RESTORING BAMBOO-DECIDUOUS FOREST AT PONG YAENG NORK AFTER FIRE

Project Name:	Restoring Bamboo-Deciduous Forest at Pong Yaeng Nork After Fire
Sponsor:	Plant Genetic Conservation Project Under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn – Chiang mai University (RSPG-CMU)
Project Duration:	May 2024 - November 2025
Project Organizer:	Forest Restoration Research Unit (FORRU-CMU), Department of Biology, Faculty of Science, Chiang Mai University
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Summary

This project aimed to restore bamboo-deciduous forest to a 10-rai plot in Mae Rim district, which had previously been used by villagers for ginger and avocado farming, before being returned to the national park in early 2022. A severe fire, during the 2024 dry season destroyed most of the existing tree cover, prompting the need for intervention. The site was also selected for the Young Forest Restorers (YFR) school program

Trees were planted over 8.4 rai of the plot (the rest was covered with bamboo) at the start of the 2024 rainy season, with maintenance (weeding and fertilizer application) over two rainy seasons. A rapid site assessment and drone survey (conducted in May 2024) revealed that the fire had cleared most ground vegetation, leaving bare soil and sparse tree cover, though large living bamboo clumps survived. Ground surveys calculated an existing natural regenerant density of 79 trees/rai, indicating an additional 421 trees/rai (totalling 3,536 saplings) were required to meet restoration targets.

Site preparation involved weeding by park staff and local villagers, marking planting points 1.8 meters apart with bamboo poles and pre-digging the planting holes. Planting began on June 29. Totally, 1,600 saplings were planted across 4 rai by 106 participants, including local schools (Varee, Dara Academy, Satit CMU), village volunteers and international conservationists from Malaysia (TRCRC). This area was dedicated to a specialized organic fertilizer experiment, using 10 framework species. On July 11 & 13 the remaining 4.4 rai were planted with 1,900 trees of 23 species, supported by corporate volunteers from SIG company, the Ratchapreuk Foundation and additional YFR schools.

The fertilizer experiment utilized four blocks with varying application rates per tree (50g, 100g, 150g, and 200g), applied three times in the first rainy season and three times in the second. Weeds were hand-pulled within a 50 cm radius of each tree and reapply fertilizers at 6-to-8-week intervals.

Monitoring was performed a couple of weeks after planting (baseline July 2024), at the end of the first rainy season (R1) in November 2024, and at the end of the second rainy season (R2) in November 2025. Growth was evaluated using tree height and the relative growth rate of root collar diameter (RGR-RCD). The R1 survey revealed 80% survival dropping to 77% by R2, with more than half of the selected species exceeding 80% survival. Combining growth with survival - *Erythrina*

stricta and *Balakata baccata* exhibited highest performance A fertilizer dose of 150g per time yielded the most optimal growth performance. Conversely, the 100g treatment was deemed insufficient for optimal recovery, and the maximum dose of 200g saw a drop-off in comparative performance.

The project successfully demonstrated that the framework tree method combined with active community participation is highly effective for post-fire recovery of bamboo-deciduous forest at low elevations. Long-term tracking will continue, using drone-constructed 3D models, to monitor overall spatial forest canopy recovery.

1. Background

This project is to convert a burnt bamboo-deciduous plot at Pong Yang Nork, Mae Rim, Chiang mai, back into native bamboo-deciduous forest, primarily for biodiversity recovery within Doi Suthep-Pui National Park. Total area around 10 rai, the land was recently returned to the national park since 30 January 2022 by villagers, who had been it for ginger and avocado agriculture. Fire burnt through the site in the 2024 dry season, killing most of the trees.

Figure 1 - Participants on planting day, 29th June 2024

Since the area is easily accessible by road, FORRU-CMU considered it was an ideal tree-planting location for schools participating in the unit's Young Forest Restorers project (YFR), sponsored by Keidanren Nature Conservation Foundation (KNCF). Consequently, the plan below is to plant 8.4 rai of the site on 29/6 and 13/7/24, in collaboration with the Doi Suthep-Pui National Park authority and Pong Yaeng Nok Village.

2. Objective

To retore 8.4 rai of bamboo-deciduous forest, following fire, with the primary aim to recover biodiversity to meet conservation objectives of Doi Suthep-Pui National Park. This includes planting 3,500 trees in the rainy season of 2024 and maintaining the planted trees for at least two years.

3. Characteristics of the restoration site, area survey and map

The 10-rai restoration site is in Pong Yaeng Nork district and lies within the boundaries of Doi Suthep-Pui National Park. The site was previously covered with bamboo-deciduous forest (*sensu* Maxwell and Elliott, 2001) at 790-800 m above sea level.

A rapid site assessment was performed on May 10th. Fire had completely removed the ground vegetation, leaving bare soil over most of the site (Figure 2). Tree cover was very sparse over most of the site, although some trees survived in the lower SW corner. There were many clumps of burnt bamboo, which had lost their foliage but were still alive.

An aerial survey by drone (Figure 3) estimated total tree/bamboo cover across the whole site was 1.6 rai, leaving 8.4 rai requiring planting. From 10 circular sample plots of 10 m diameter, randomly placed across the site, the density of natural regenerants (saplings taller than 50 cm and live tree stumps) was estimated at 79/rai (± 2.6, 95% c.l.) (Appendix 2). Therefore, the required number of planted trees will be 421/rai—totally 3,536 trees for the entire 8.4 rai. The species of trees among those surviving on site were *Mangifera indica, Oroxylum indicum*, *Croton oblongifolius, Albizia chinensis, Fernandoa adenophylla, Fagraea fragrans* and *Ficus* sp.

Figure 2 - Restoration plot in Pong Yang after fire.

Therefore, two planting events were planned. The first one on June 29th, to coincide with a training workshop for a group of Malaysian conservationists (TRCRC) and a second one on July 13th, with both events also open for schools participating in the Young Forest Restorers program.

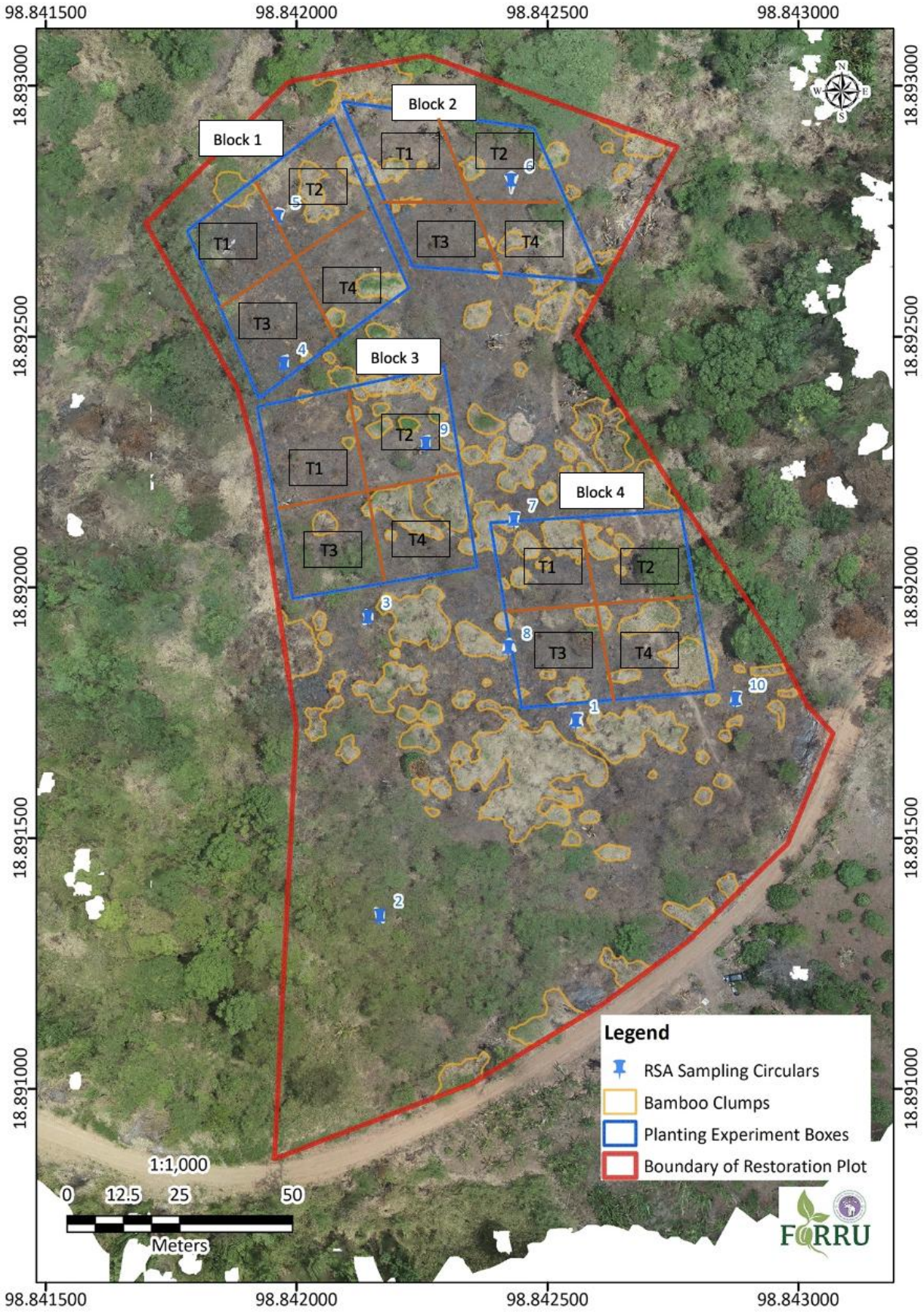


Figure 3 – Arial survey by drone

5. Planting Preparation

5.1 Site Preparation

It was recommended to the Doi Suthep-Pui National Park authority (DSNP) to remove large woody debris and perform weeding before the planting events, to ease access, to retain smaller debris on site for micro-habitat and nutrient retention.

Due to recent burning, weed growth was initially low at this site, but weeds started to grow up rapidly shortly after the survey was completed (Figure 4). Glyphosate spraying was recommended to DSNP, but it was not allowed. Therefore, manual weeding was scheduled for 24th June by DSNP staff and villagers.

Figure 4 – weed growth 5/6 – note bamboos have survived burning

Bamboo sticks will be used to mark the planting spots (1.8 m apart), as well as surviving natural regenerants. Holes. twice the size of the sapling containers (9 x 2.5-inch plastic bags). will be dug by each pole. Planting equipment and materials will be transported to the site one day before the planting days.

On June 13th and 26th the treatment plots for the fertilizer experiment were laid out with the help of GIVE volunteers.

Figure 5 – GIVE volunteer and FORRU staff clear weed and setup experiment plot.

5.2 Species Selection

Framework trees species, which FORRU-CMU has found to grow well on nearby similar bb/df sites (at Ban Meh Meh), were selected for planting at this site. The trees were sorted and labelled at FORRU's nurseries on 17th June and will be moved to the site on 28th June.

Figure 6 – FORRU staff and volunteer transfer sapling to planting site

Ten species were selected for the experiment, with 40 trees of each species to be planted in each of 4 x 1-rai treatment plots (totally 160 of each species) during the 1st planting event on 29th June (Table 1)

In the remaining 4.4 rai, 23 species will be planted in various quantities, according to availability in nurseries – totally 1,900 trees (Table 2)

The Forest Restoration Research Unit has two active nurseries near the planting site: Ban Mae Sa Mai community tree nursery (BMSM) and Doi Suthep research nursery (DS). In addition, schools participating in the YFR project have been producing saplings from locally collected seed in their own on-campus nurseries with technical support from FORRU-CMU since April 2022. Therefore, some of their saplings are also ready for planting at this site.

Table 1 Total number and lists of species for experiment in Day 1 (4 rai)

S.no	Thai name	Species	Successional guilds	Low elevation	High elevation	Total no. of sapling	Label numbers T1 T2 T3 T4
118	มะกล่ำตาไก่	*Adenanthera microsperma*	climax	200	1,100	160	118.1-40 41-80 81-120 121-160
31	สะเดาช้าง	*Acrocarpus fraxinifolius*	Pioneer	500	1,250	160	31. 1-40 41-80 81-120 121-160
131	ตาเสือทุ่ง	Heynea trijuga	Pioneer	200	1,500	160	131. 1-40 41-80 81-120 121-160
13	มะซัก	*Sapindus rarak*	Intermediate	200	1,620	160	13. 1-40 41-80 81-120 121-160
15	สลีนก	*Balakata baccata*	Pioneer	375	1,350	160	15. 1-40 41-80 81-120 121-160
323	ทองเหลือง	*Erythrina stricta*	Pioneer	400	1,680	160	323. 1-40 41-80 81-120 121-160
4	เติม	*Bischofia javanica*	Intermediate	200	1,300	160	4. 1-40 41-80 81-120 121-160
364	เดื่อใบใหญ่	*Ficus auriculata*	climax	525	1,400	160	364. 1-40 41-80 81-120 121-160
133	มะค่าโมง	*Afzelia xylocarpa*	Climax	350	500	160	133. 1-40 41-80 81-120 121-160
12	กล้วยฤาษี	*Diospyros glandulosa*	climax	650	1,650	160	12. 1-40 41-80 81-120 121-160
						1600	

Table 2 Total number and lists of species Day 2 (4.4 rai)

S.no	Thai name	Species	Successional guilds	Low elevation	High elevation	Total no. of sapling
310	ราชพฤกษ์	*Cassia fistula*	climax	400	900	40
204	แคหางค่าง	*Markhamia stipulata*	climax	575	1,275	40
36	มะขามป้อม	*Phyllanthus emblica*	Pioneer	60	1,700	50
13	มะซัก	*Sapindus rarak*	Intermediate	200	1,620	200
301	กางหลวง	*Albizia chinensis*	Pioneer	450	1,600	50
317	ทองหลาง	*Erythrina subumbrans*	Pioneer	200	1,680	50
425	มะห้อ	*Spondias lakonensis*	Pioneer	450	850	40
161	ฝาละมี	*Alangium kurzii*	climax	600	1,400	50
320	เสี้ยวดอกแดง	*Bauhinia purpurea*	Pioneer	350	900	100
4	เติม	*Bischofia javanica*	Intermediate	200	1,300	50
364	เดื่อใบใหญ่	*Ficus auriculata*	climax	525	1,400	150
41	กัลปพฤกษ์	*Cassia bakeriana*	Pioneer	1,000	1,350	100
492	มะกล่ำตาควาย	*Adenanthera parvonina*				150
241	หว้าขี้กวาง	*Eugenia fruticosa*	climax	200	1,525	90
438	หาดหนุน	*Artocarpus lakoocha*	climax	650	1,100	50
487	แคบิด	*Fernandoa adenophylla*		200	850	40
365	มะเดื่ออุทุมพร	*Ficus racemosa*	climax	60	650	20
218	อบเชย	*Cinnamomum inners*	climax	350	1,900	100
450	ยางโอน	*Polyalthia viridis*	climax	500	800	150
296	อวบดำ	*Chionanthus ramiflorus*	climax	550	850	150
53	ปอมื่น	*Colona floribunda*	Pioneer	650	1,250	80
66	มะกัก	*Spondias axillaris*	Pioneer	460	1,600	50
376	กะเหรี่ยง	*Ficus capillipes*	climax	1,050	1,100	100
						1,900

5.3 Experiment design

A total of 4 blocks were used for the organic fertilizer experiments, with 4 treatments per block:

- **Treatment 1 (Control):** 50 grams of organic fertilizer
- **Treatment 2:** 100 grams of organic fertilizer
- **Treatment 3:** 150 grams of organic fertilizer
- **Treatment 4:** 200 grams of organic fertilizer

All treatments were applied at the time of planting, three times during the 1st rainy season and three times during the 2nd rainy season. Ten species were selected for the experiment, using 40 saplings per treatment per block.

6. Planting Events

Planting spots and any surviving natural regenerants will be marked with bamboo poles and holes dug twice the size of the containers (approx. 1.8 m apart on average). Participants will be instructed to use a knife to cut open the sapling bag area to remove the saplings from the bag in an attempt not to affect the root system. The saplings will then be planted in the holes and soil added from back fill and firmly pressed down. Outside the experimental area, 50 g of organic fertilizer will be applied in a circle 20 cm from the stem around each sapling. Within the experimental area the fertilizer dosage will be according to the experimental treatments.

Planting equipment

1. Baskets for sapling transport across the site
2. Hoe
3. Box cutters to open plastic bags
4. Gloves
5. Fertilizer, bucket for fertilizer and measuring cup
6. Bamboo poles
7. First aid supplies

First planting day on 29th July, planted in experiment blocks, total of 10 species 1,600 sapling with Varee school, Dara Academy and Satit Chiang mai school that in part of YFR project. Moreover, have participants from National Park, villagers, Tropical Rainforest Conservation & Research Centre (TRCRC) and FORRU staff, total 106 people.

On 11th July with SIG company (30 peoples) and Ratchapreuk foundation planted 400 sapling (around 1 rai). The left of 3.4 rai, 1,500 sapling was planted on 13th July with YFR school (Varee, Chiang mai Christian and Mae Ho Pra school), National Park and FORRU staff.

Figure 8– Planting day

7. Site Maintenance

Weeding and fertilizer application will be done 3 times on 29th July, 5th September and 16th October in the first rainy season and 3 times in the second rainy season on 15th June, 1st August and 4th October at approximately 6-8 weeks apart, depending on rate of weed growth. On each occasion, weeds will be hand-pulled in a radius of about 50 cm around each tree and 50 g of organic fertilizer applied as above (or as specified within the experimental area).

Figure 9 – FORRU volunteers help weeding and fertilizing.

8. Tree Monitoring

Monitoring of tree survival and growth was performed with YFR schools and volunteers, supervised FORRU-CMU staff, shortly after planting (baseline data) on 19th July, at the end of the first rainy season (R1 monitoring) on 23rd November and end of second rainy season (R2 monitoring) on 17th November 2025. FORRU-CMU staff analyzed the data and results are presented below. Measurements included tree height and root collar diameter (RCD) to assess tee growth. For the small trees, Vernier calipers were used to measure RCD at the widest point. Tape measures were used to measure tree height from the root collar to the highest shoot tip and to measure crown width at the widest point. A simple health score of 0 to 3 was assigned to each tree and a descriptive note made of any health problems observed. The same scoring system was applied to weed cover (within 1 m of the tree stem) and for shade over the planted trees. Monitoring will be repeated, using the same methods at the end of the second rainy seasons, to calculate survival and relative growth rates and to detect any differences between the experimental treatment.

Figure 10 FORRU staff and volunteer do baseline and R1 monitoring

Post-planting baseline (BL)

Baseline monitoring revealed that 3 saplings had died between planting and July 19, due to rough handling or trampling during the planting process. For the 56 saplings not found during the baseline survey, they were assigned the status of "Not found but probably alive." The initial survey indicated a survival rate of 99.8%.

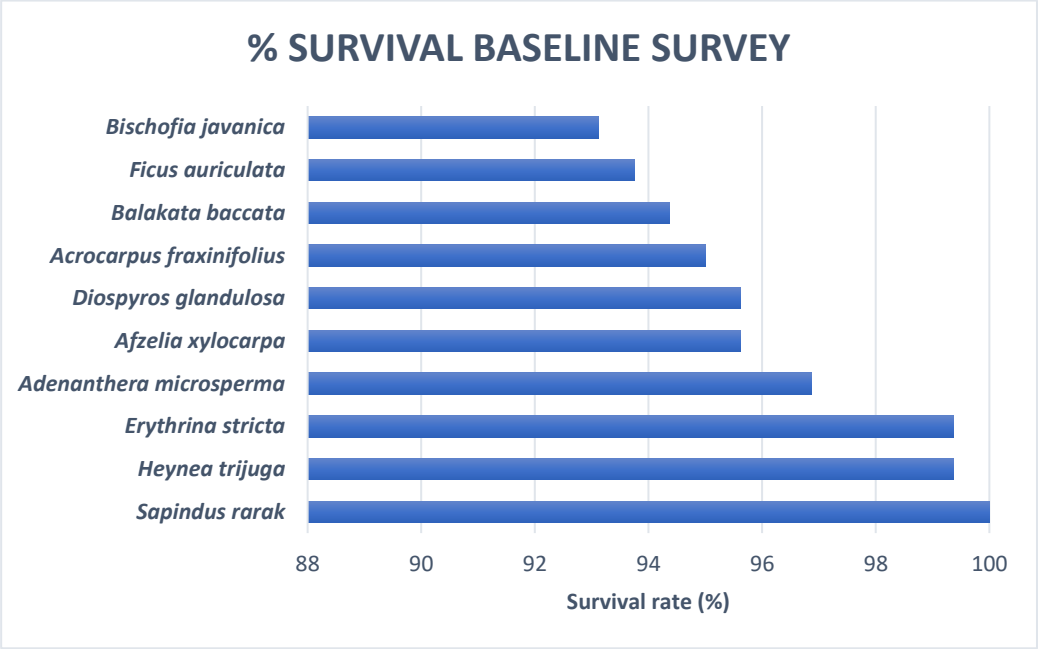


Figure 11 Species specific on survival between planting and baseline survey 19th July

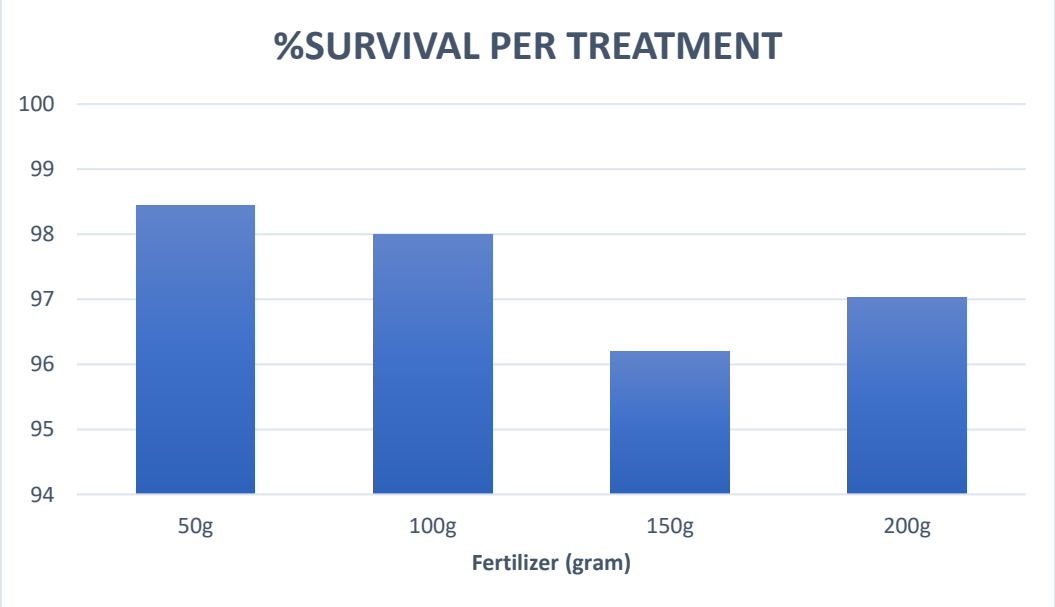


Figure 12 Treatment specific on survival rate between planting and baseline survey 19th July

1st rainy monitoring

Trees that were not found during the R1 survey were assigned as “not found probably alive”, if they had been recorded as alive during the baseline survey with a healthcare of 1.5 or higher, whereas those with a BL health score of lower than 1.5 were assigned as “not found probably dead”. These status assignments may be readjusted retrospectively according to the R2 survey results at the end of 2025.

The overall survival rate of planted trees was very similar across all species. A total of 1,206 trees were recorded as alive (or likely alive), with survival rates exceeding 80% for every species (Figure 14). Such high values are considered "excellent" compared to FORRU-CMU's previous experiments (Elliott et al., 2003). Focusing on fertilizer treatments (Figure 15), the 100-gram and 200-gram treatments achieved excellent survival rates of 81.4%, while the 50-gram treatment showed a moderate survival rate (less than 70%), demonstrating a significant difference between the 50-gram treatment and the others.

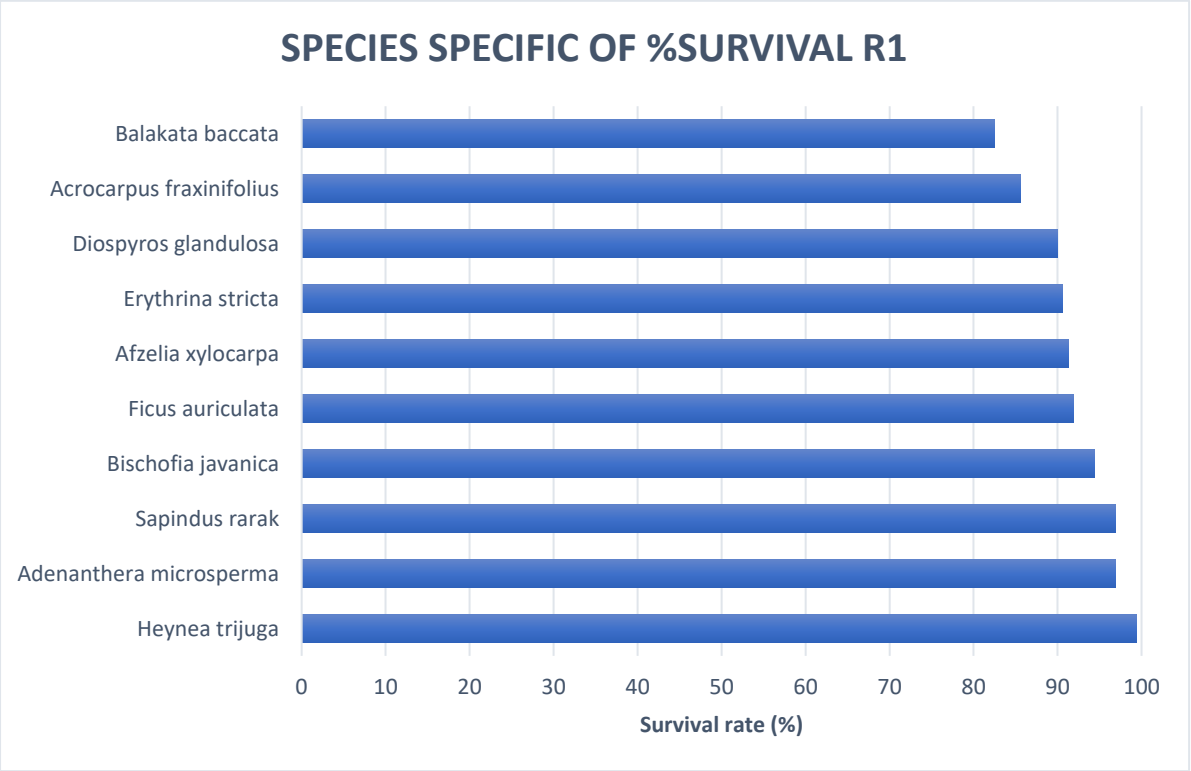


Figure 14 Species specific on survival between baseline and R1 survey 23rd November

The growth metric used was relative growth rate of root collar diameter (RGR-RCD). A value of 100%/y indicates an annual doubling in size and is considered excellent. Acceptable values are 50-100%/y, whilst values below 50% are considered poor growth. Negative values indicate that a species is dying out and is not suited to prevailing site conditions. Two species had excellent growth (*Erythrina stricta, Balakata baccata*) and the others 8 species had poor growth (<50%/y)(Figure 16). For all treatment were provide all acceptable values is higher than 70% (Figure 17).

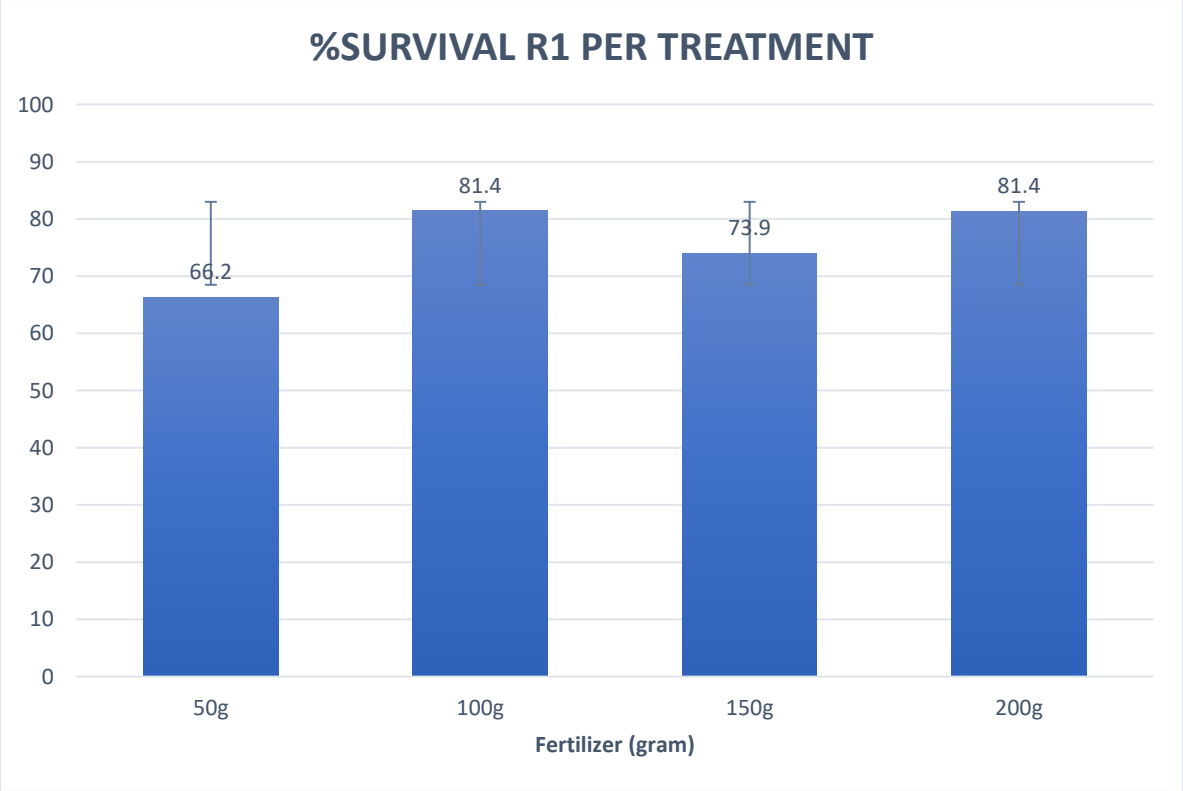


Figure 15 Treatment specific on survival rate between baseline and R1 survey 23rd November

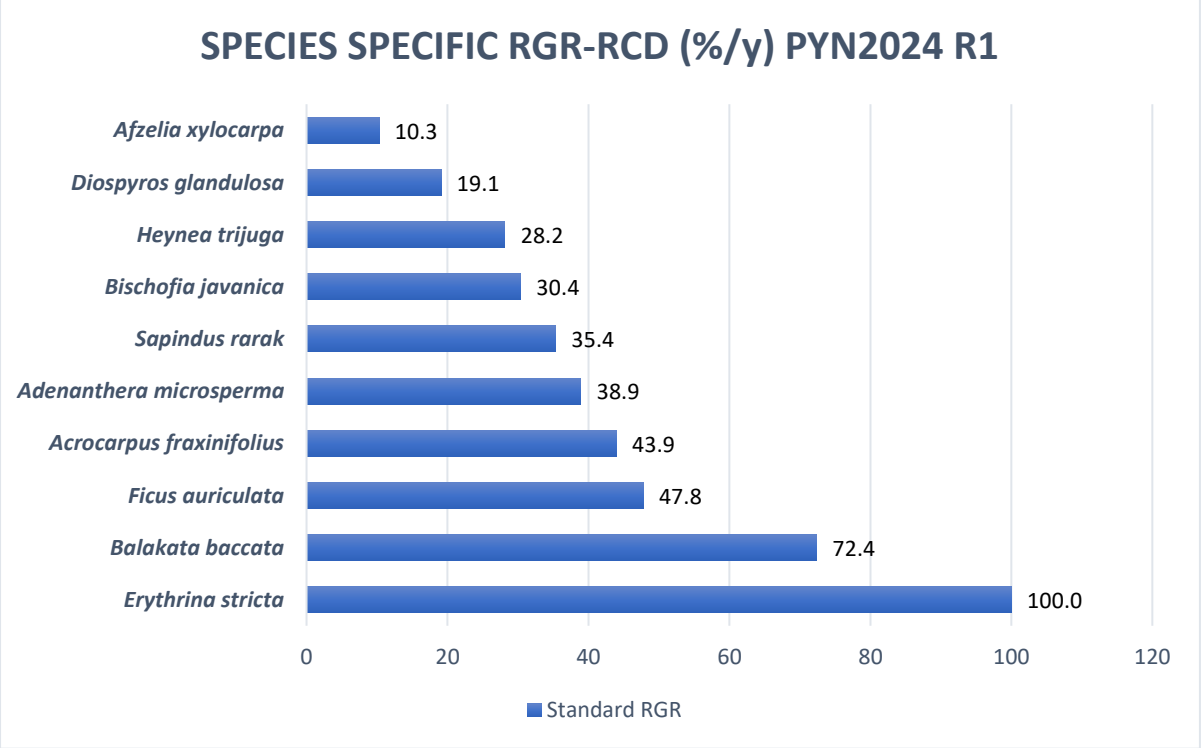


Figure 16 Species-Specific mean relative growth rates from planting to R1 survey 23rd November

A performance index was calculated by multiplying % survival and standardize RGR-RCD (converted to a scale of 0-100%) – giving equal weight to growth and survival. The raw performance score was converted to a percentage of the highest species score, to create a *relative* performance score, enabling fair comparisons among species.

Erythrina stricta performed exceptionally better than the other species. Species that achieved more than 50% was *Balakata baccata* and the others left 8 species have lower than 40% (Figure 18) as same as relative growth rates values. (Figure 16)

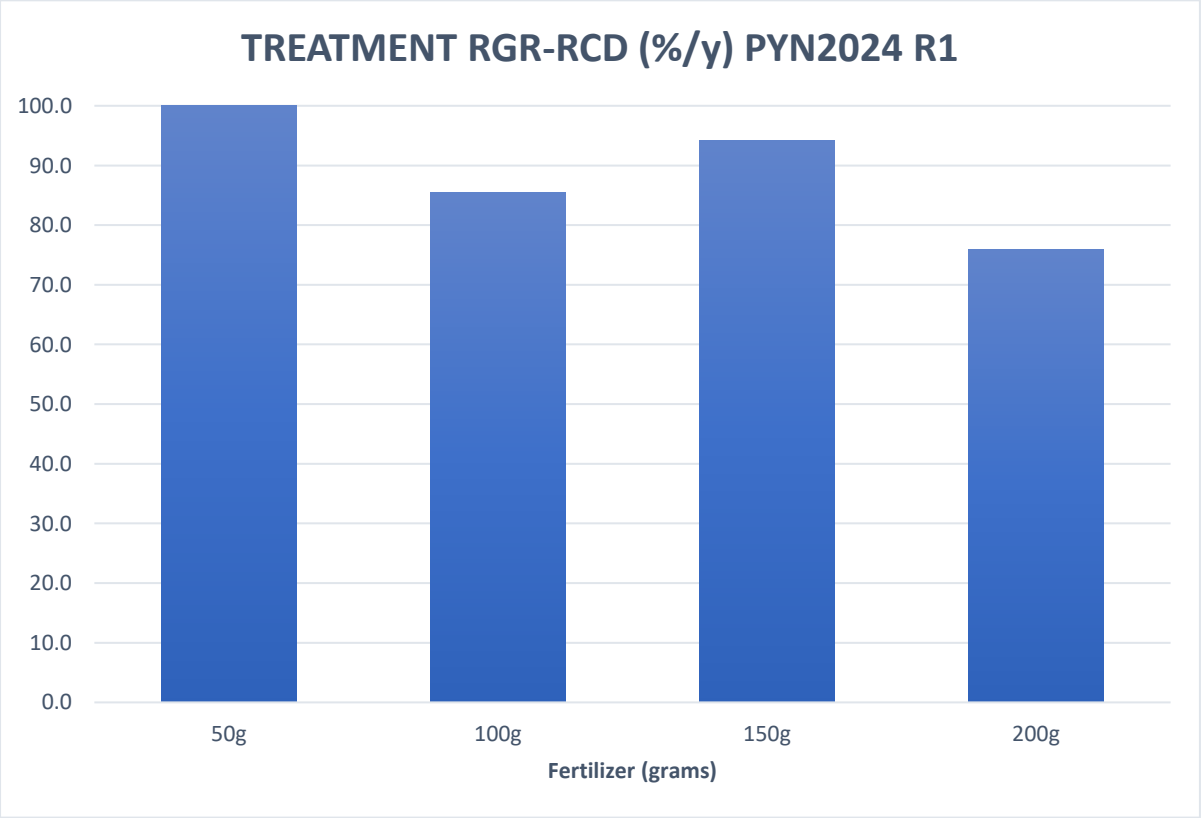


Figure 17 Treatment-specific mean relative growth rates from baseline to R1 survey 23rd November.

Most species performed better with 100 g and 150 g of fertilizer, achieving 99.9% and 100% performance, respectively (Figure 19). This may be attributed to changes in soil nutrient levels. In contrast, the 200 g fertilizer treatment resulted in a significantly lower performance, but it still exceeded 80% on the performance index.

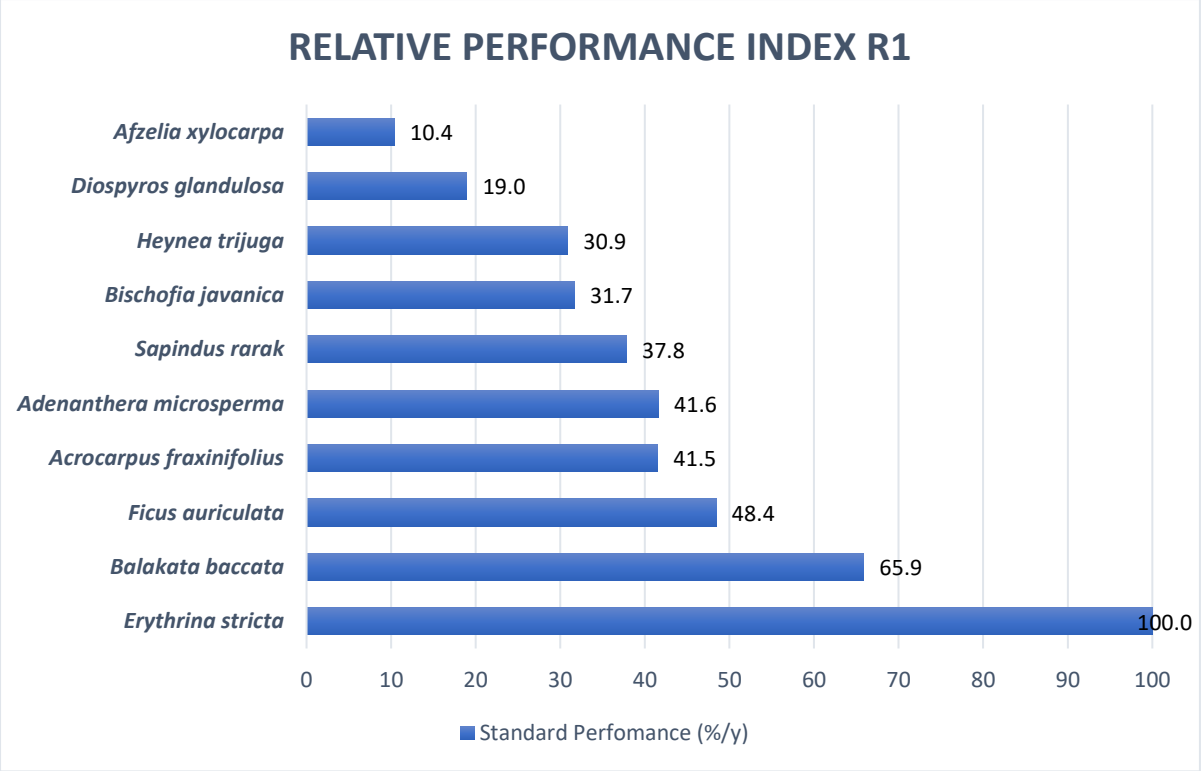


Figure 18 Specie-specific performance index between baseline to R1 survey 23rd November.

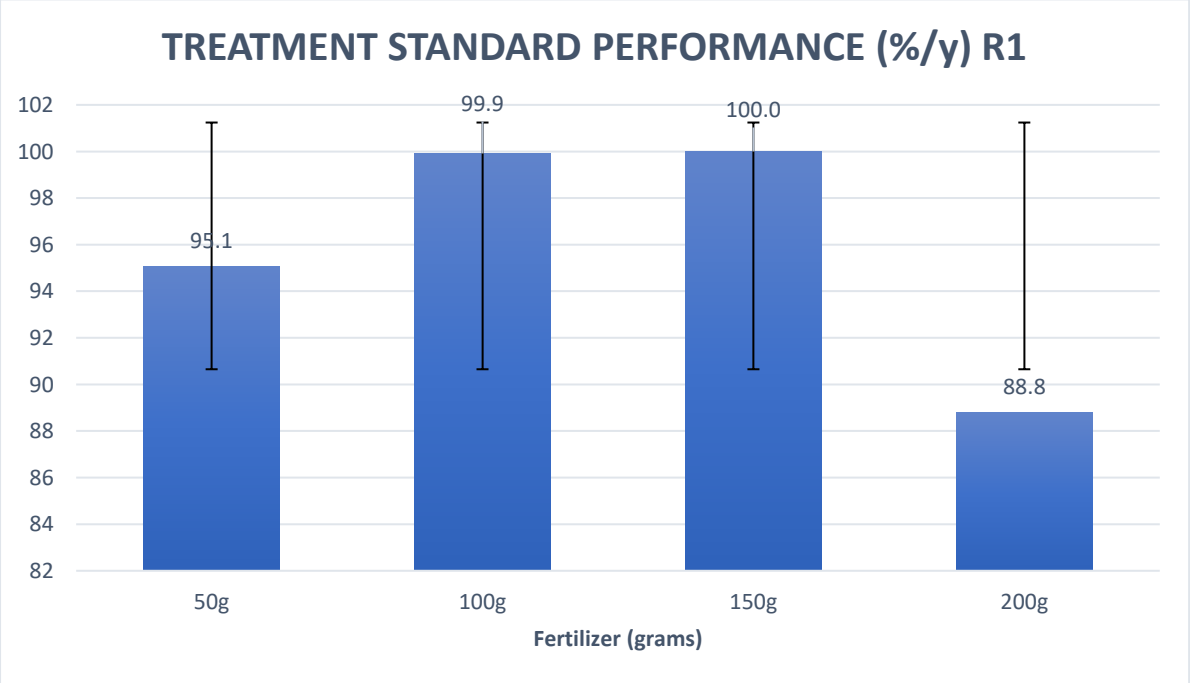


Figure 19 Treatment-specific mean relative growth rates from baseline to R1 survey 23rd November.

2nd rainy monitoring

Record data same as R1 monitoring that trees were not found during the R2 survey were assigned as “not found probably alive”, if they had been recorded as alive during the R1 survey with a healthcare of 1.5 or higher, whereas those with a R1 health score of lower than 1.5 were assigned as “not found probably dead”.

The overall survival rate of planted trees was difference across species. A total of 1,238 trees were recorded as alive (or likely alive), with survival rates 77%. More than half of all species exceed 80% (Figure 20) are considered "excellent" compared to FORRU-CMU's previous experiments (Elliott et al., 2003).

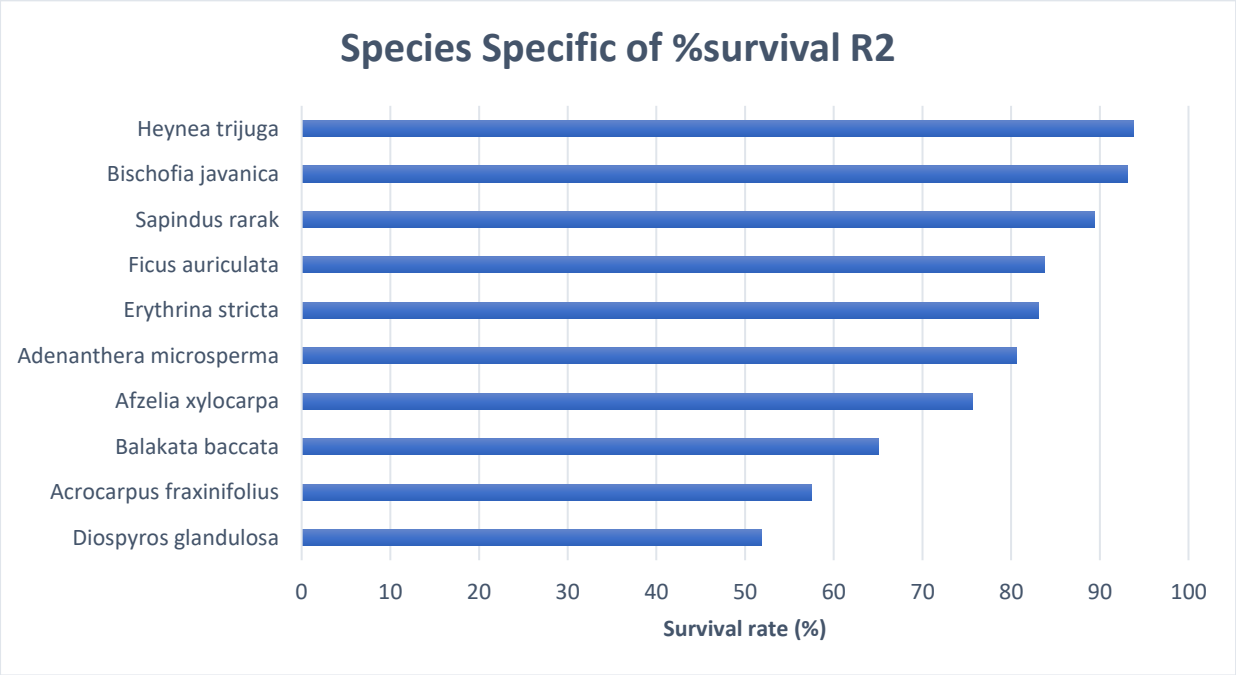


Figure 20 Species specific on survival between R1 and R2 survey.

On fertilizer treatments (Figure 21), the 150-gram achieved excellent survival rates of 81.4%, while the others 50, 100 and 200-gram treatment showed an acceptable survival rate (more than 70%), demonstrating a non-significant difference between treatment and blocks on survival rate.

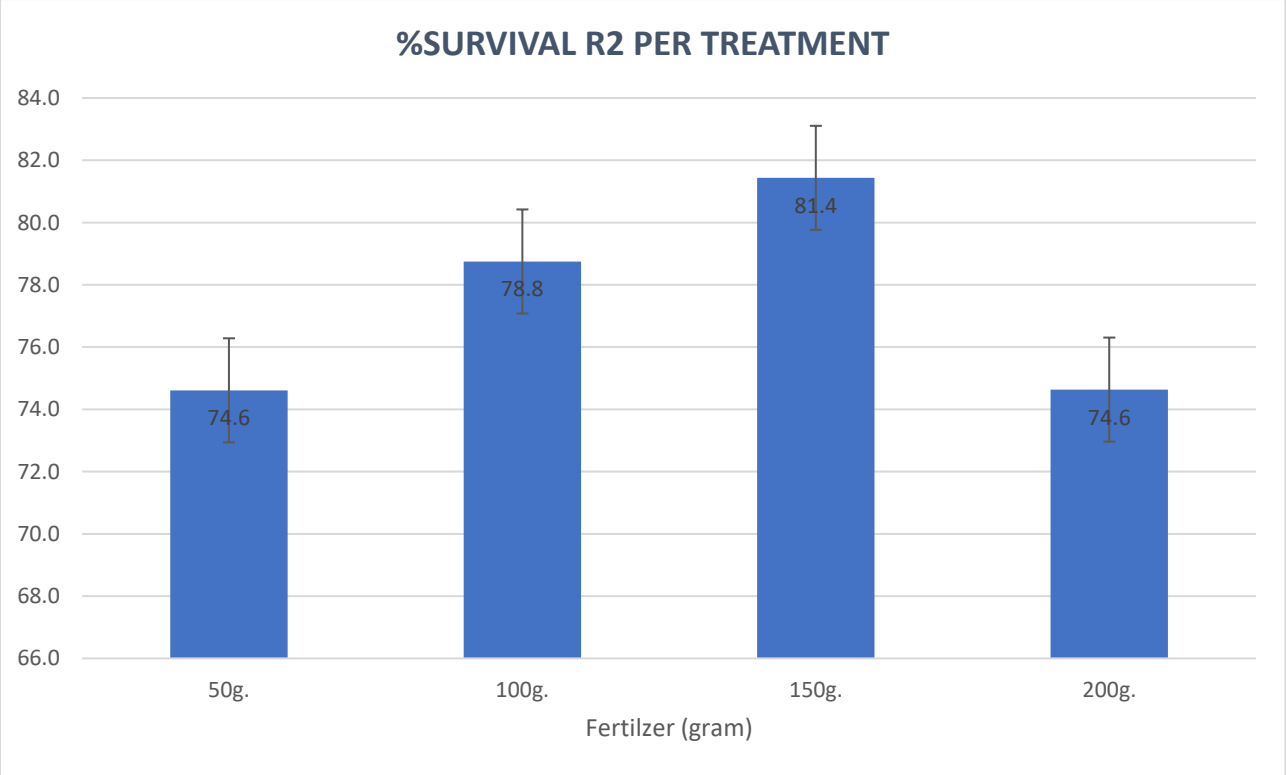


Figure 21 Treatment specific on survival rate between R1 and R2 survey.

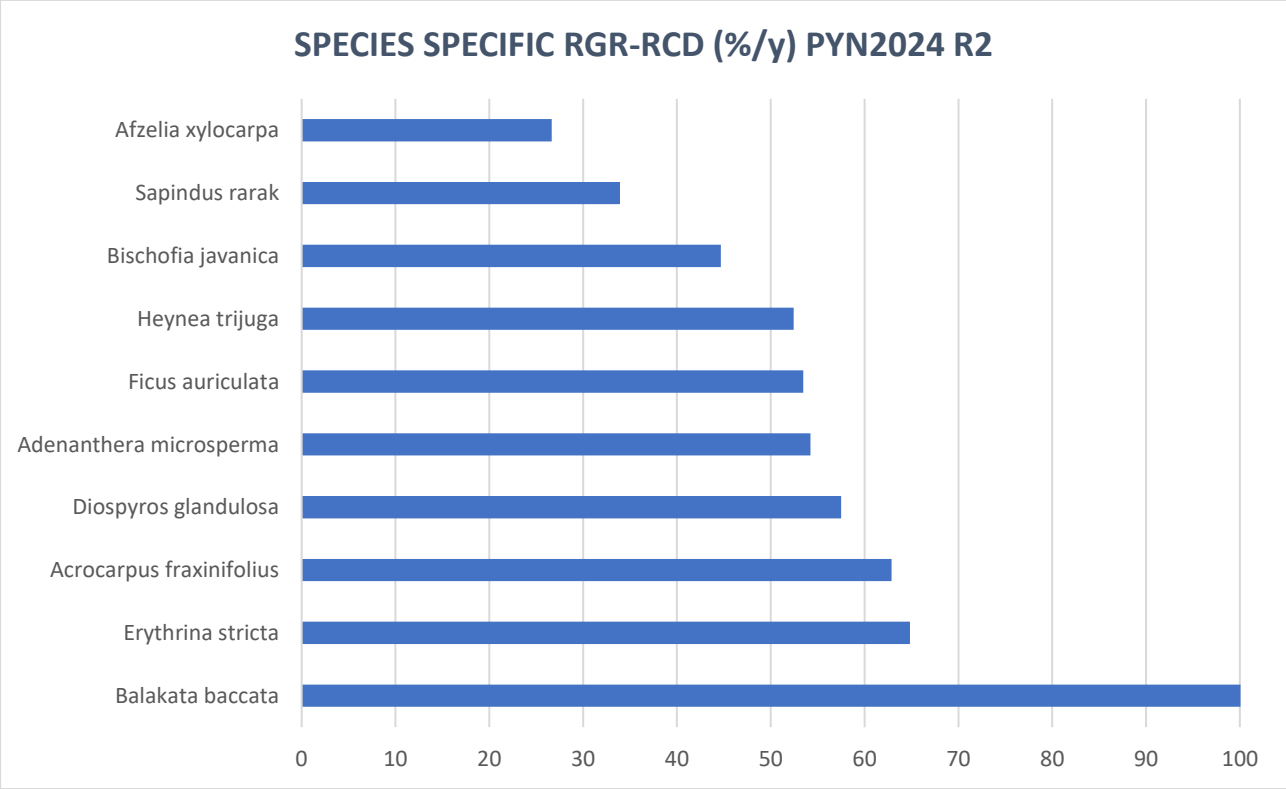


Figure 22 Species-Specific mean relative growth rates from planting to R1 survey 23rd November.

The growth metric used was relative growth rate of root collar diameter (RGR-RCD). A value of 100%/y indicates an annual doubling in size and is considered excellent. Acceptable values are 50-100%/y, whilst values below 50% are considered poor growth. *Erythrina stricta* had excellent growth and the others 3 species had poor growth (<50%/y)(Figure 22). For 50g, 150 g and 200g. treatment were providing all acceptable values is higher than 70% (Figure 23) only 100g treatment had lower than 70%.

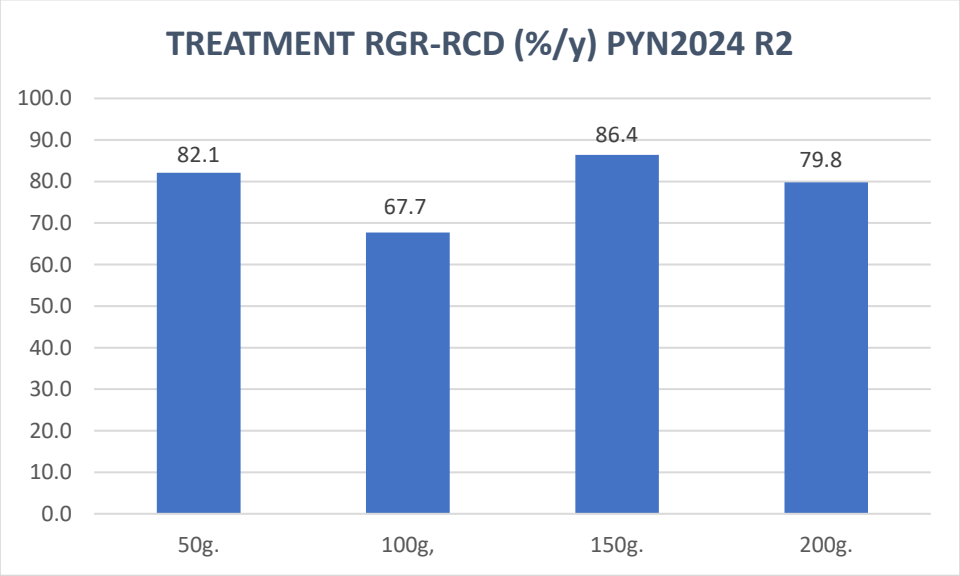


Figure 23 - Treatment-specific mean relative growth rates from R1 to R2 survey.

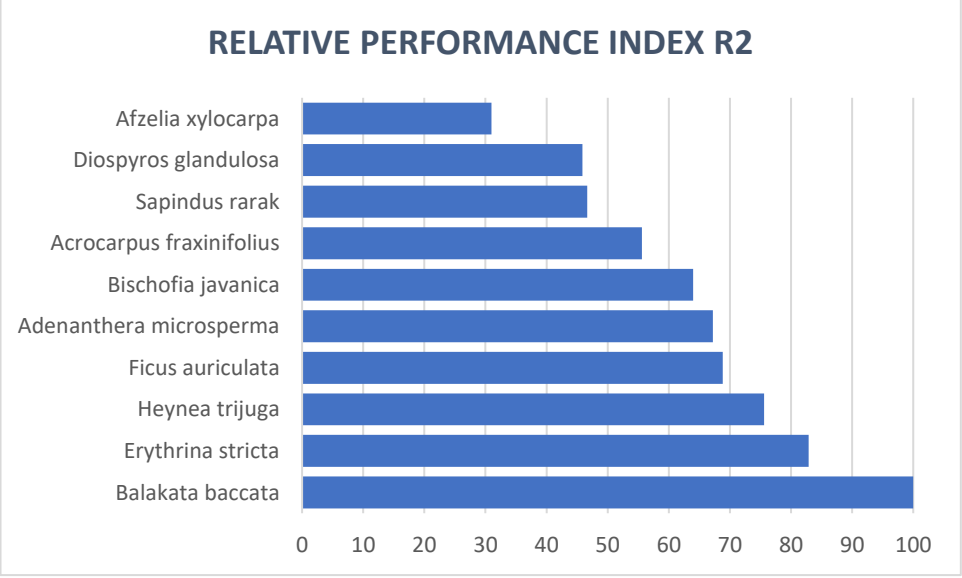


Figure 24 - Specie-specific performance index between R1 to R2 survey.

A performance index was calculated by multiplying % survival and standardize RGR-RCD (converted to a scale of 0-100%) – giving equal weight to growth and survival. The

raw performance score was converted to a percentage of the highest species score, to create a *relative* performance score, enabling fair comparisons among species.

Erythrina stricta performed exceptionally better than the other species. Species that achieved more than 50% had 7 species and Afzelia xylocarpa lower than 40% (Figure 24).

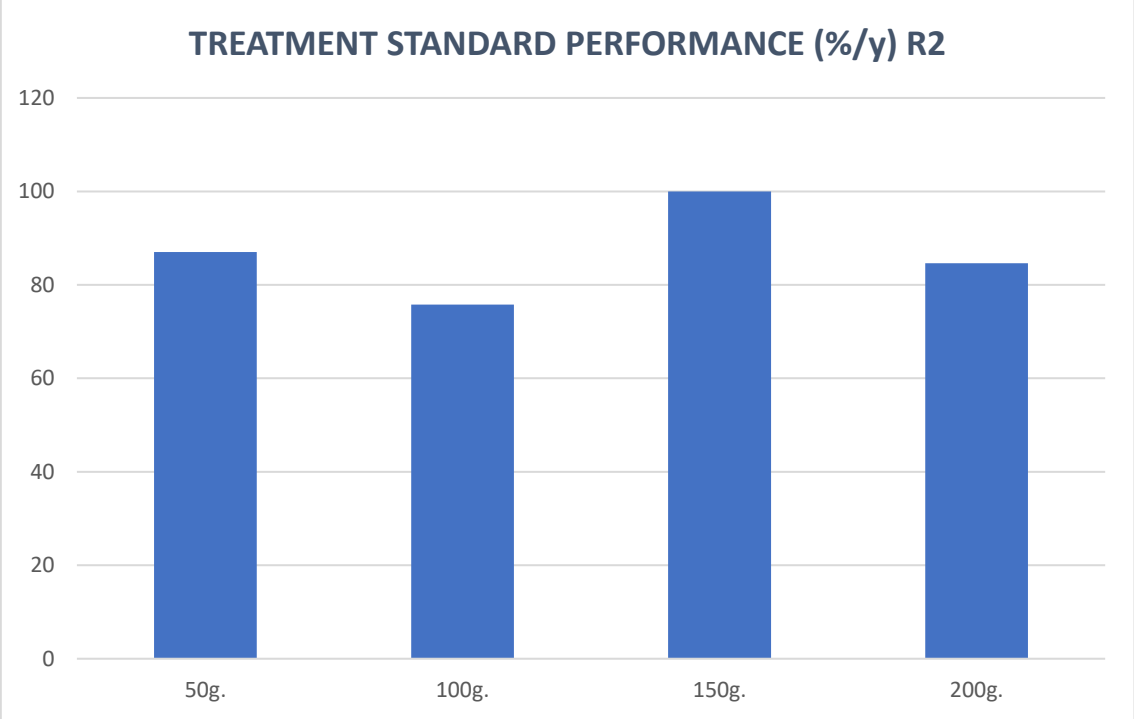


Figure 25 - Treatment-specific mean relative growth rates from R1 to R2.

Most species performed with 150g of fertilizer, achieving 100% performance, (Figure 25). This may be attributed to changes in soil nutrient levels. In contrast, the 100 g fertilizer treatment resulted in a significantly lower performance, but it still acceptable exceeded 70% on the performance index.

Conclusion

Experimental results identified *Erythrina stricta* and *Balakata baccata* as the highest-performing species in terms of growth and survival. Furthermore, the fertilizer trials demonstrated that application rates of 150 g produced the most effective growth results, while the 100 g treatment was found to be insufficient for optimal biodiversity recovery.

10 . Aerial Monitoring

The site will also be monitored by drone, enabling ortho maps (such as the one presented in Figure 3) and 3D models of the forest to be constructed, to provide an overview of recovery and detect spatial variation.

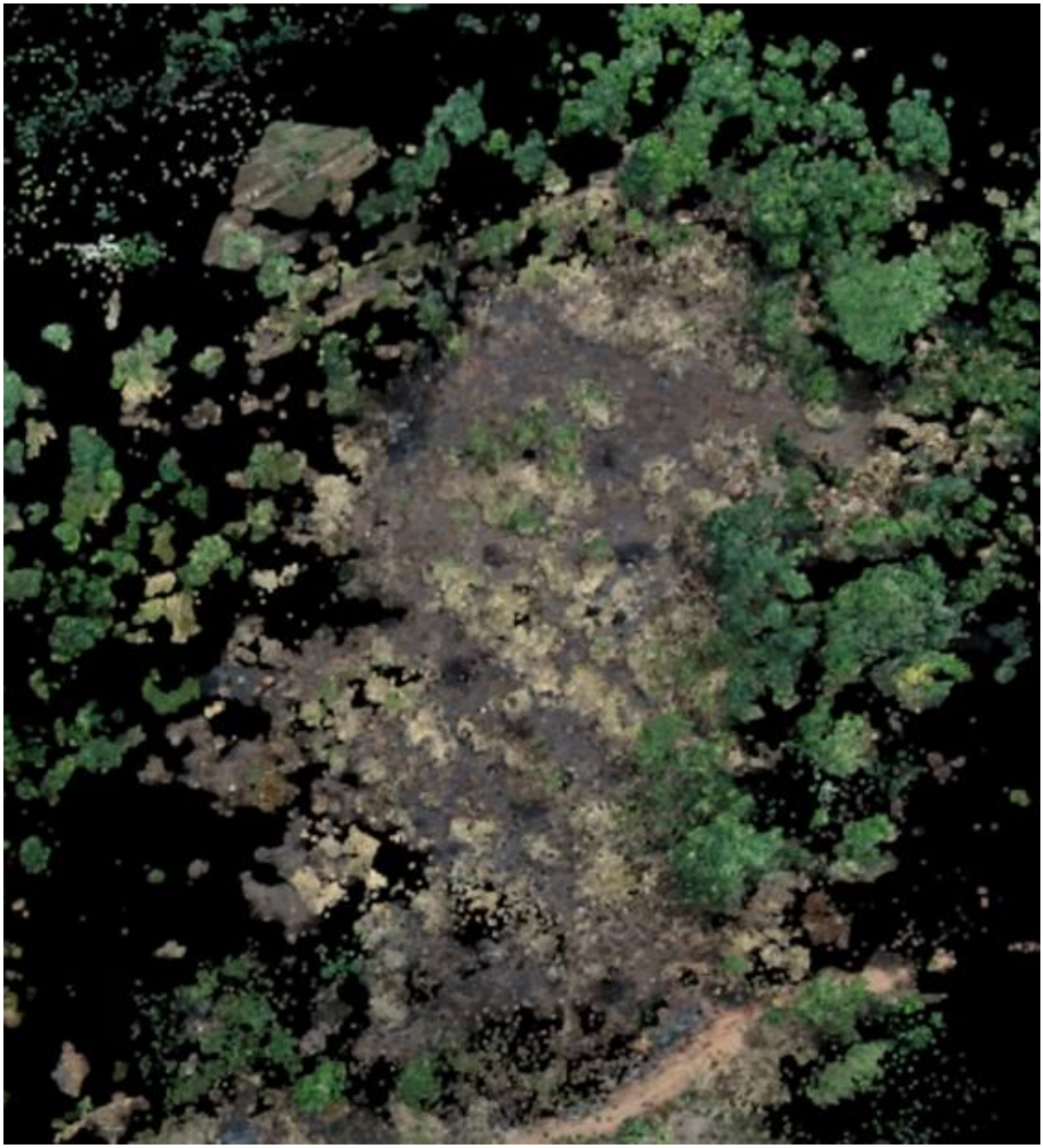


Figure 5 3D models from drone surveys of the site after planting.

References

Maxwell, J. F. & S. Elliott, 2001. Vegetation and Vascular Flora of Doi Sutep–Pui National Park, Chiang Mai Province, Thailand. Thai Studies in Biodiversity 5. Biodiversity Research & Training Programme, Bangkok. 205 pp.

Appendix 1 – Schedule of Tasks

May 10, 2024	Rapid site assessment and drone survey	FORRU
May 16 2024	Planting planning meeting – species selection	FORRU
June 13, 2024	Site preparation before planting (mowing and handling wood chips) – demarcate experimental plots	FORRU and GIVE volunteers
June 17, 2024	Tagging each sapling used in restorative planting	FORRU and volunteers
June 22, 2024	Site preparation (weeding, removing big wood).	FORRU and Villager
June 26, 2024	Site preparation (settle bamboo stake and digging planting holes)	FORRU and Volunteer
June 28, 2024	Transfer saplings, equipment to the 1st planting area and settle and distribute sapling to each hole	FORRU
June 29, 2024	Transfer fertilizer to planting site Planting Day 1 Area 4 Rai	FORRU and everyone
July 9,2024	Site preparation (Bamboo poling to the 2nd planting area)	FORRU
July 11,2024	Site preparation (digging planting hole) and 1 rai planting	Villagers, FORRU, and SIG company
July 12,2024	Transfer saplings, equipment to the 1st planting area and settle and distribute sapling to each hole	FORRU and Volunteers
July 13, 2024	Planting Day 2 Area 3.4 Rai	FORRU and everyone
July 19, 2024	Baseline Monitoring in experimental plots	FORRU and volunteers.
July 29, 2024	1st Site Maintenance	FORRU and volunteers.
September 5, 2024	2nd Site Maintenance	FORRU and volunteers.
October 16, 2024	3rd Site Maintenance	FORRU and volunteers.
November 23, 2024	The end of 1st rainy season monitoring	FORRU and volunteers.
January 31, 2025	Report for the end of 1st Rainy season	FORRU
February 12-13, 2025	Fire Prevention	FORRU and YFR school
June 15, 2025	4th Site Maintenance	FORRU and volunteers.
August 1, 2025	5th Site Maintenance	FORRU and volunteers.
October 4, 2025	6th Site Maintenance	FORRU and volunteers.
November 17, 2025	The end of 2nd rainy season monitoring	FORRU and volunteers.
December 2025	Report for the end of 2nd Rainy season	FORRU

Appendix 2

Rapid site assessment

RAPID SITE ASSESSMENT									
Site: PYN 2024						Recorder: Bee		Date: 2024 May, 10th	
Circle	**Latitude (N)**	**Longitude (E)**	**Livestock signs**	**Fire signs**	**Weeds - %cover/mean height/ ± tree saplings**	**No. trees >50 cm tall (<30 cm gbh)**	**No. live tree stumps**	**No. trees>30 cm gbh**	**"Total No. regenerants"**
1	18.891810	98.846280	Not found	Found	0% cover	0	0	0	0
2	18.891340	89.842167	Not found	Found	5% cover, 0.20 m.	1	1	10	12
3	18.891935	98.842143	Found	Found	10% cover, 0.5 m.	4	0	1	5
4	18.892440	98.841975	Not found	Found	0% cover	6	0	0	6
5	18.892733	98.841963	Not found	Found	5% cover, 0.20 m.	1	0	0	1
6	18.892806	98.842428	Not found	Found	0% cover	0	0	0	0
7	18.892129	98.842434	Not found	Found	0% cover	0	0	2	2
8	18.891874	98.842423	Not found	Found	20% cover	4	0	0	4
9	18.892281	98.842258	Not found	Found	0% cover	0	0	3	3
10	18.891771	98.842875	Not found	Found	0% cover	0	0	6	6
					TOTALS	16	1	22	39
"Site description Deforested then reclaimed by the park . Not too slope, mostly burnt, bamboo dominant."							(= total/10)	Mean	3.9
							(= mean x 1,600/78.5)	"Average /Rai"	79.5
							95% c.l.		2.9
							จำนวนที่ต้องปลูก/ไร่(500-Average/Rai)		421

Appendix 3

Photo monitoring


PYN 3 N
PYN 3 W


PYN 3 S
PYN 3 E


PYN 4 S
PYN 4 W


PYN 4 E
PYN 4 N


E PYN 5
N PYN 5
W PYN 5
S PYN 5
W PYN 6
S PYN 6
N PYN 6
E PYN 6


E PYN 7
S PYN 7
N PYN 7
W PYN 7


E PYN 8
W PYN 8
N PYN 8
S PYN 8


S
PYN
9


E
PYN
9


N
PYN
9


W
PYN
9


S
10
PYN

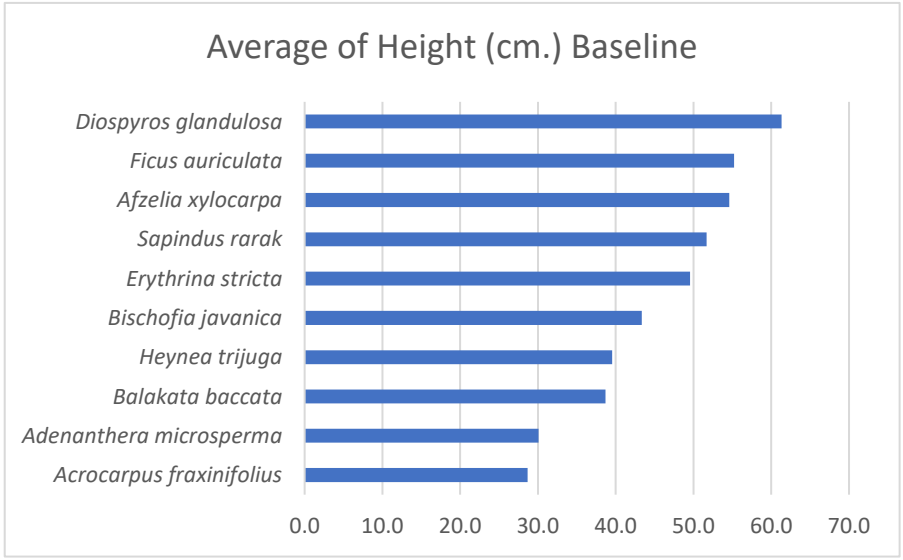

E
10
PYN

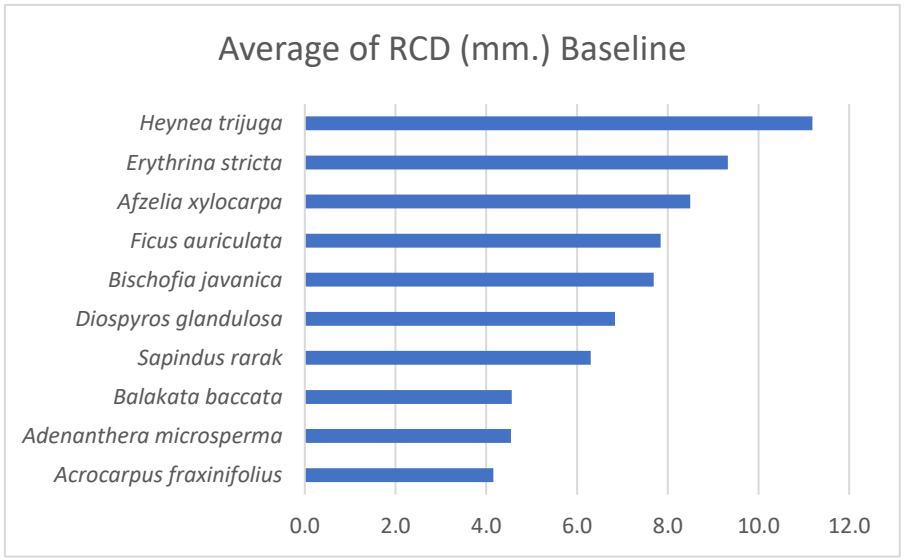

N
10
PYN

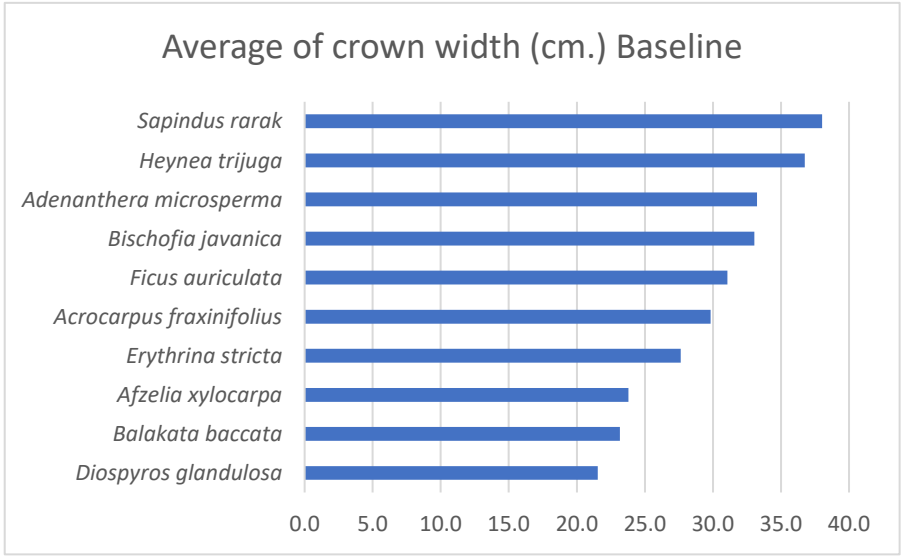
Appendix 4

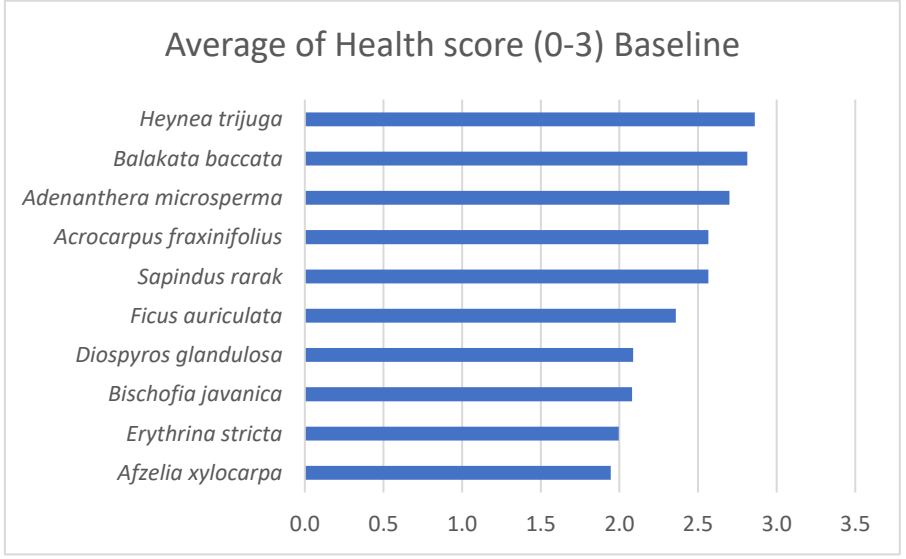
Tree monitoring

BASELINE SURVEY DATA

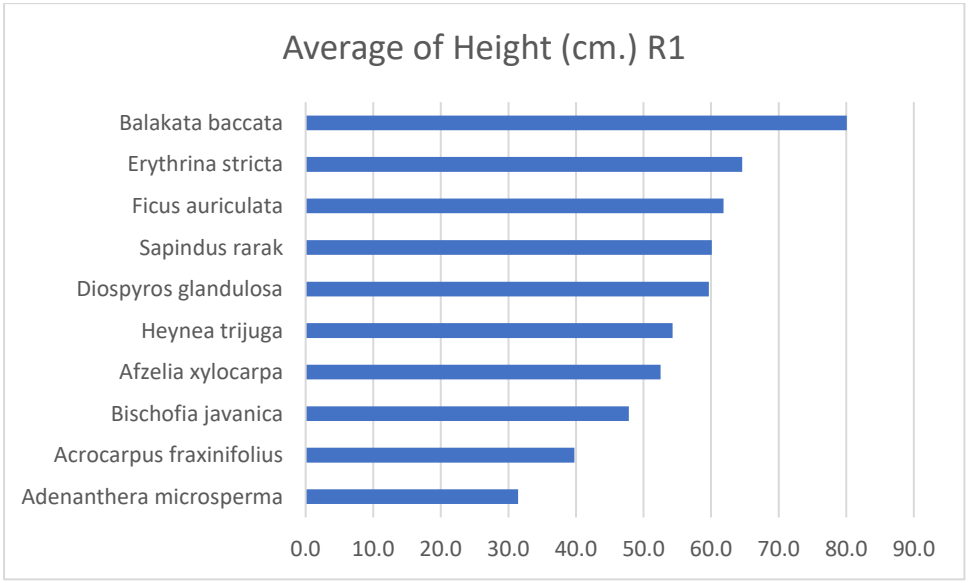


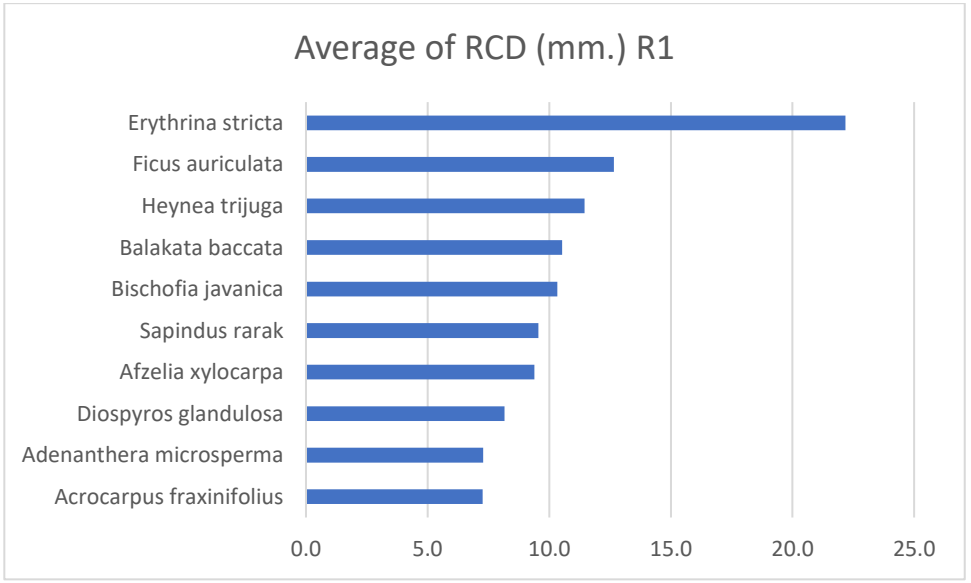


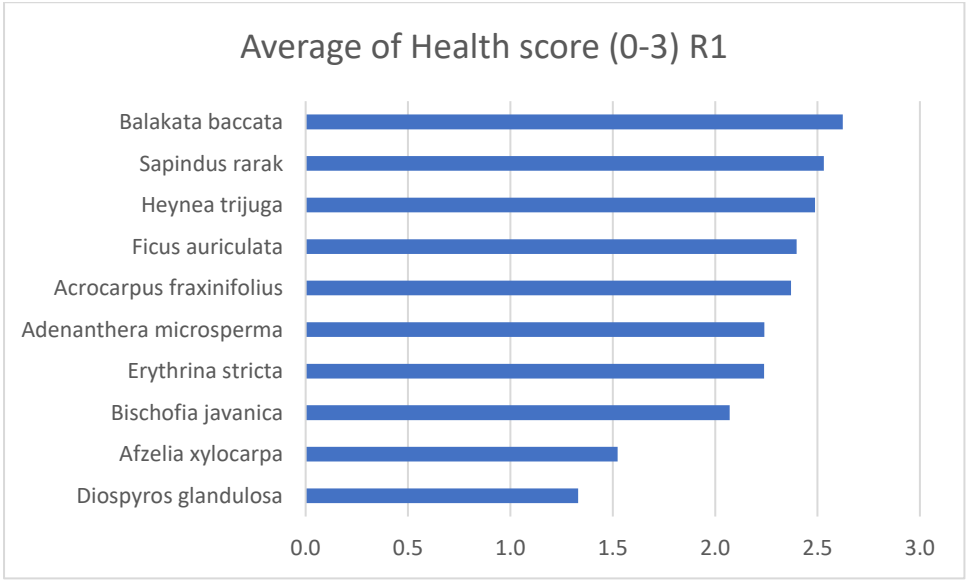


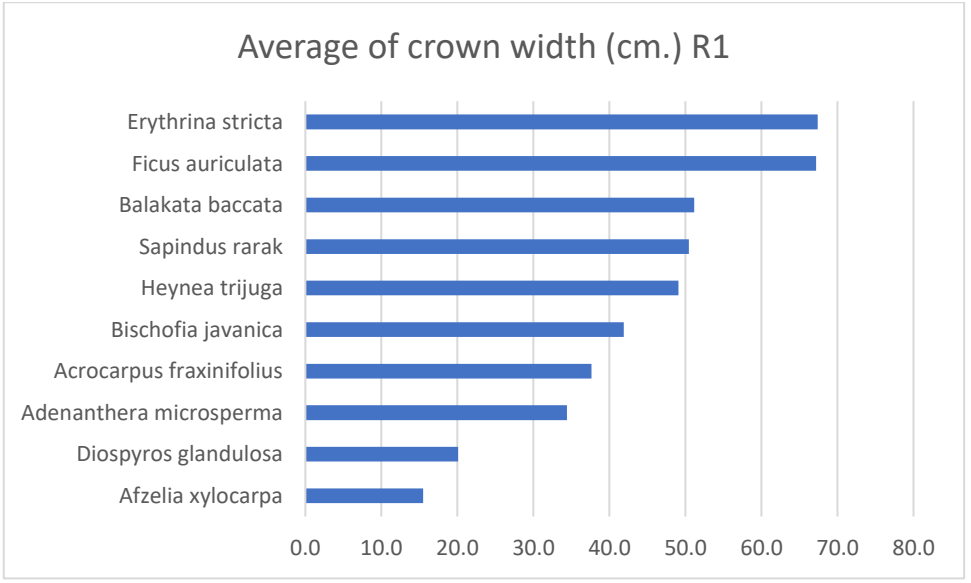


R1 SURVEY DATA









R2 SURVEY DATA