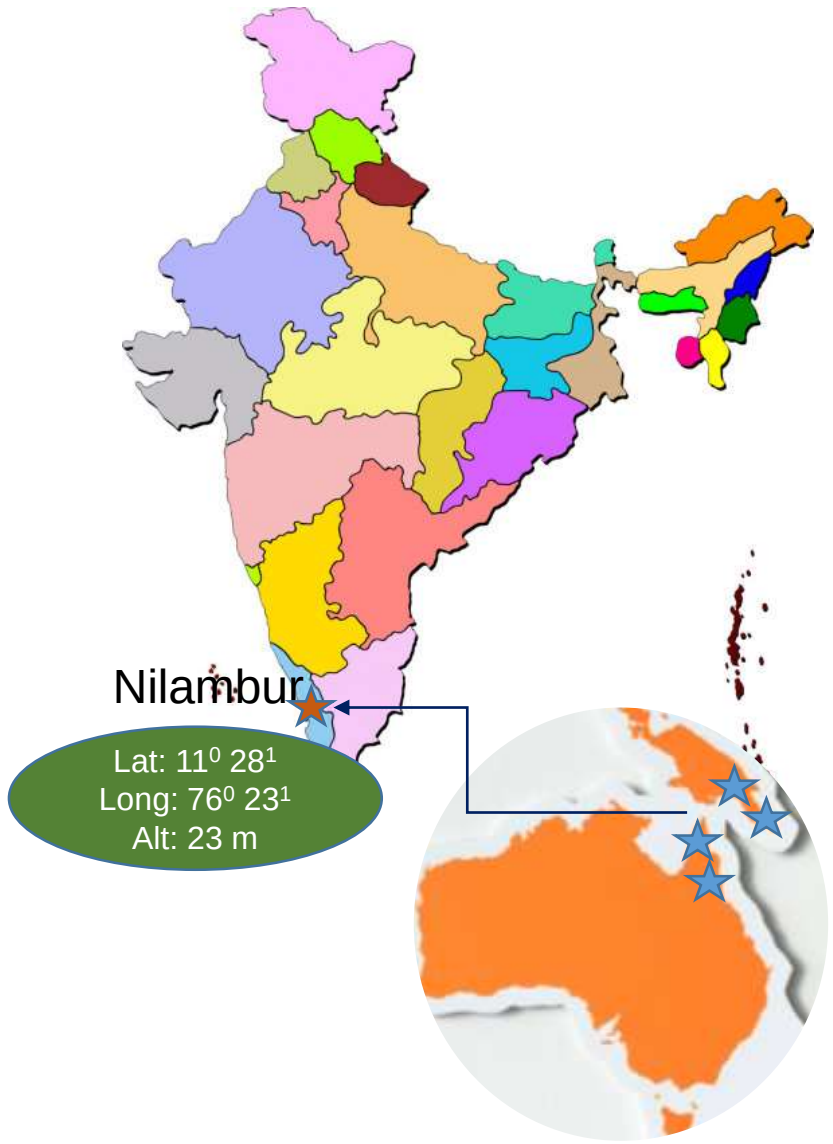
Introduction

- *Acacia mangium* Willd. was introduced to India in the1980s from unknown sources of poor stem form and growth.
- New family seedlots were introduced from Papua New Guinea (PNG) and Queensland region to enhance productivity.
- Seedling seed orchards (SSO) are commonly used as production populations in breeding programs for short rotation Acacias.
- To meet the immediate seed requirement, first-generation progeny trials were converted to SSOs.
- SSOs are expected to generate superior quality seed and gain compared to other unimproved sources.

Introduction…

- Different selection strategies can be employed for enhancing gain.
- Truncation selection will retain trees from only superior families.
- Phenotypic selection is done based on the phenotypic value without considering the family merit.
- Fertility of trees also has to be considered, as it ultimately decides the transfer of the genes to the seed crop.
- This study aims to predict the impact of two selection methods on genetic gain and diversity in a first generation progeny trial of *A. mangium* at seven years.

Materials and Methods

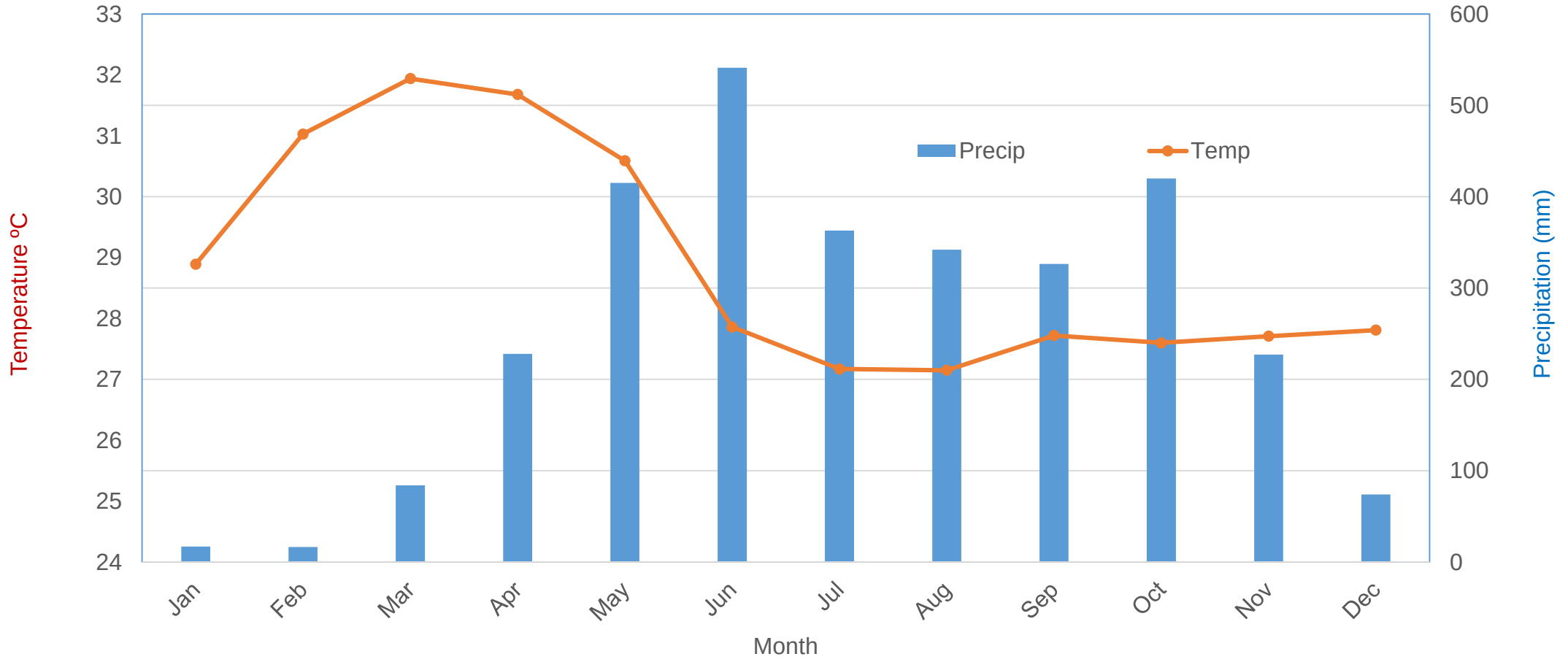


A. mangium families evaluated at Nilambur, Kerala, India

S. No.	Source	Origin	Families	CSIRO Number
1	Tully mission	Queensland Central Region	5	17703
2	Pascoe R	Far North Queensland	4	19151
3	Wipim Oriomo	Papua New Guinea SE	6	19233
4	Balimo	Papua New Guinea SW	5	19610

No. of families : 20
Replication : 3
Plants/Plot : 9
Spacing : 3 mx1.5 m

Mean monthly temperature and precipitation of trial site (Nilambur, Kerala)



Mean annual temperature:28.9°C

Total annual rainfall : 3054mm

Assessment of progeny trial

- Growth and Pods / tree were recorded at seven years.
- Number of Pods were recorded using binoculars.
- The number of primary, secondary and tertiary branches, and the pods per tertiary branch were recorded in all the trees.
- Estimates of number of pods per tree were obtained by extrapolating the counts.

  (Bila *et al.,* 1999; Kang and Lindgren, 1998).

Evaluation of dynamics of *A. mangium* SSO

- Fertility Variation: Sibling coefficient (ψ) - Kang and Lindgren, 1999

  Probability that two genes originate from the same parent, was used to quantify the fertility differences between orchard genotypes.

- Relative population size (*Nr*) - Lindgren *et al*. 1996

  The relative population size (N_r) was used to compare the effective number of trees contributing to random mating with the actual number of trees in the orchard.

- Group coancestry (Θ) - Lindgren and Mullin, 1998

  Probability that two genes taken at random from the gene pool of the expected seed orchard crop will be identical by descent.

Results

Growth, survival and fertility at 7 years

Provenance	Ht (m)	DBH (cm)	Pods/Tree	Survival %
Papua New Guinea	20.1	19.0	305.0	61.0
Queensland	20.0	17.6	281.0	57.5
p	0.654	0.002	0.756	0.61
se	0.2	0.6	78.3	7.0

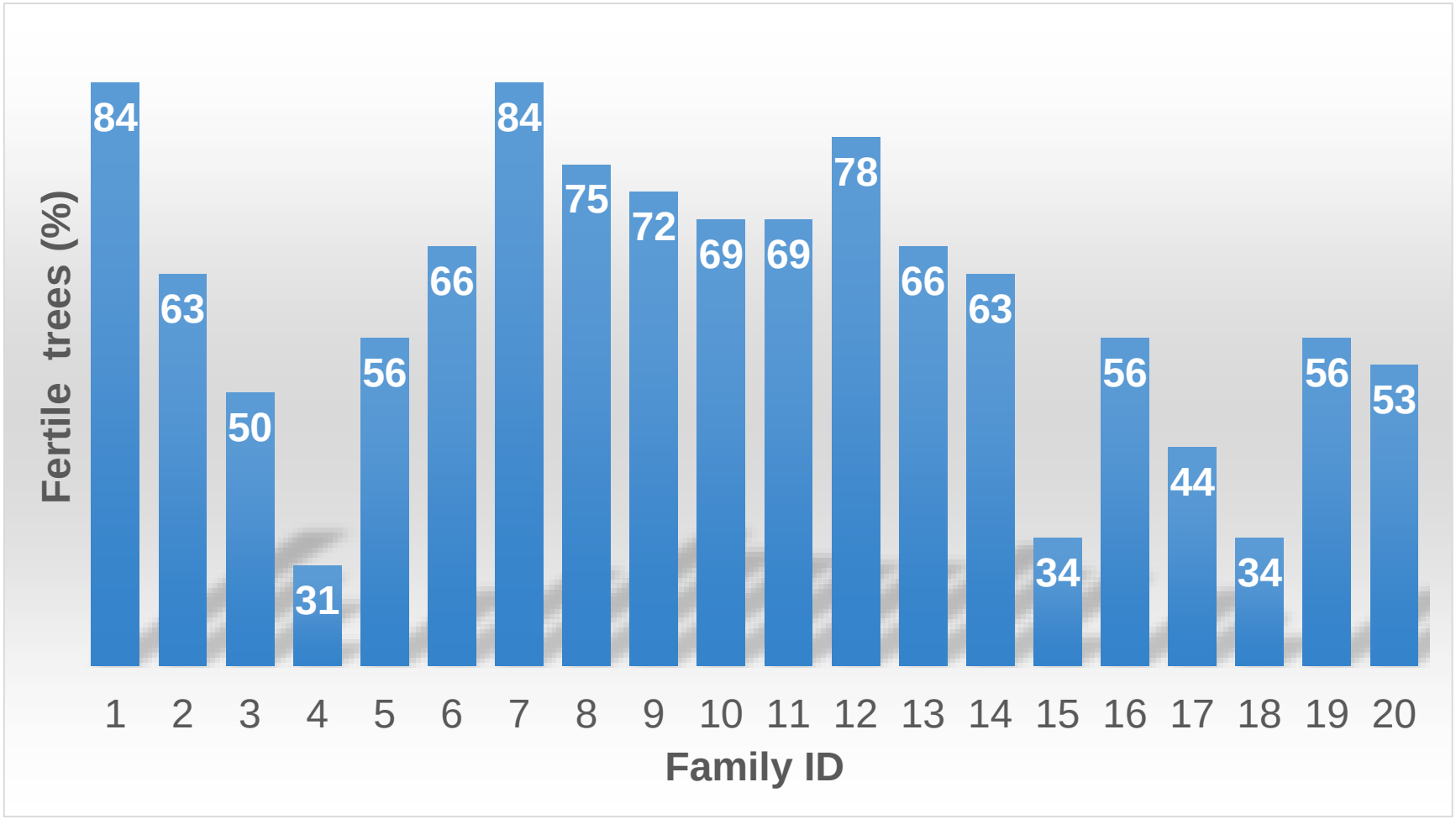
Survival ranged from 34 to 85% in the families Trial average was 64%

Phenotypic correlation between growth (Ht & DBH) and Pods/Tree at seven years

Trait	Ht	DBH	Pods/Tree
Ht	1		
DBH	0.473 NS	1	
Pods/Tree	0.038 NS	0.330 NS	1

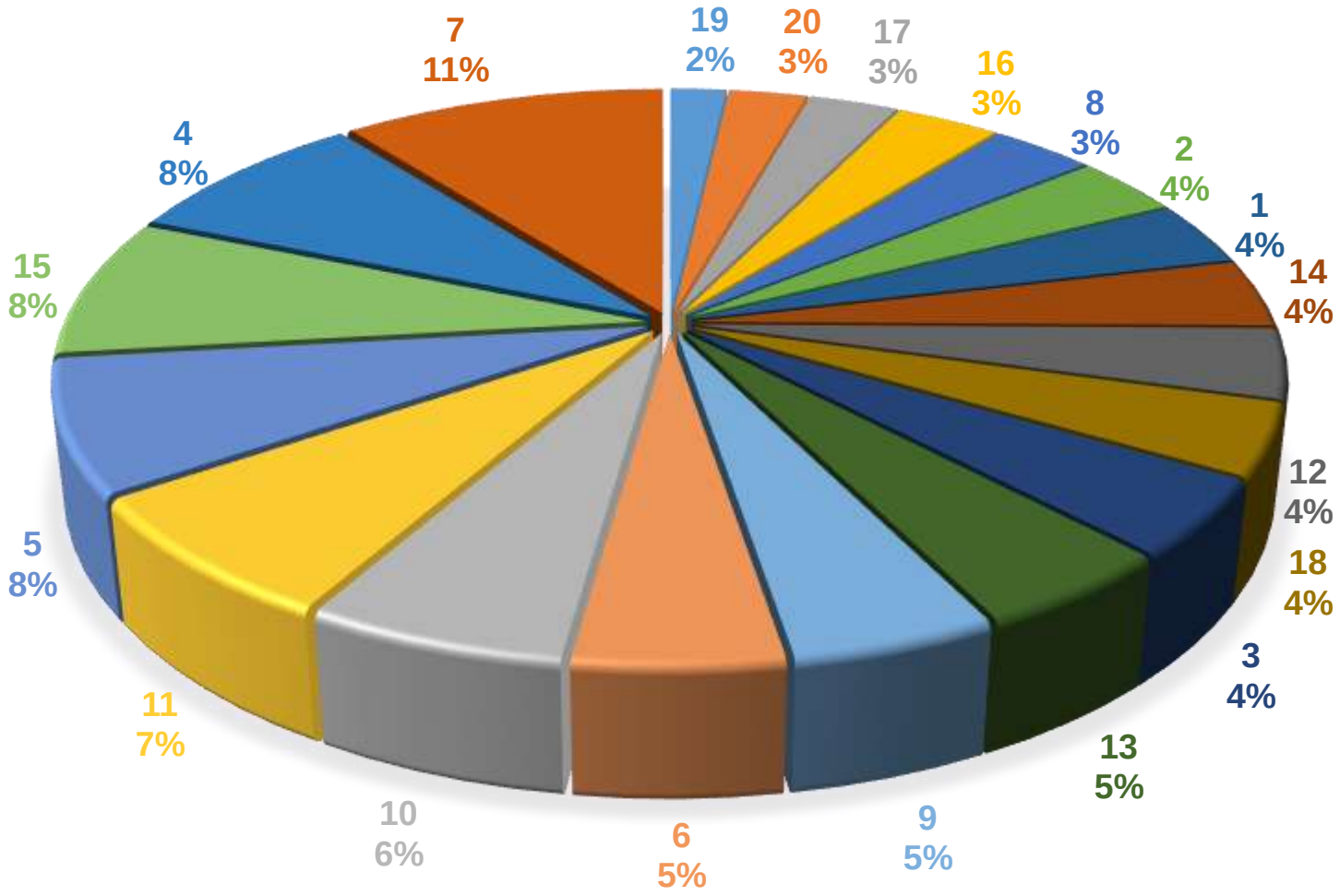
Tree Ht and DBH had no significant correlation with pods/tree

Variation in fertility in *A. mangium* trees at 7years



Average fertile trees: 60%

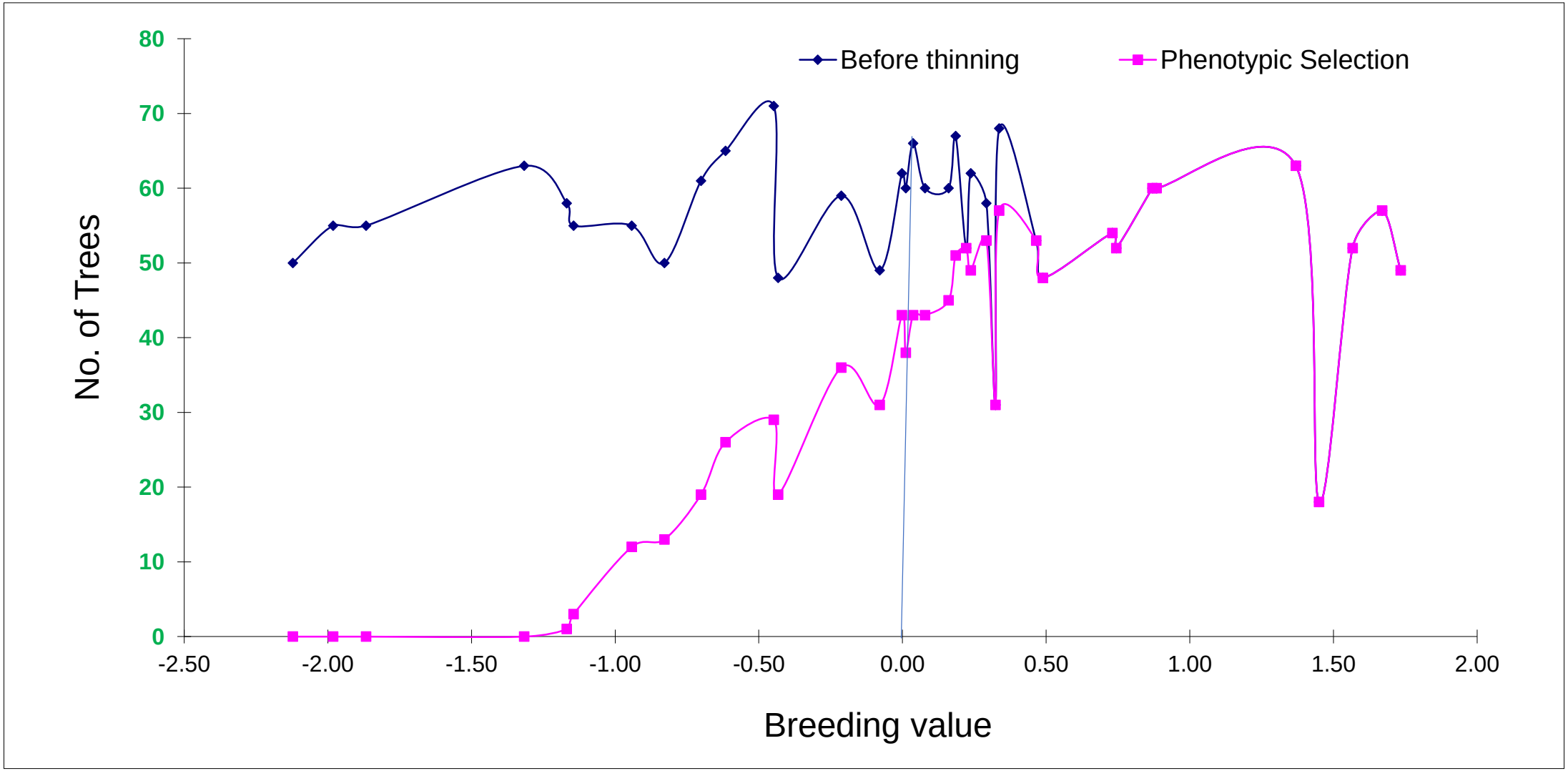
Fertility status of *A. mangium* families



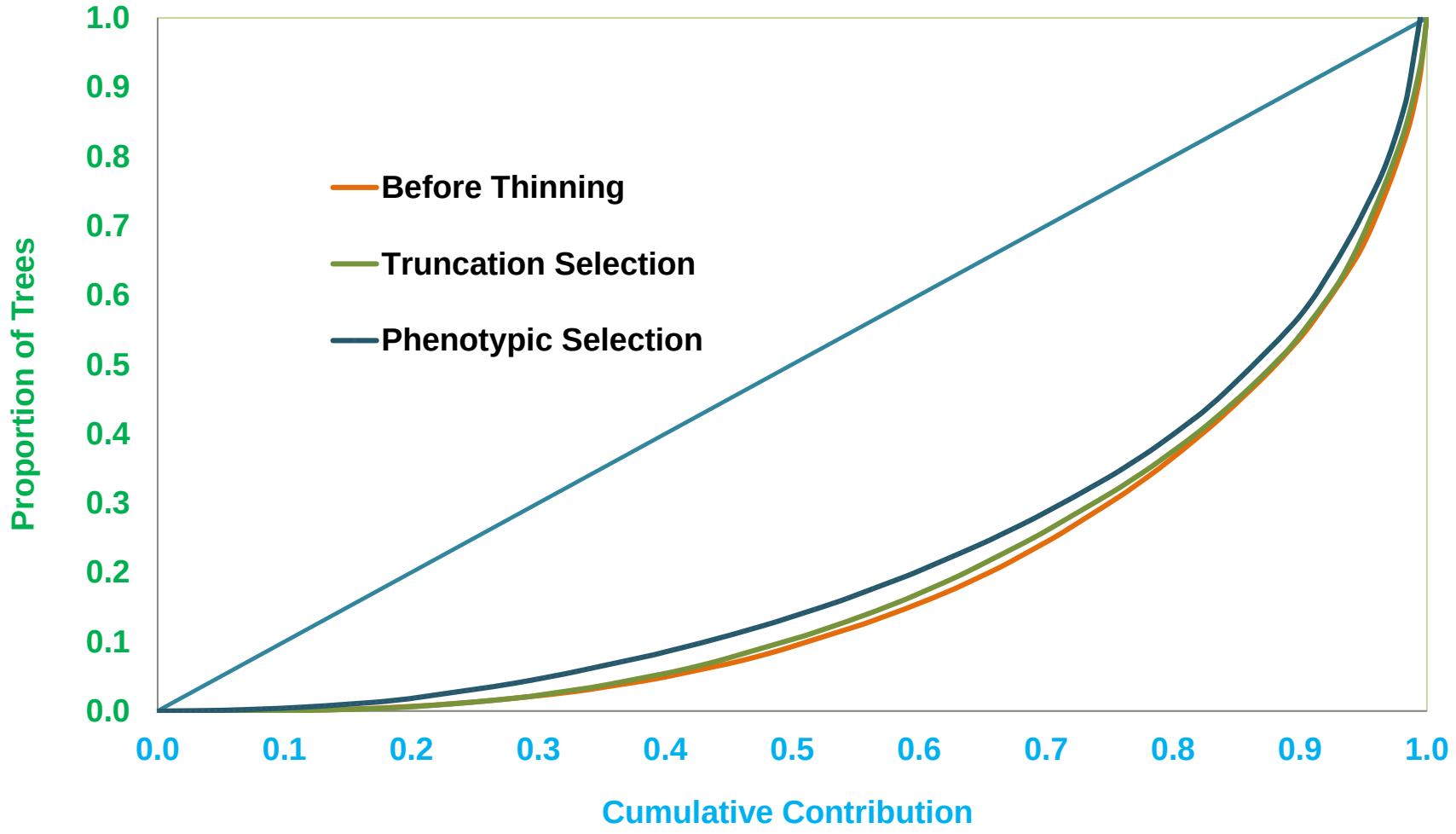
Fertility variation, Gain and Diversity in SSO

S. No.	Parameters	Before Thinning	Truncation Selection	Phenotypic Selection
1	Number of trees (N)	405	272	197
2	Fertility variation (Ψ)	3.7	3.4	3.1
3	Relative population size (*Nr*)	0.27	0.29	0.32
4	Group coancestry (Θ)	0.033	0.050	0.035
5	Avg. DBH (cm)	18.7	19.1	21.7
6	Gain %	-	2.14	16.04
7	No. of families	20	15	20

No. of trees/family retained in different selection methods



Cumulative contribution of individual trees in the two strategies



Conclusion

- PNG seed lots had better growth than QLD families.
- There was no significant correlation between growth and fertility.
- Phenotypic selection of trees increased both gain (16%) and expected diversity (*Nr*: 32%) of seed crop.

Thank You