

# Reducing initial stocking rates in smallholder teak woodlots: results of a Nelder wheel experiment in Northern Lao PDR after 15 growing seasons



THE UNIVERSITY  
OF QUEENSLAND  
AUSTRALIA

---

T2.29 STRENGTHENING TEAK FOREST MANAGEMENT FOR SUSTAINABLE TEAKWOOD  
SUPPLY CHAINS AND TRADE

MARK DIETERS<sup>1</sup>, OUTHAI SOUKKHY<sup>2</sup> VILAPHOB PHOUTHONE.

<sup>1</sup> THE UNIVERSITY OF QUEENSLAND, SCHOOL OF AGRICULTURE AND FOOD SCIENCE,  
BRISBANE AUSTRALIA <sup>2</sup> NORTHERN AGRICULTURE AND FORESTRY COLLEGE (NAFC),  
MINISTRY OF AGRICULTURE AND FORESTRY (MAF), LUANG PRABANG PROVINCE, LAO PDR

# Objectives

---

1. Understand the impacts of spacing and thinning on productivity and value of teak and companion crops, in teak-based agroforestry systems.
2. Develop options for diverse teak-based agroforestry systems involving native non-timber forest products, Crops and Production of fodder for livestock.
3. Facilitate the adoption of viable teak-based agroforestry systems through the development of improved genetic resources.

# Teak based agroforestry systems

---

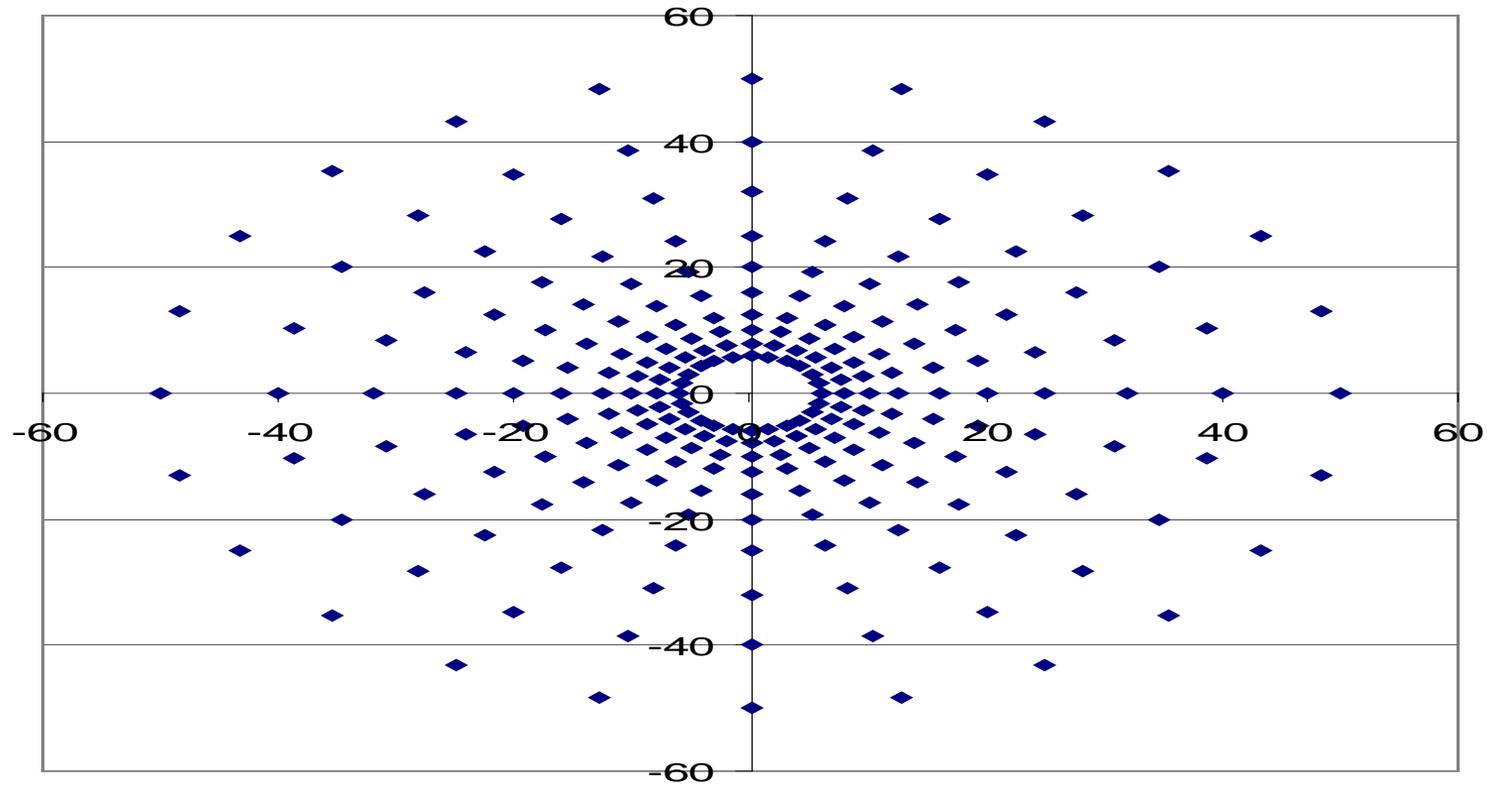
Bay width (i.e. distance between adjacent sets of paired rows)	10 m	12 m	15 m
Spacing between rows within each set of paired rows	2.1 m	2.1 m	2.1 m
Spacing between trees within rows	1.8 m	1.8 m	1.8 m
Initial stocking	605 trees/ha	518 trees/ha	425 trees/ha
Percentage of total area occupied by trees	17.4 %	14.9 %	12.3 %

# Companion crops for incorporation within teak-based agroforestry systems

The smallholder will largely incorporate companion crops of their choice, but within overall strategic plan of the project such that we achieve a balanced mix of agroforestry systems

most probably include growth of an annual cash crop such as maize, upland rice, or Job's tears planted at the same time as the trees in the first year, and a perennial crop planted either as mixture in the first year, or following harvest of the annual crop in the second year

**Broom grass**, po sa, stylo (or other fodder), cassava and banana are potential companion crops.

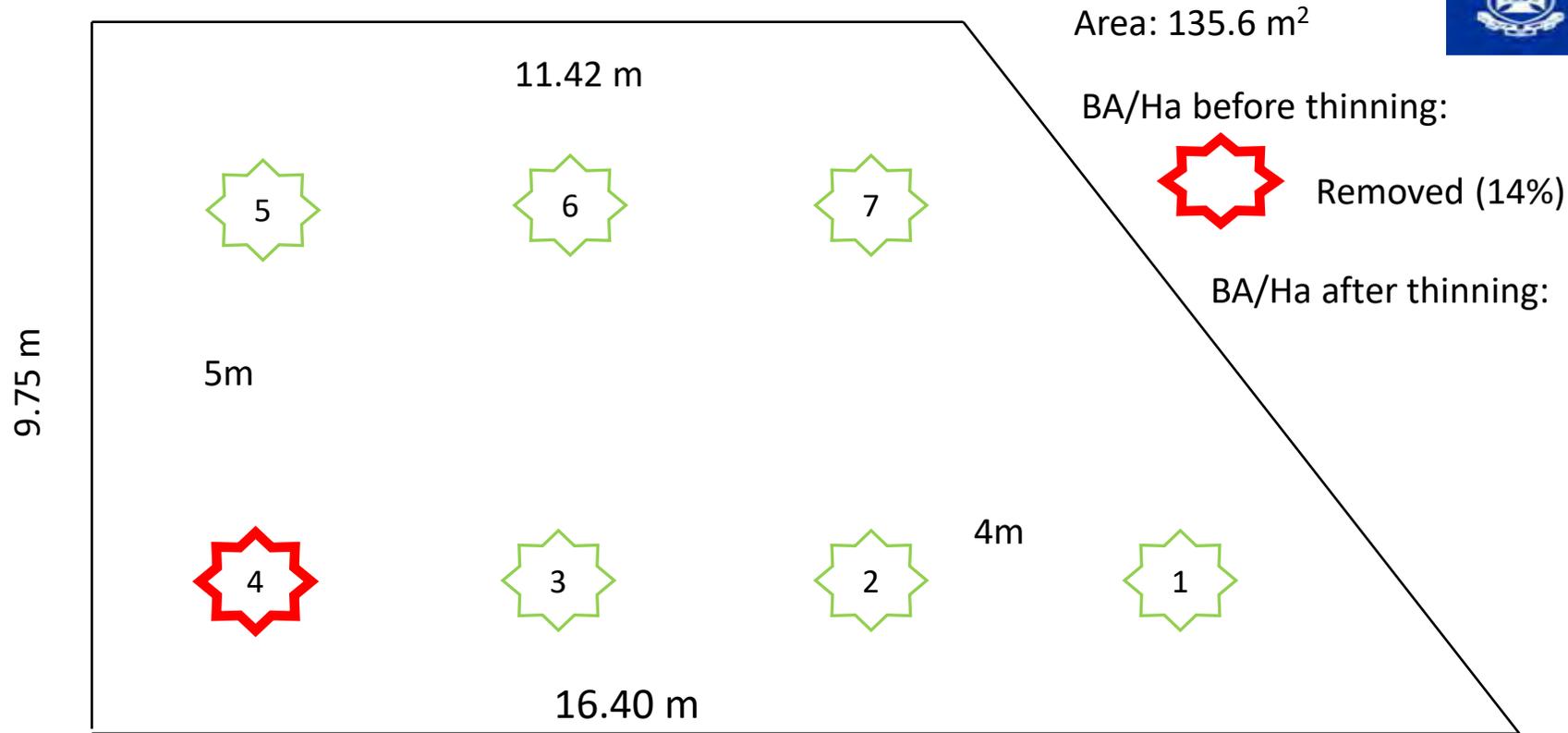


**Figure 1** Standard layout of trees used to establish the Nelder wheels (scale in metres). This experimental design has been used to demonstrate spacing in many tropical and temperate tree species

**Table 1** Distance of arcs (trees) from the central pivot, area per tree, spacing per tree and equivalent initial stocking rates (stems per hectare) in Nelder wheel.

<b>Arc (Trees)</b>	<b>Distance from Central Pivot (m)</b>	<b>Area per Tree (m<sup>2</sup>)</b>	<b>Spacing (m)</b>	<b>Stocking (sph)</b>
1	6.0	Isolation	Isolation	—
2	7.9	4.1	2.1 x 2.1	2424
3	10.0	6.0	2.5 x 2.6	1659
4	12.5	9.8	3.5 x 3.3	1026
5	16.0	15.7	4 x 4.2	637
6	20.0	23.6	5 x 5.2	423
7	25.0	39.2	7 x 6.5	255
8	32.0	62.8	8 x 8.4	159
9	40.0	94.5	10 x 10.4	106
10	50.0	Isolation	Isolation	—

# College Teak Spacing Trial Plot A (5m x 4m)





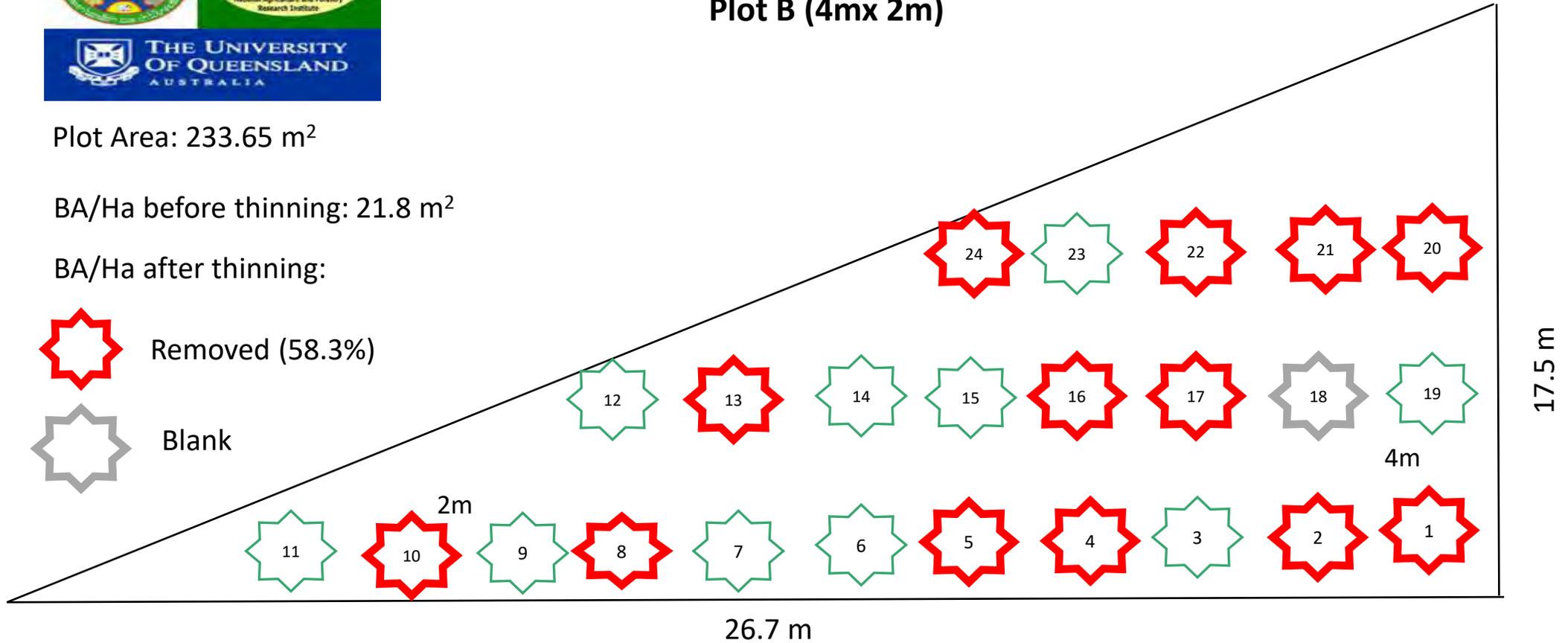
## College Teak Spacing Trial Plot B (4m x 2m)

Plot Area: 233.65 m<sup>2</sup>

BA/Ha before thinning: 21.8 m<sup>2</sup>

BA/Ha after thinning:

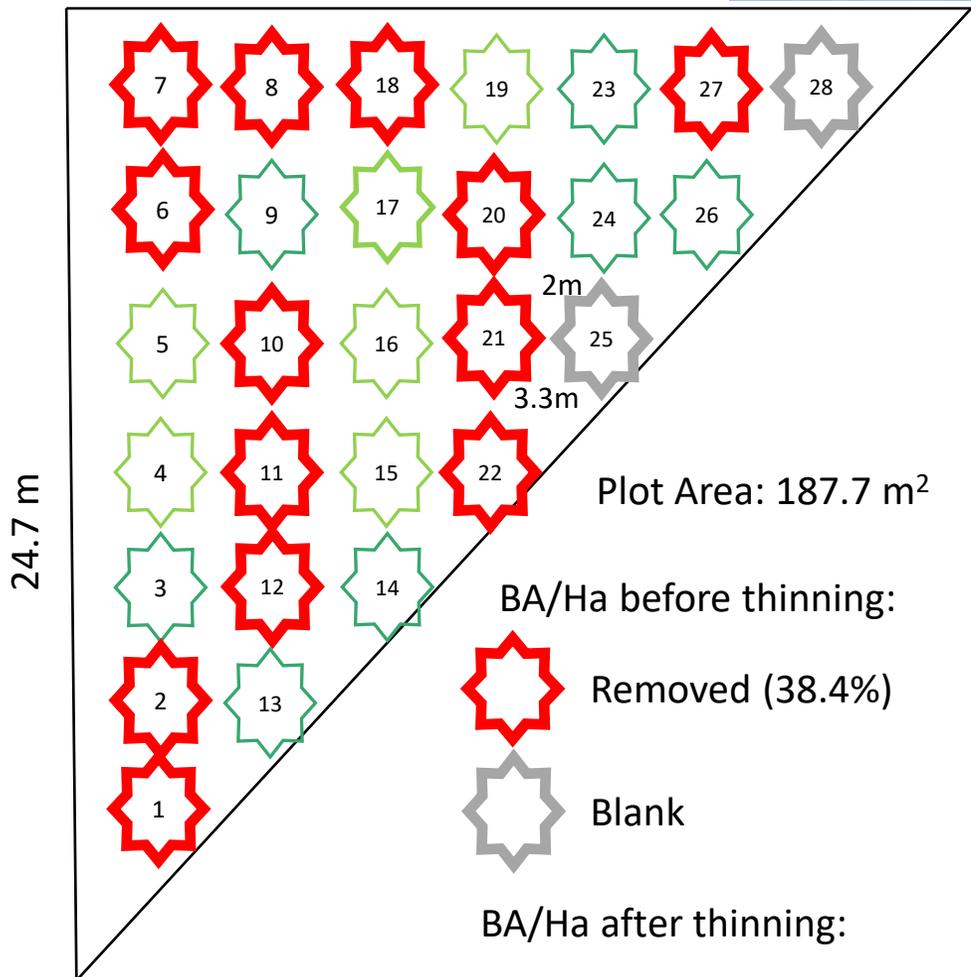
-  Removed (58.3%)
-  Blank



# College Teak Spacing Trial Plot C (3.3mx 2m)

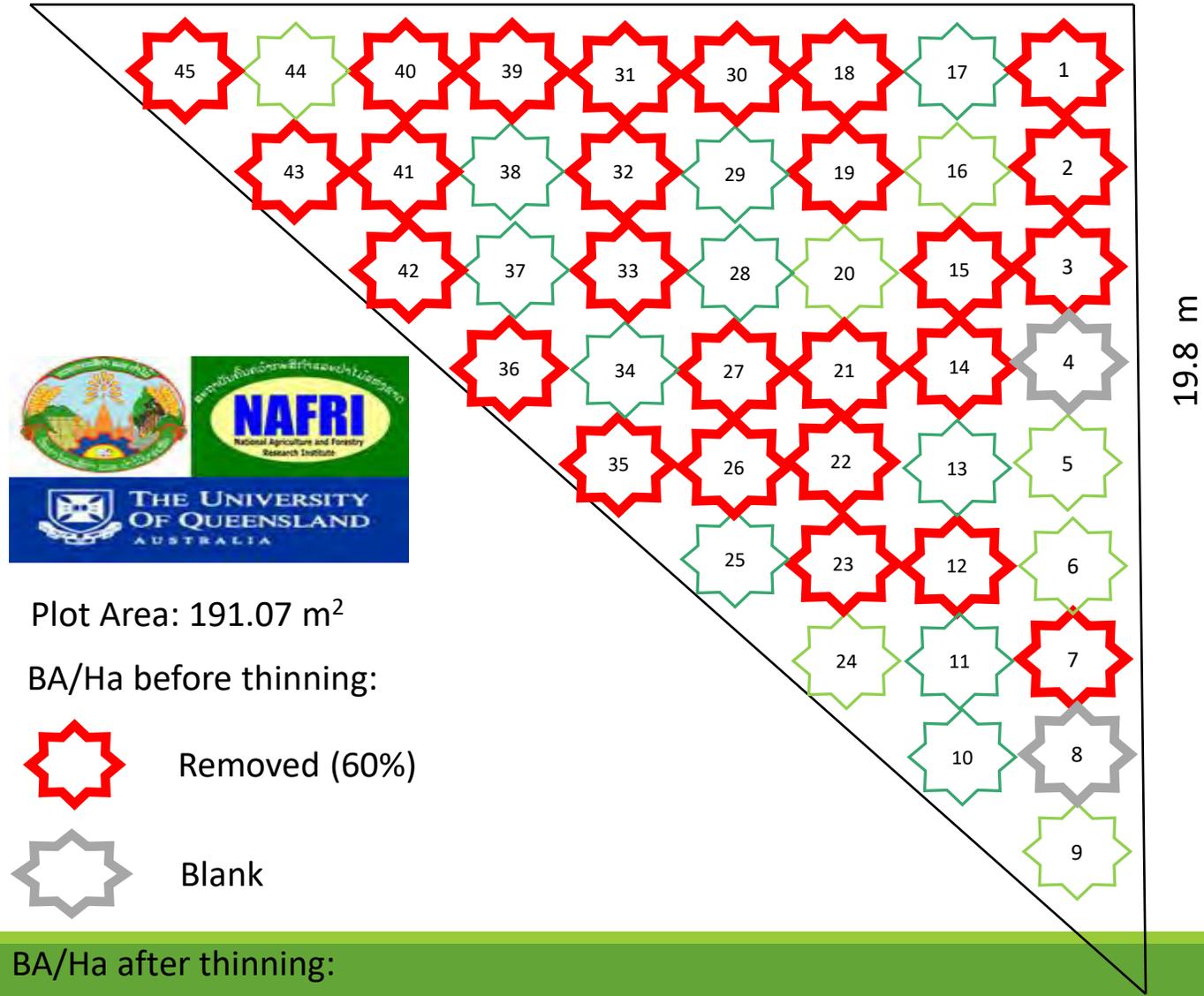


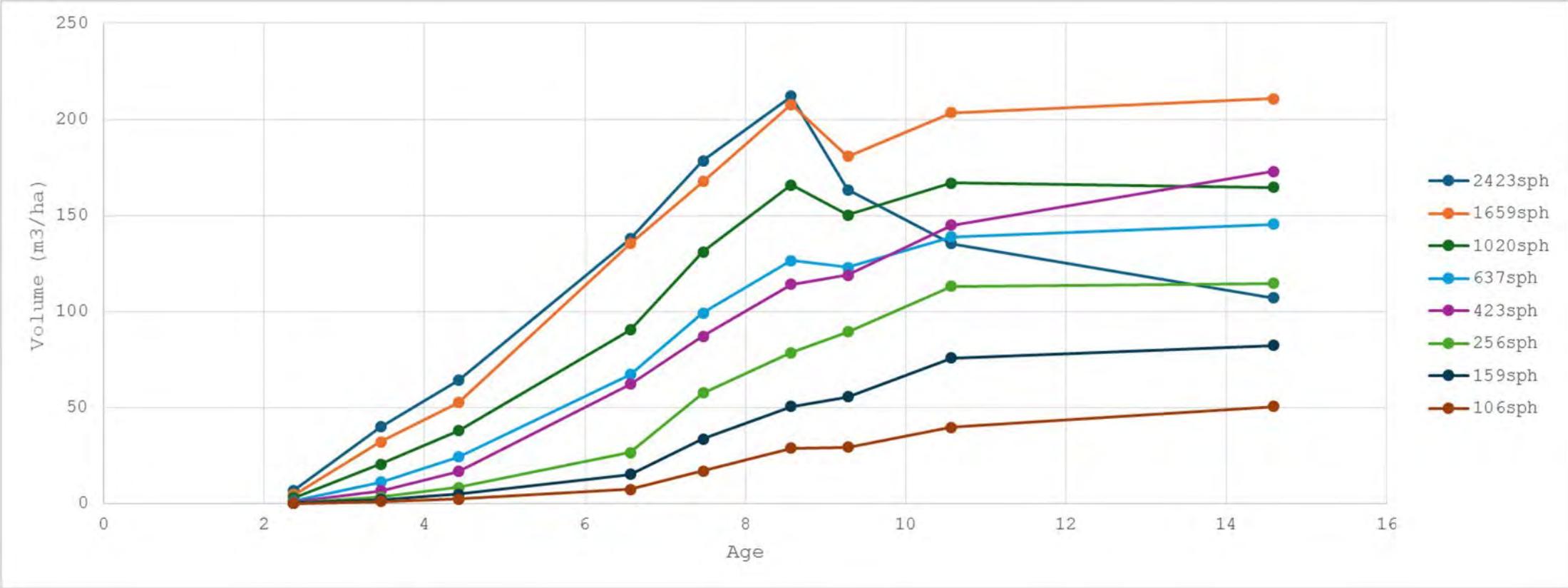
15.2 m

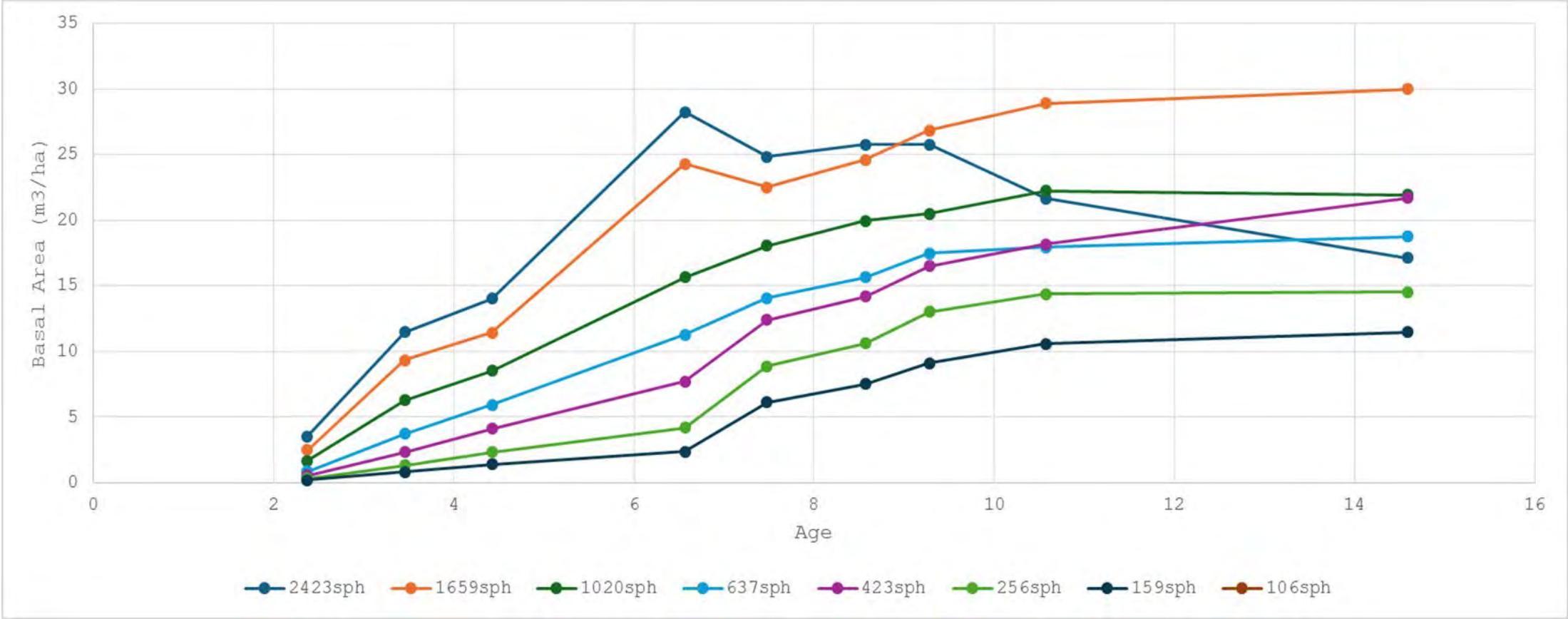


# College Teak Spacing Trial Plot D (2m x 2m)

19.3 m







Dr Mark Dieters visited Nelderwheel after 8<sup>th</sup>  
year planted



Mark Dieters visited Nelderwheel after 8<sup>th</sup> year planted



Teak Nelderwheel 2014 at NAFC



On 17/5/2023 Delegate from GLZ visited Nelderwheel at NAFC



On 20/12/2023 MAF Delegate visited Nelderwheel at NAFC



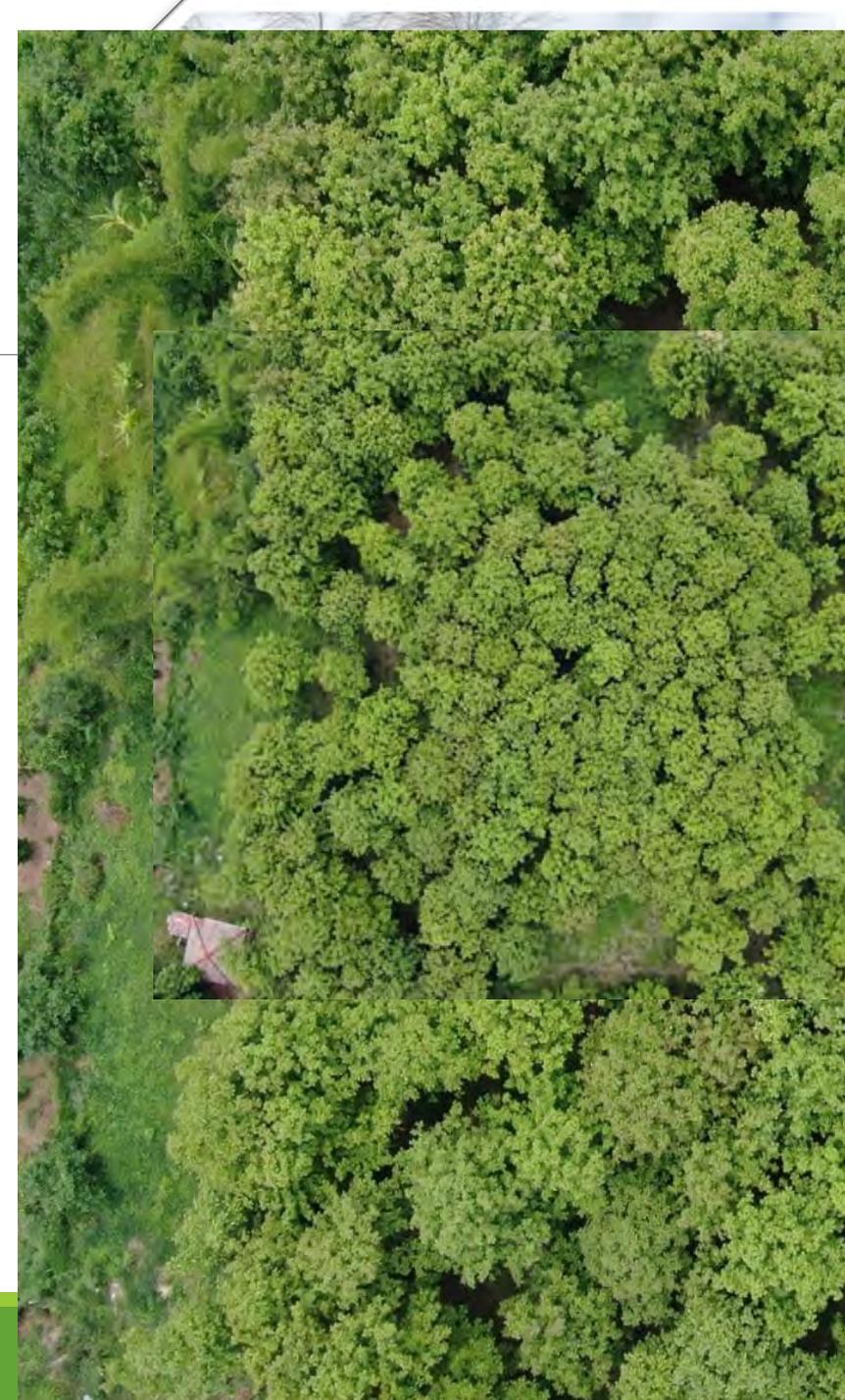


# Importance of teak woodlots

---

Teak has been planted in the upland areas of Northern Laos for more than 50 years, resulting in an estimated 27,481 ha of teak, established as a patchwork of small woodlots distributed across the landscape. (PAFO, 2023).

There were varying reasons underpinning the adoption of teak planting by smallholder farmers in northern Lao PDR, from securing land tenure, to providing a mechanism for long-term investment (i.e., a green bank). Typically, teak woodlots were established at high initial stocking rates, and were then thinned by progressively removing the largest trees once they obtain a marketable size.



# Importance of teak woodlots

---

There were varying reasons underpinning the adoption of teak planting by smallholder farmers in northern Lao PDR, from securing land tenure, to providing a mechanism for long-term investment (i.e., a green bank). Typically, teak woodlots were established at high initial stocking rates, and were then thinned by progressively removing the largest trees once they obtain a marketable size



# Thining activities

---

- The results demonstrate the potential for teak to be grown under shorter rotations, by either planting at around 625 t/ha or adopting early pre-commercial thinning to reduce stocking levels to 500-600 t/ha. This approach can allow intercropping with the developing teak for longer periods, greatly increase diameter increments, thereby reducing time to first commercial harvest and increasing profitability.



# Thining Activities/Agroforestry

. Woodlots can then be commercially thinned (from below) at 12-15 years of age, or potentially clear-cut at 15 years, and the coppice managed to regenerate the woodlot, providing long-term, sustainable timber production, with limited management requirements.





# College Broom Grass Clonal Bank Plot 1 (3 m x 2 m)

33 m



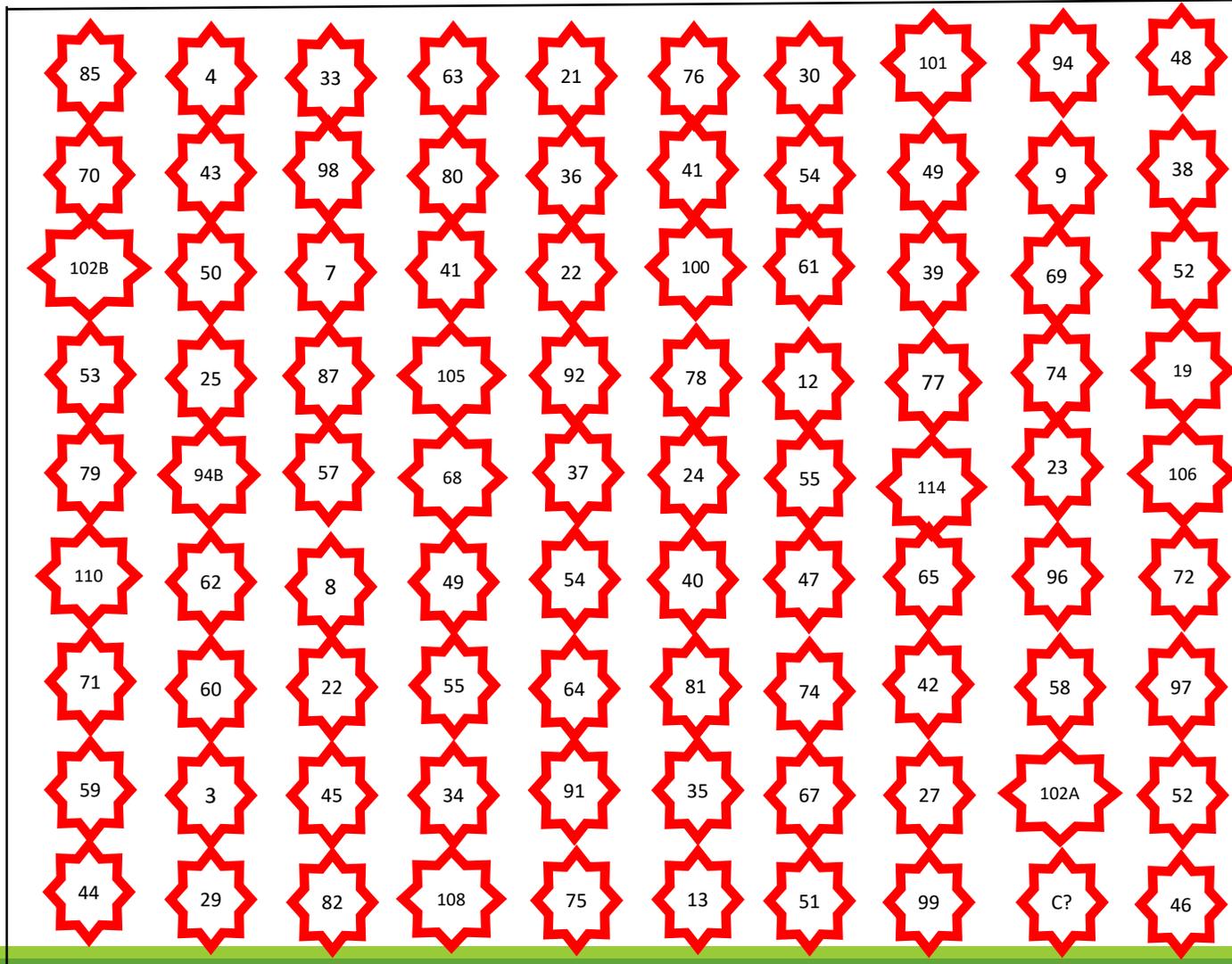
Broom Grass Clone

Plot Area: 660 m<sup>2</sup>

Spacing: 2m x 3m

Number of Clones:  
85 individuals plus  
5 individual repeats

Planted: 11-05-2015  
Revised on the 11-05-2015



20 m

# Broomgrass Germplasm at NAFC 2024



# Broomgrass Germplasm at NAFC 2024





Farmers Evaluated broom grass varieties 8-9/03/2023



Farmers Evaluated broom grass varieties 8-9/3/2023

Farmers make broom grass processing on 03-08/04/2023





Farmers make broom grass processing on 03-08/04/2023



# Acknowledgement

---

Dr Mark Dieters Email; m.dieters@hotmail.com

Dr. Outhai soukkhy (NAFC) .Email; [outhainafc@yahoo.com](mailto:outhainafc@yahoo.com)  
Telephone; (856 20)55571828

Nora Devoe Email: nora.devoe@aciarc.gov.au

Ms. Maichor (NAFC)

Mr Vilaphob Phouthone

Students from NAFC

Dr. Gary Sexton

Dr. Jonathan Newby (UQ)

Mr. Somphanh Sakanphet (UARC)



THE UNIVERSITY  
OF QUEENSLAND  
AUSTRALIA

<https://latarp.wordpress.com/>

---

ຂອບໃຈຫລາຍໆ  
Many thanks

ACIAR FST/2012/041

