

DISCOVER THE FUTURE OF GANODERMA CARE

STREPTOMYCES BIOCONTROL:
NATURE'S SELF DEFENCE
AGAINST GANODERMA.



PASCAL
BIOTECH

COMPANY BACKGROUND



WHO WE ARE

A pioneering biotech firm focused on research-driven solutions that promote sustainability and resilience in agriculture



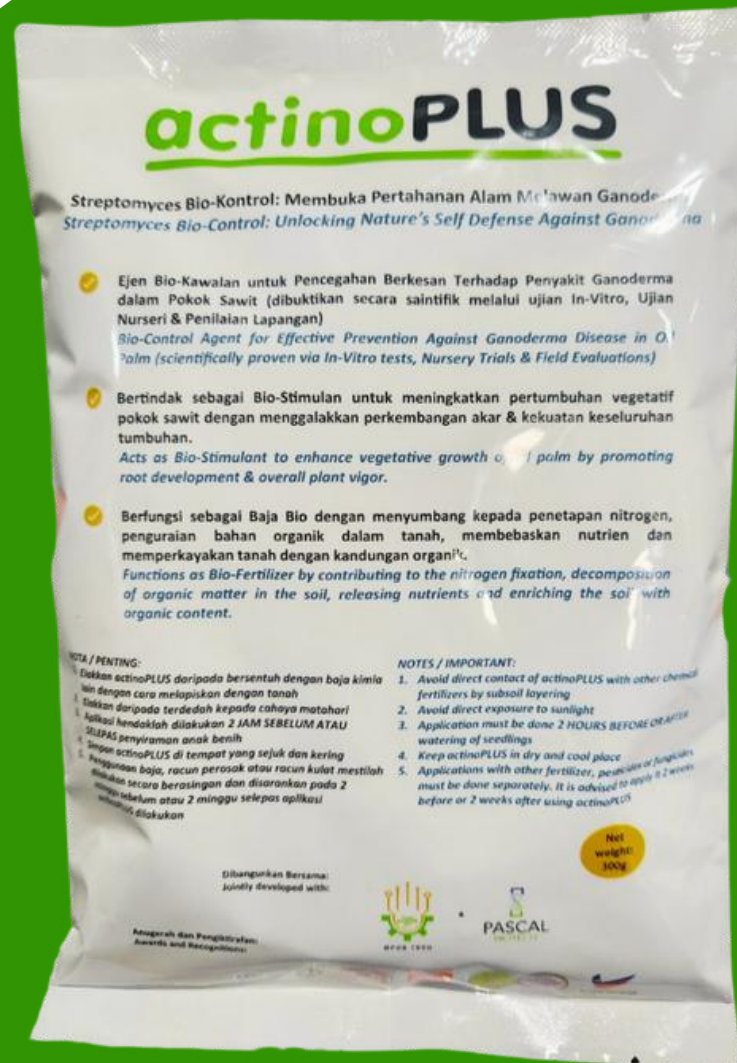
OUR MISSION

To be a global leader in sustainable agriculture, transforming the way crops are protected through innovative biological solutions.



OUR APPROACH

Driven by science and guided by sustainability, our solutions are built on cutting-edge research and a strong belief in environmental stewardship



PRODUCT INTRODUCTION: ACTINO PLUS

actinoPLUS

Streptomyces Bio-Kontrol: Membuka Pertahanan Alam Melawan Ganoderma
Streptomyces Bio-Control: Unlocking Nature's Self Defense Against Ganoderma

- ✓ Ejen Bio-Kawalan untuk Pencegahan Berkesan Terhadap Penyakit Ganoderma dalam Pokok Sawit (dibuktikan secara saintifik melalui ujian In-Vitro, Ujian Nursery & Penilaian Lapangan)
Bio-Control Agent for Effective Prevention Against Ganoderma Disease in Oil Palm (scientifically proven via In-Vitro tests, Nursery Trials & Field Evaluations)
- ✓ Bertindak sebagai Bio-Stimulan untuk meningkatkan pertumbuhan vegetatif pokok sawit dengan menggalakkan perkembangan akar & kekuatan keseluruhan tumbuhan.
Acts as Bio-Stimulant to enhance vegetative growth of oil palm by promoting root development & overall plant vigor.
- ✓ Berfungsi sebagai Baja Bio dengan menyumbang kepada penetapan nitrogen, penguraian bahan organik dalam tanah, membebaskan nutrien dan memperkayakan tanah dengan kandungan organik.
Functions as Bio-Fertilizer by contributing to the nitrogen fixation, decomposition of organic matter in the soil, releasing nutrients and enriching the soil with organic content.

NOTA / PENTING:

1. Elakkan actinoPLUS daripada bersentuh dengan baja kimia lain dengan cara melapiskan dengan tanah
2. Elakkan daripada terdedah kepada cahaya matahari
3. Aplikasi hendaklah dilakukan 2 JAM SEBELUM ATAU SELEPAS penyiraman anak benih
4. Simpan actinoPLUS di tempat yang sejuk dan kering
5. Penggunaan baja, racun perosak atau racun kulat mestilah dilakukan secara berasingan dan disarankan pada 2 minggu sebelum atau 2 minggu selepas aplikasi actinoPLUS dilakukan

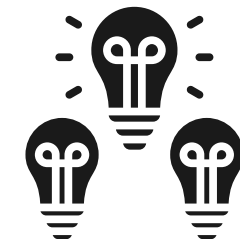
NOTES / IMPORTANT:

1. Avoid direct contact of actinoPLUS with other chemical fertilizers by subsoil layering
2. Avoid direct exposure to sunlight
3. Application must be done 2 HOURS BEFORE OR AFTER watering of seedlings
4. Keep actinoPLUS in dry and cool place
5. Applications with other fertilizer, pesticides or fungicides must be done separately. It is advised to apply it 2 weeks before or 2 weeks after using actinoPLUS

Dibangunkan Bersama:
Jointly developed with:

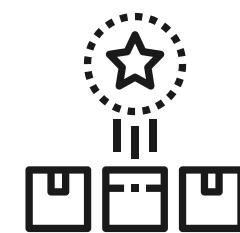


Anugerah dan Pengiktirafan:
Awards and Recognitions:



Contains Streptomyces

a naturally occurring soil bacteria which acts as an antagonist against Ganoderma

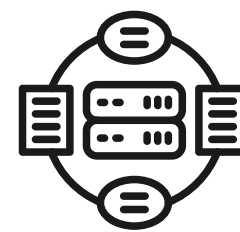


Functions

Bio-Control

Bio Fertilizer

Bio Stimulant



Product Composition

300 Grams per Sachet

Using Vermiculite as a carrier

Granular Form

PRODUCT BACKGROUND

COLLABORATORS



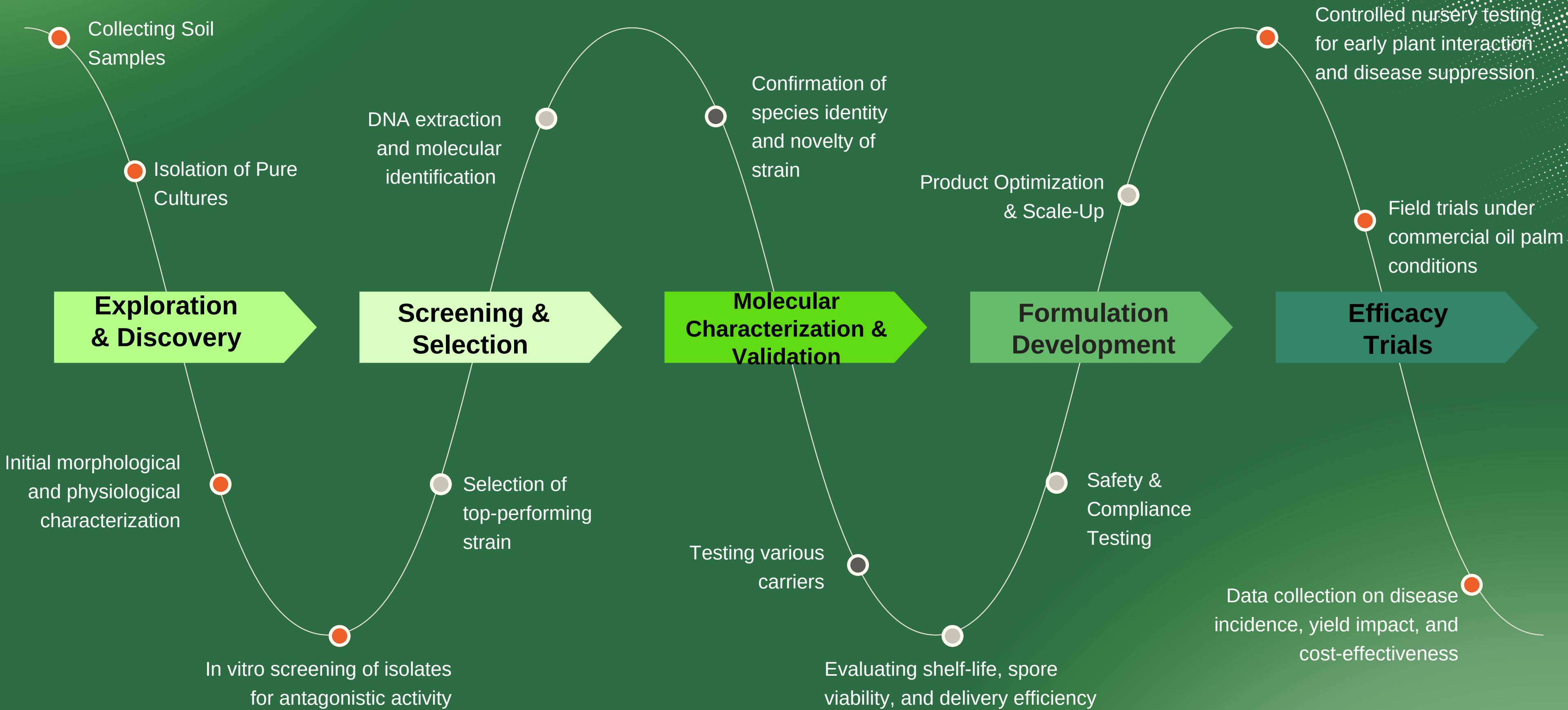
GRANTS



RECOGNITIONS



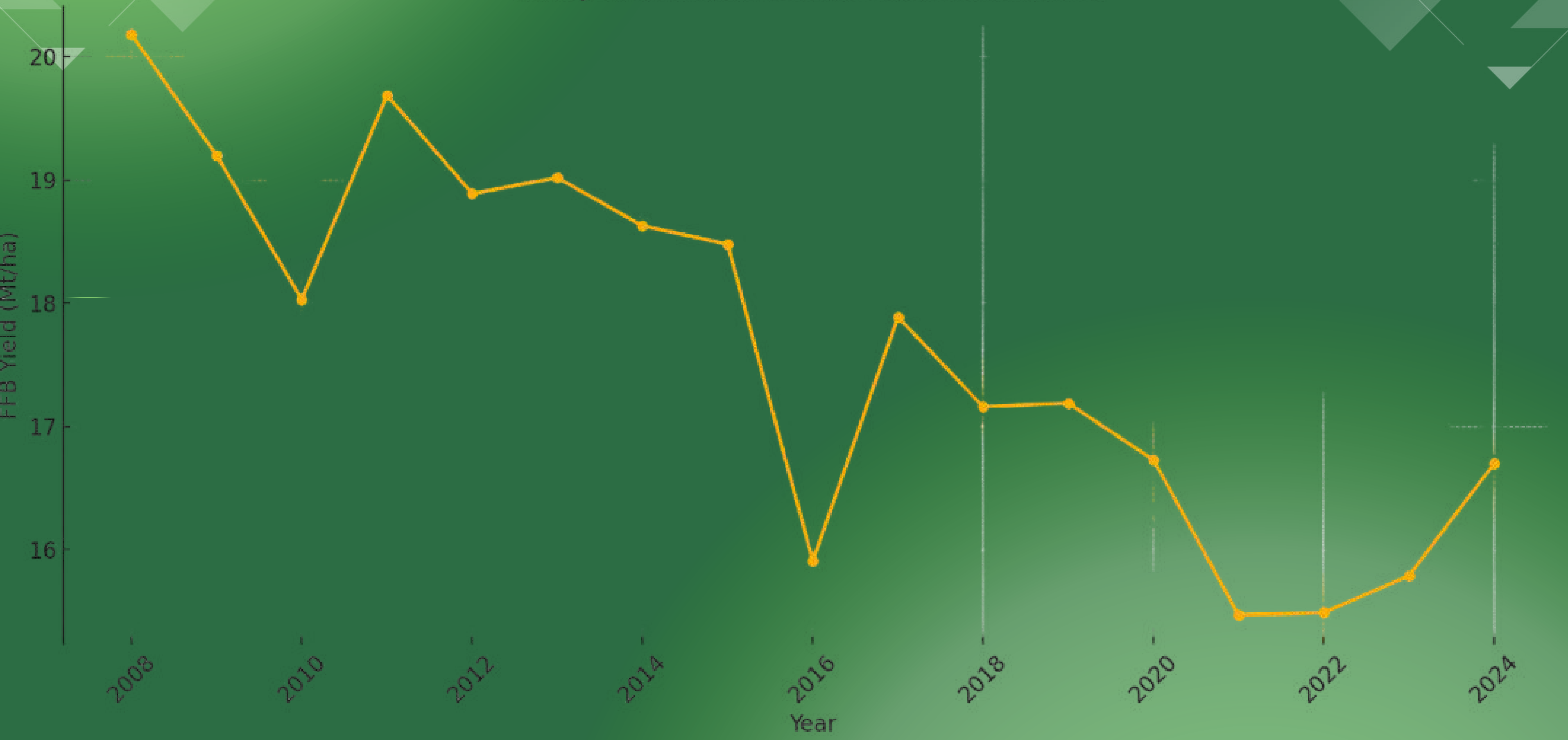
PRODUCT DEVELOPMENT





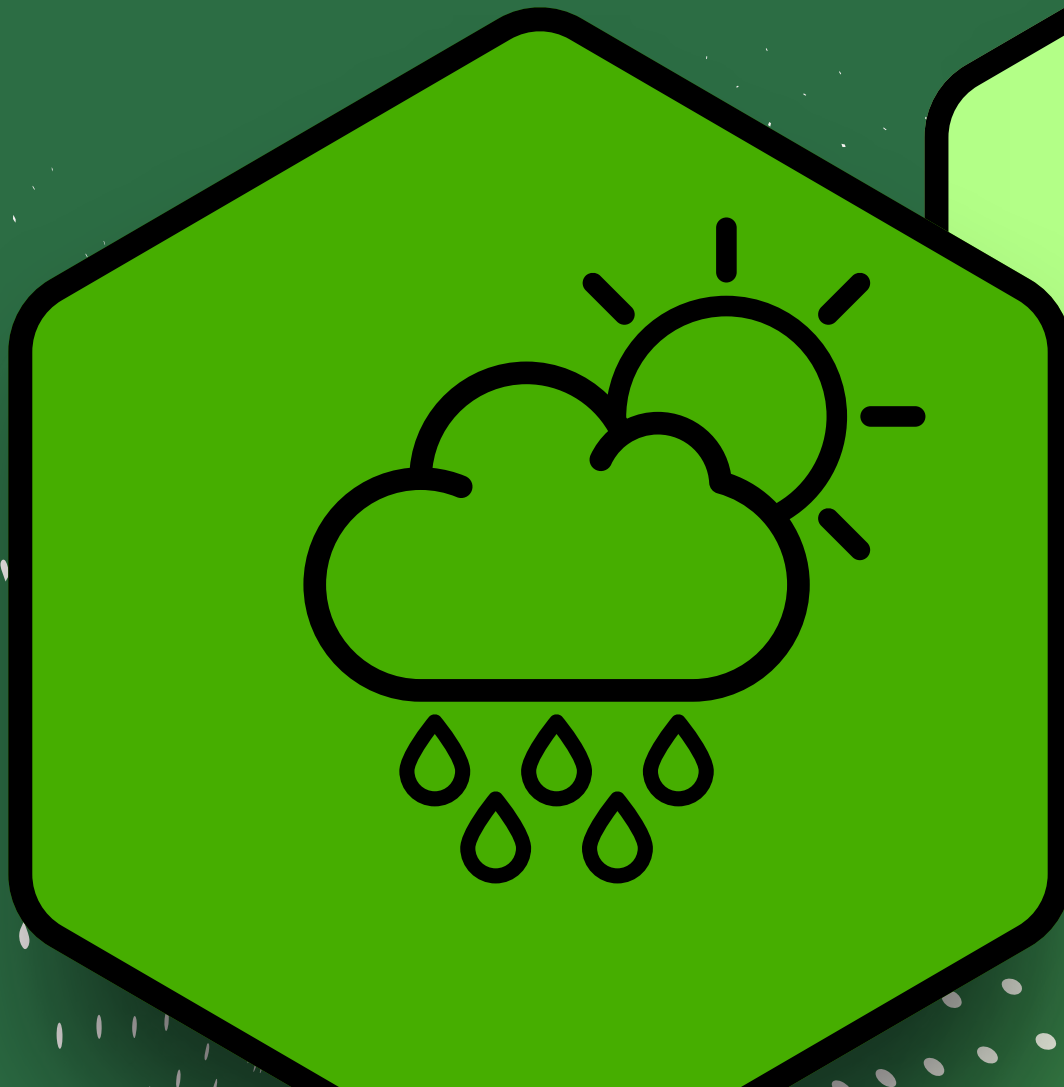
MALAYSIA'S DECLINING YIELD TREND

Malaysia Annual FFB Yield Trend (2008-2024)



Common Yield Decline Factors

Weather



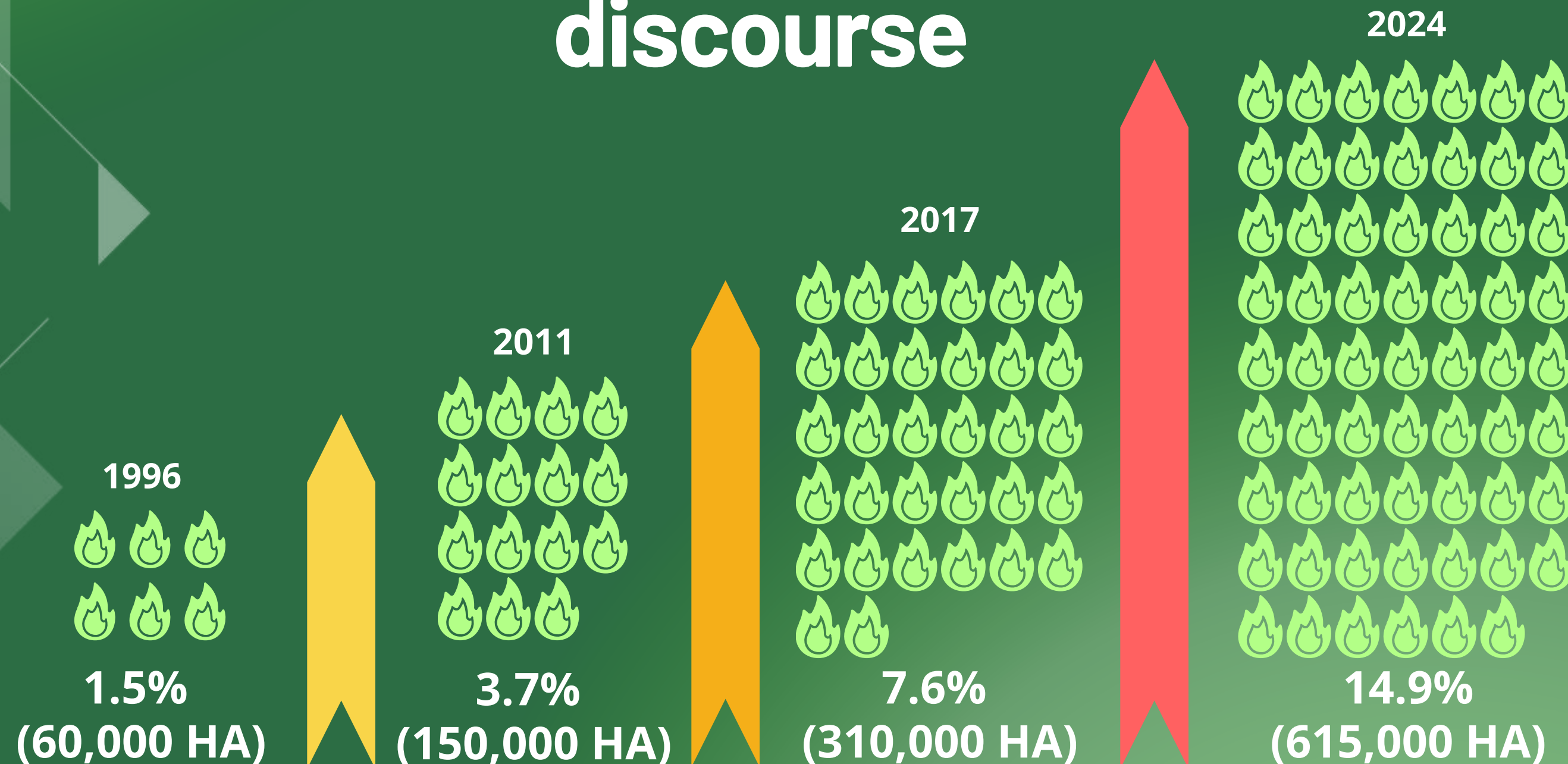
Labor Shortage



Aging Plantation

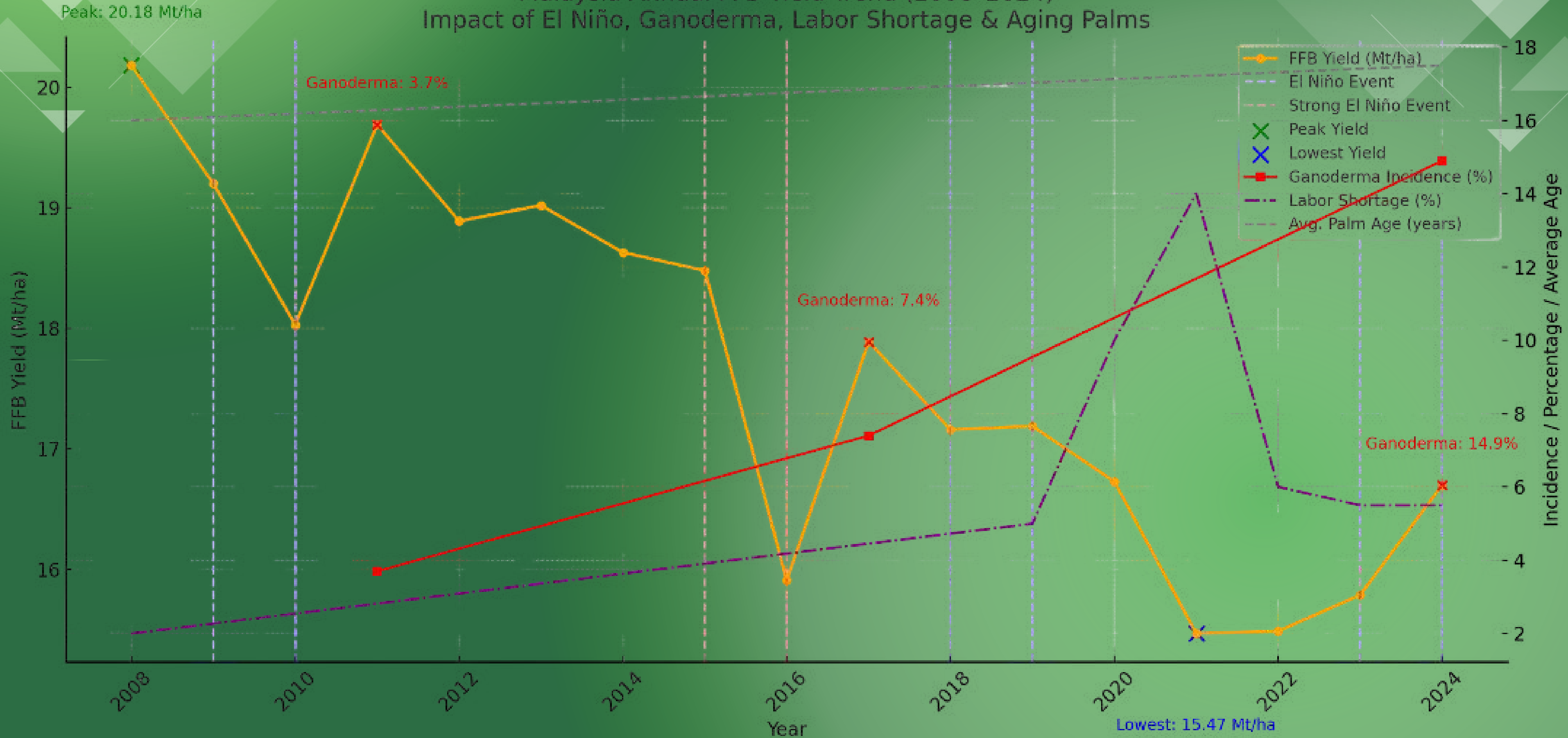


However, there's a critical **fourth dimension** that is increasingly exerting silent pressure on productivity – yet remains underrepresented in strategic discourse

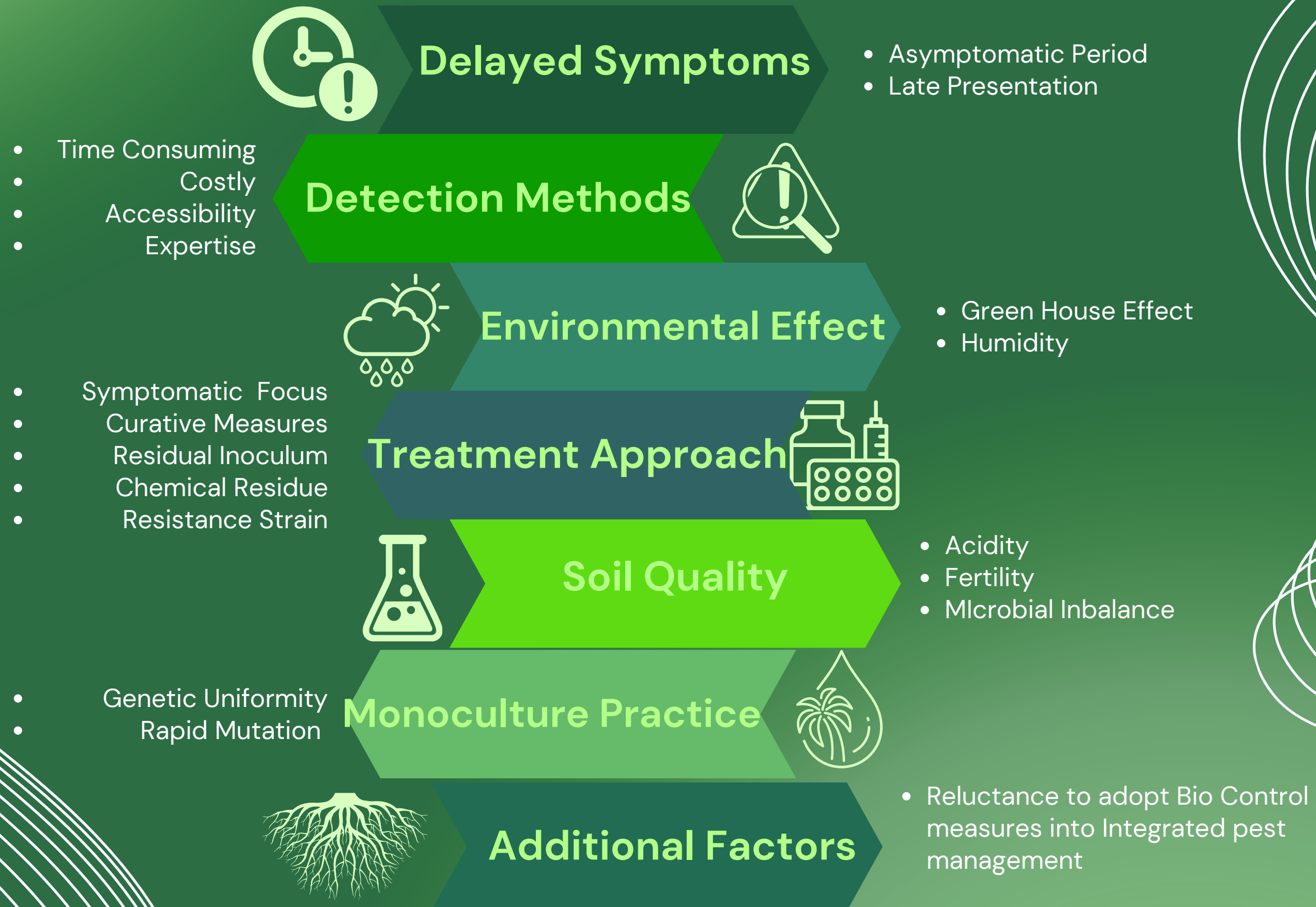


Malaysia Annual FFB Yield Trend (2008-2024)

Impact of El Niño, Ganoderma, Labor Shortage & Aging Palms



Why is the average rate of infection increasing?

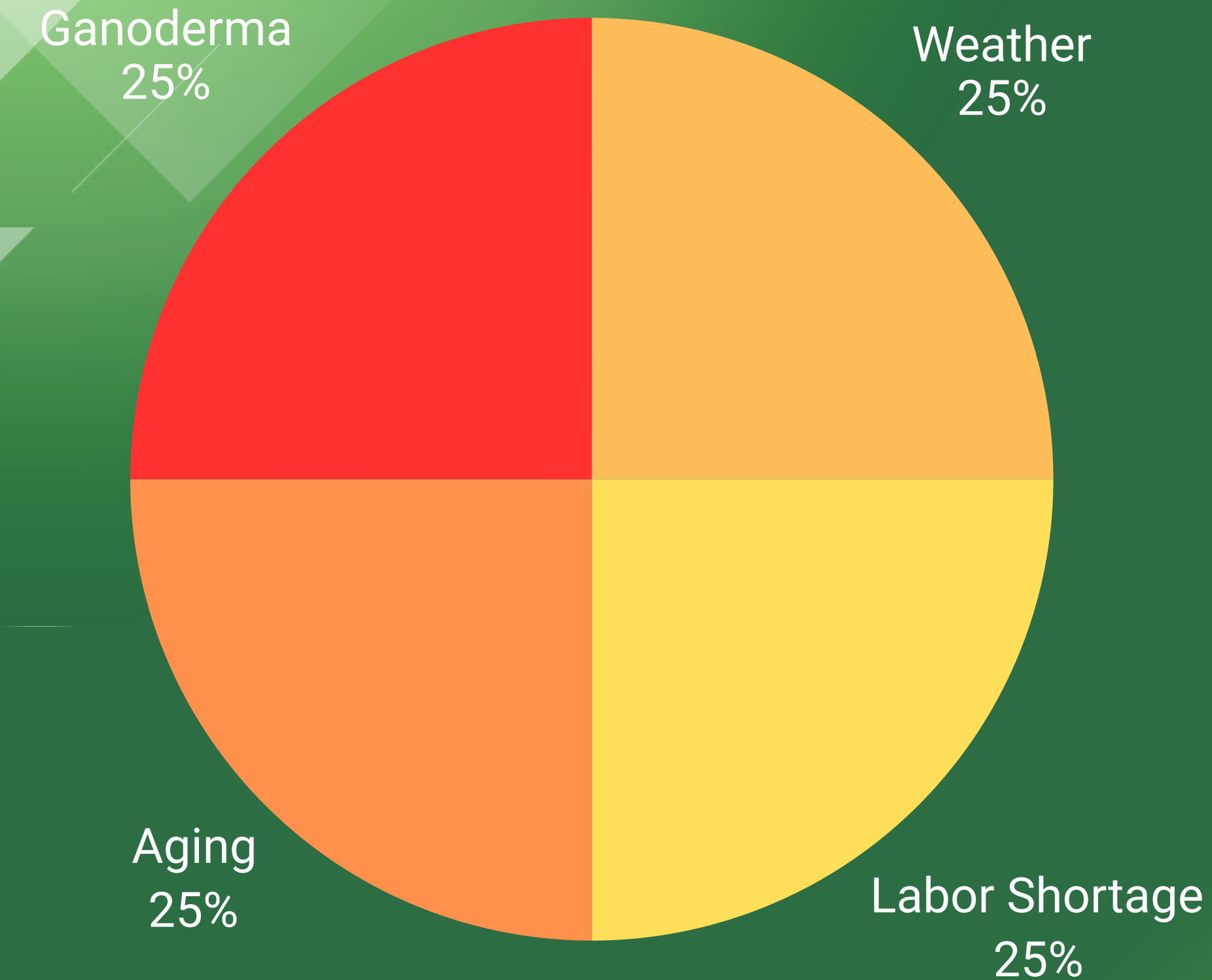


Think of oil palm as a professional athlete

As it ages, its natural performance begins to decline — that's expected.

But now imagine this athlete also suffering from an untreated illness (Ganoderma), trying to train without proper nutrition (weather), and lacking a proper coach or support team (labour shortage) to guide and condition it.

Even the most talented athlete can't win races under those conditions.



"MULTIPLE PRESSURES CONVERGING AND QUIETLY ERODING PERFORMANCE, SEASON AFTER SEASON."



TREATMENT OVERVIEW

Current Control Strategies

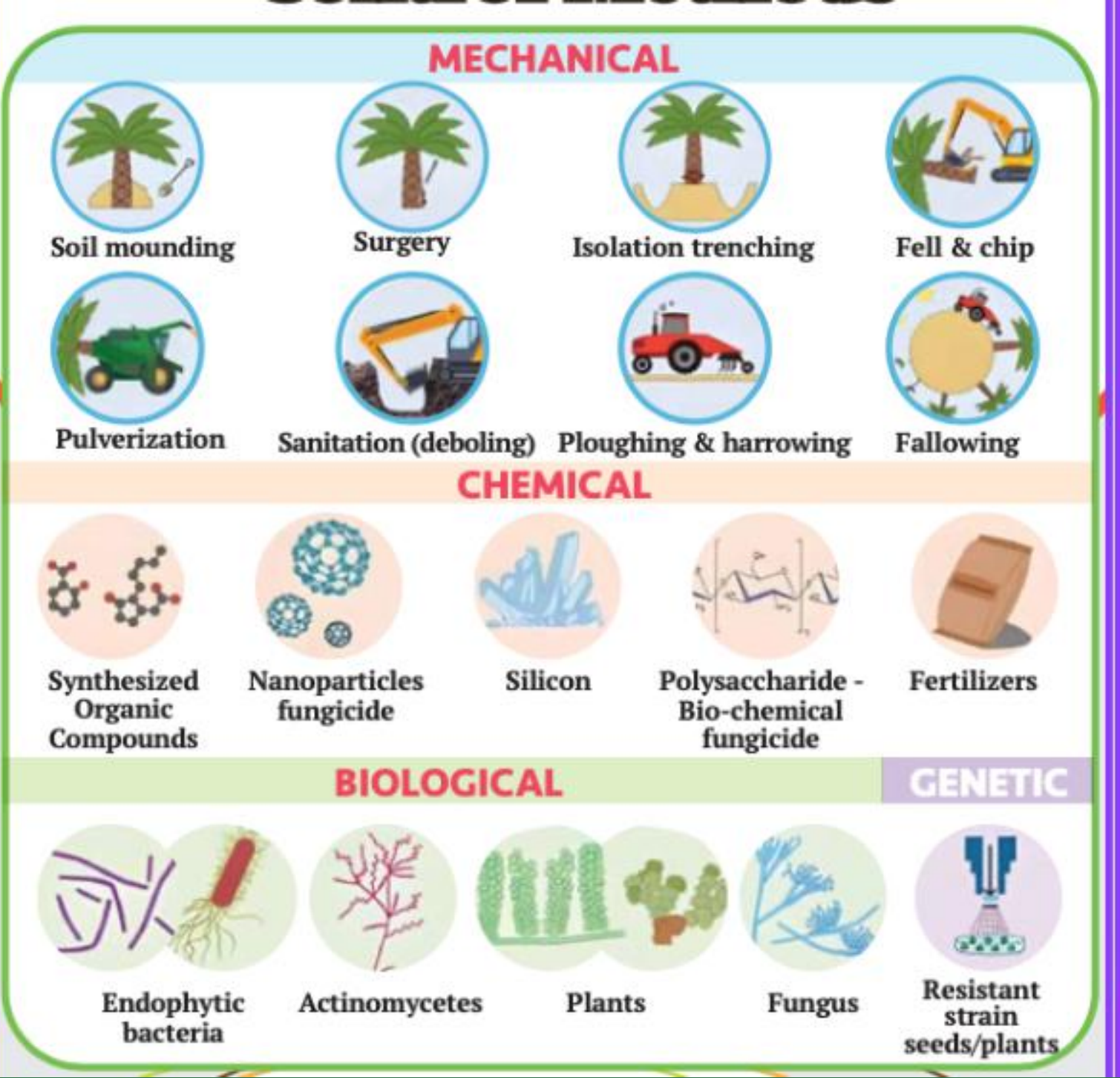
CURATIVE

- 01** Main Goal
Prolong palm lifespan
- 02** Effectiveness
Temporary relief
- 03** Application
After symptoms appear
- 04** ROI
Lower – yield continues to decline

PREVENTIVE

- 01** Main Goal
Prevent infection before it starts
- 02** Effectiveness
Long-term protection and reduced risk
- 03** Application
From the nursery stage onward
- 04** ROI
Higher – maintains palm health and yield potential

Treatment Landscape Overview



MECHANICAL

1

Sanitation methods alone only delays infection

CHEMICAL

2

Short Term Solution but environmentally degrading

GENETICS

3

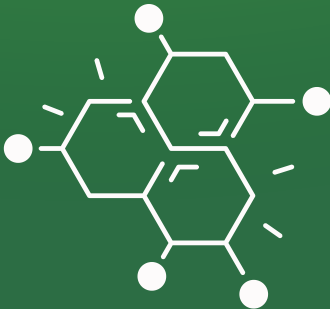
Efforts to create a resistant seedling highly complex, costly & time consuming

BIOLOGICAL

4

BCA is a better alternative for disease management in the field instead of chemical fungicides

Comparisons of Control Strategies

	 Financially efficient	 Integration	 Resistance Development	 Long Term Control	 Environmentally sustainable
					
					
					

Integrated Treatment Approach



Real-time Monitoring

- Detection (census) of potential attacks before replanting
- Regular reporting



Sanitation @ Existing Plantation

- Picking fruiting body of Ganoderma
- Surgery of diseased tissue
- Removing Infected Palms & Deboling



Sanitation @ Replanting

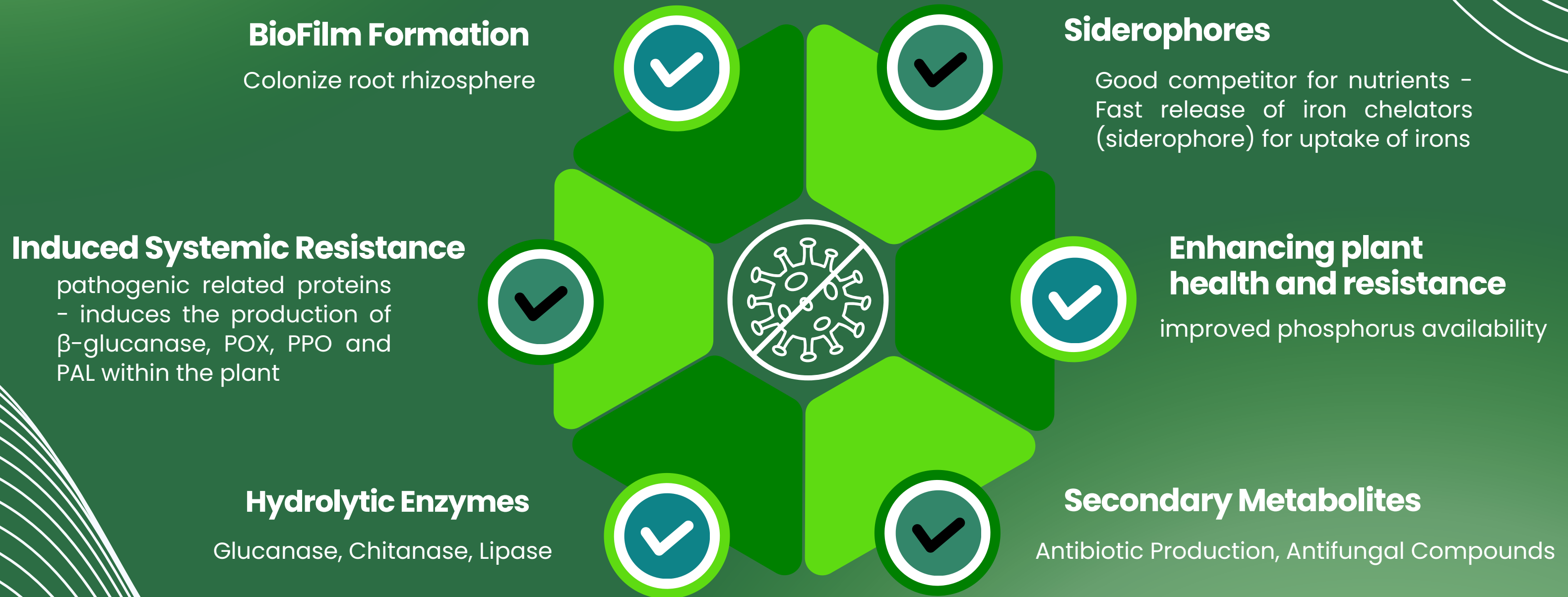
- Sanitation of inoculum source
- Remove as much infected stems, boles and roots



Preventive Control

- The use of bio-control agents to suppress pathogen

How does *Streptomyces GanoSA1* work as a bio-control agent?





EFFECTIVENESS EVALUATION

Lab Tests - In- Vitro Screening

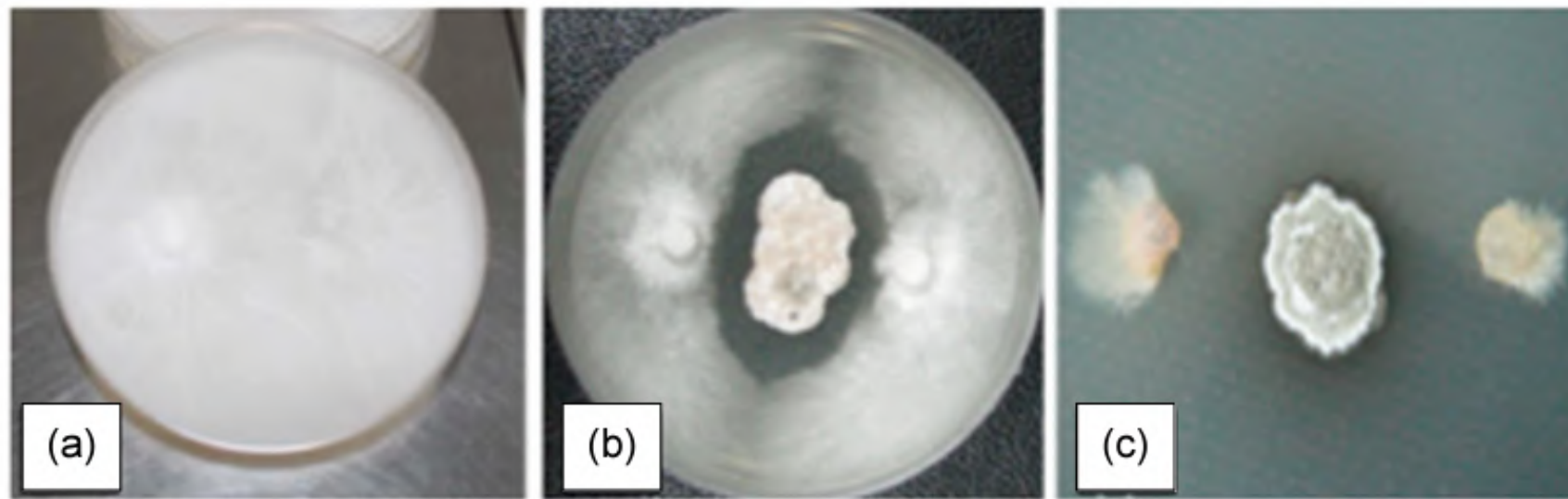
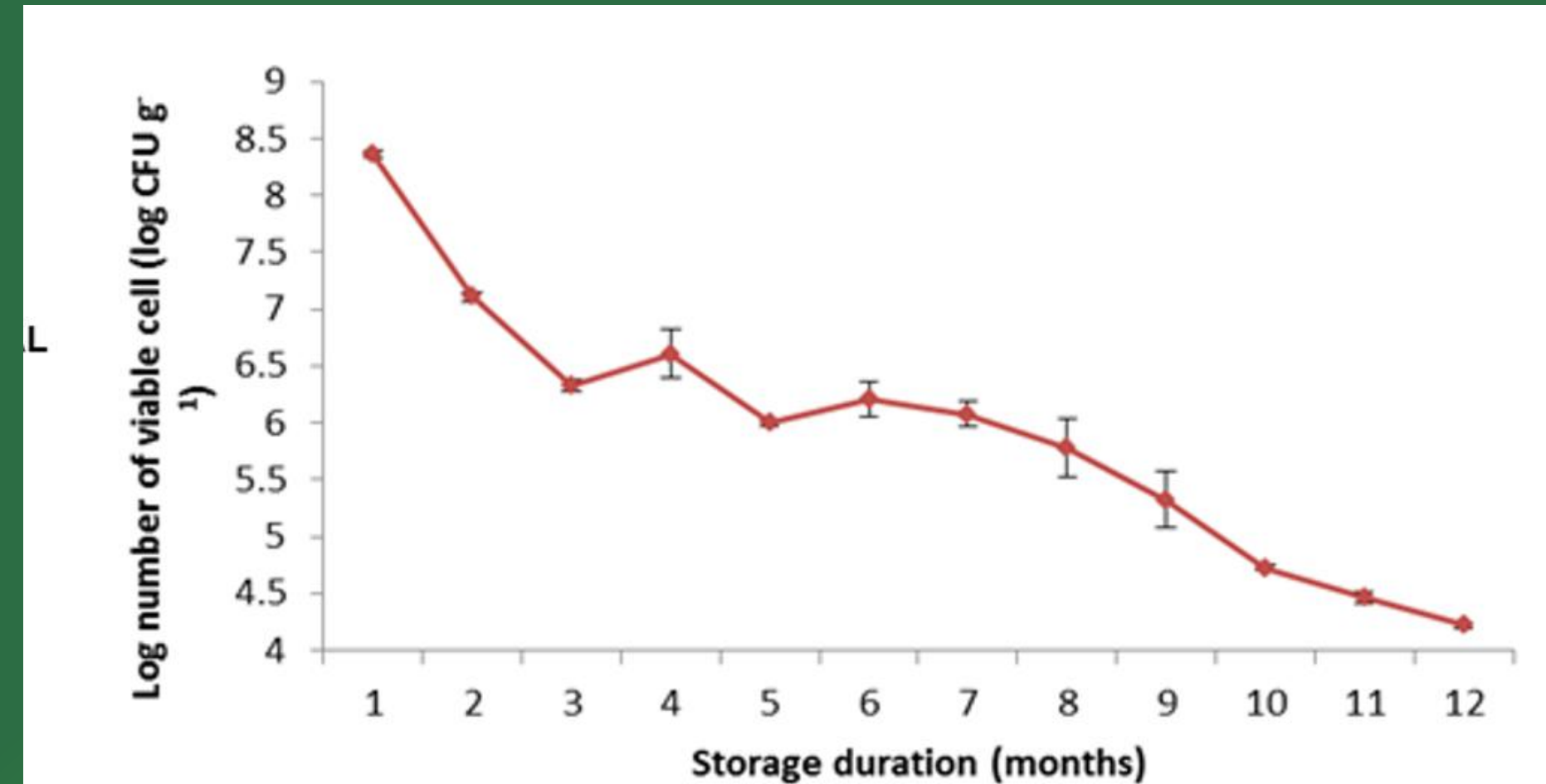


Figure 3. In vitro assay plates of actinomycetes isolates against *G. boninense*; a) control plate of *G. boninense*, b) Positive inhibition observed between actinomycetes during in vitro assay and, c) Inhibition of *G. boninense* by *Streptomyces nigrogriseolus* GanoSA1 (Shariffah Muzaimah et al., 2020).

THE EFFECT OF *Streptomyces* GanoSA1 POWDER ON PERCENT INHIBITION OF RADIAL GROWTH OF *Ganoderma boninense*

<i>Streptomyces</i> GanoSA1 POWDER against <i>Ganoderma boninense</i>		Storage time (months)						
		0	2	4	6	8	10	12
Percentage Inhibition of Radial Growth (PIRG %)	Trial 1	100	100	100	88.6	83.8	74.1	54.3
	Trial 2	100	100	100	85.1	84.8	75.0	65.7
	Trial 3	100	100	100	86.5	80	73.33	57.1



The average number of viable *Streptomyces* GanoSA1 in vermiculite: biochar powder formulation during storage.

Lab Tests - Bio-Chemical Identification

Table 1

Morphological and physiological characteristics of *Streptomyces nigrogriseolus* GanoSA1 after 7 days of incubation.

Morphological characteristic				
	Growth of <i>Streptomyces nigrogriseolus</i> GanoSA1	Reverse color	Diffusible pigment	Spore formation
	Aerial surface color			
YME	Light-bluish gray	Brown	–	++
ISP3	Gray	Gray	–	++
ISP4	Light gray	Brown	–	+
ISP5	White	Brown	–	±
Spore formation	Rectiflexibiles/ Retinaculiaperti			
Physiological characteristic				
➤ β-1,3-glucanase	+			
➤ Chitinase	+			
➤ Cellulase	–			
➤ Lipase	+			
➤ Siderophores	+			
➤ Phosphate solubilization	+			
➤ Indole acetic acid	–			

Temperature effect

➤ 28 °C	++
➤ 30 °C	++
➤ 40 °C	+
➤ 50 °C	–

pH

➤ 4.5	++
➤ 5.5	++
➤ 6.5	++
➤ 7.5	++
➤ 8.5	++

NaCl

➤ 2%	++
➤ 4%	++
➤ 6%	++
➤ 8%	+
➤ 10%	–
➤ 12%	–

Pesticides

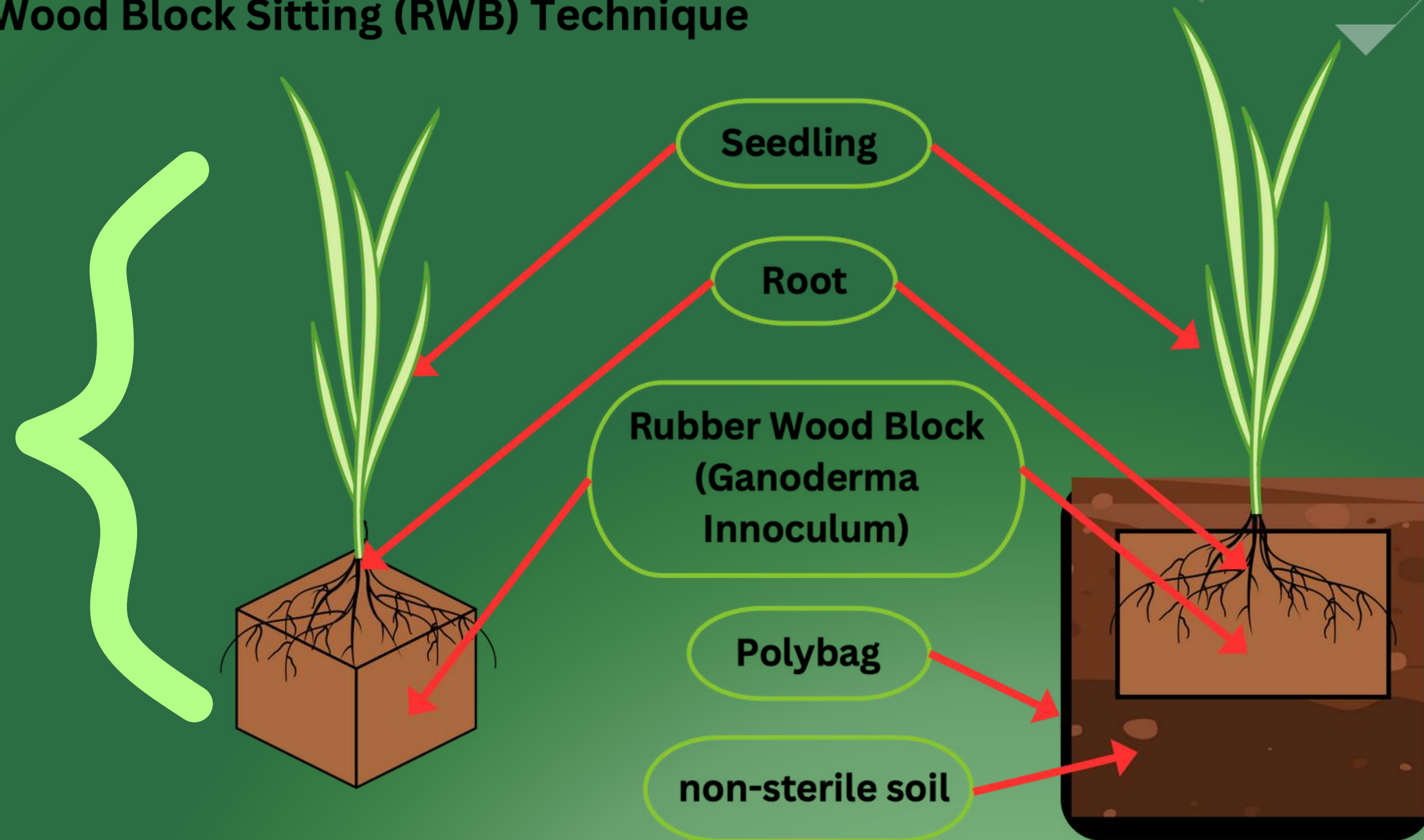
	Pesticide strength (%)		
	1	0.5	0.25
➤ Glyphosate isopropylamine	±	+	++
➤ Paraquat dichloride	–	–	±
➤ Glufosinate ammonium	–	–	–

Streptomyces growth: (–) no growth; (±) little growth with no aerial mycelia; (+) little growth; (++) medium growth.

NURSERY TRIALS

MPOB-UKM Research Station, Bangi, Selangor

Rubber Wood Block Sitting (RWB) Technique



NURSERY TRIALS

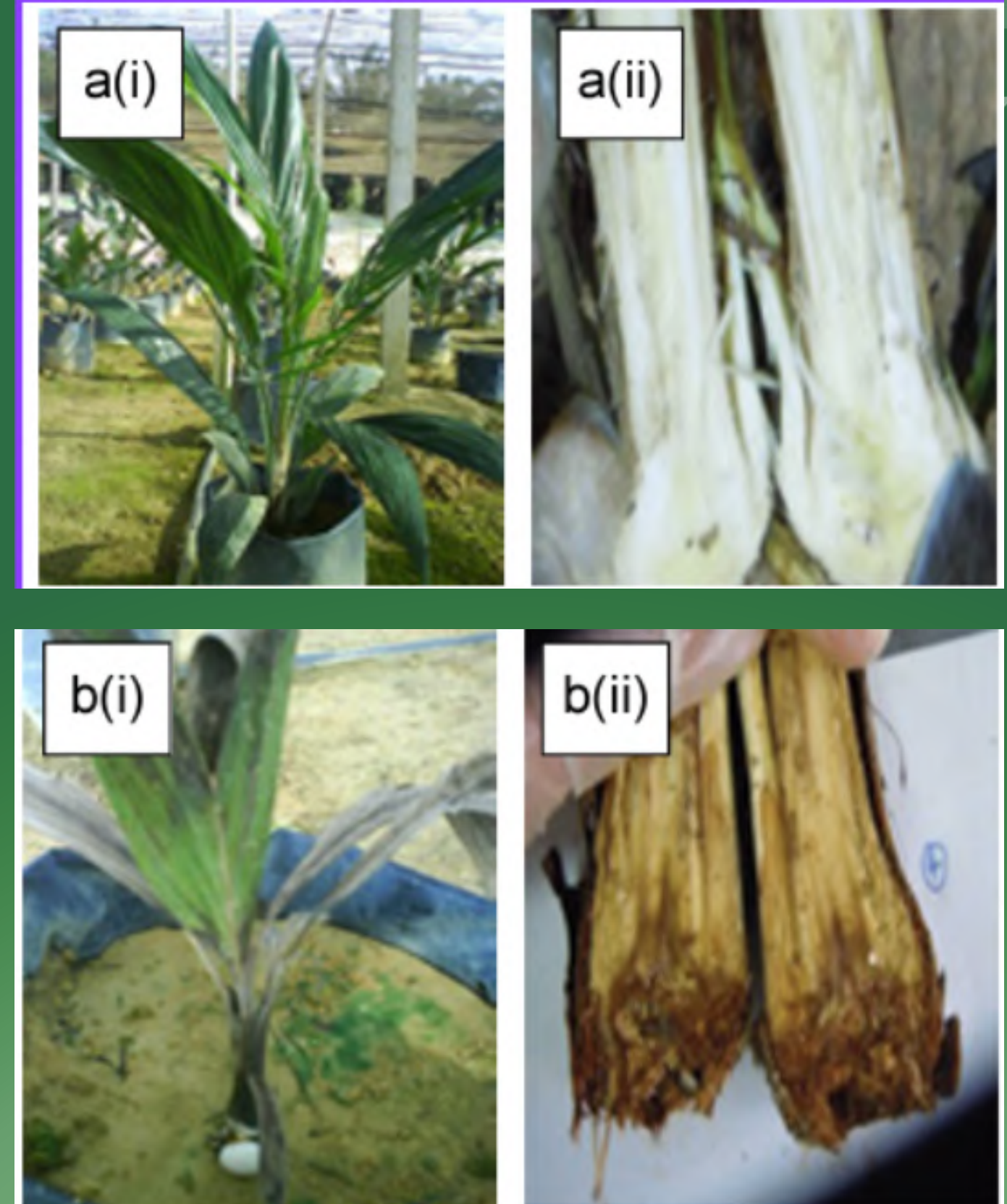
MPOB-UKM Research Station, Bangi, Selangor

Table 2

The effect of *Streptomyces nigrogriseolus* GanoSA1 on disease and vegetative growth of oil palm.

Treatment	Control	<i>S. nigrogriseolus</i> GanoSA1 powder
Disease assessment		
Disease incidence (%)	91.11 ± 4.29 ^a	48.89 ± 7.54 ^b
Severity of foliar symptoms (%)	83.11 ± 3.29	42.45 ± 5.57 ^b
Dead seedlings (%)	80.00 ± 6.03 ^a	31.11 ± 6.98 ^b
Disease severity (external, %)	75.00 ± 2.79 ^a	31.11 ± 1.57 ^b
Disease severity (internal, %)	88.89 ± 2.91 ^a	43.32 ± 4.94 ^b
AUDPC (unit ²)	151.94 ± 24.07 ^a	52.22 ± 7.03 ^b
Disease reduction (%)	–	63.01 ± 4.99 ^a
Vegetative growth		
Number of fronds	11.67 ± 0.28 ^a	13.278 ± 0.38 ^b
Plant height (cm)	106.44 ± 2.32 ^a	116.27 ± 2.25 ^b
Stem girth (cm)	50.37 ± 1.53 ^a	58.73 ± 1.35 ^b
Root mass (g)	130.58 ± 1.1 ^a	165.52 ± 0.67 ^b
Leaf mass (g)	255.59 ± 1.78 ^a	272.6 ± 3.35 ^a

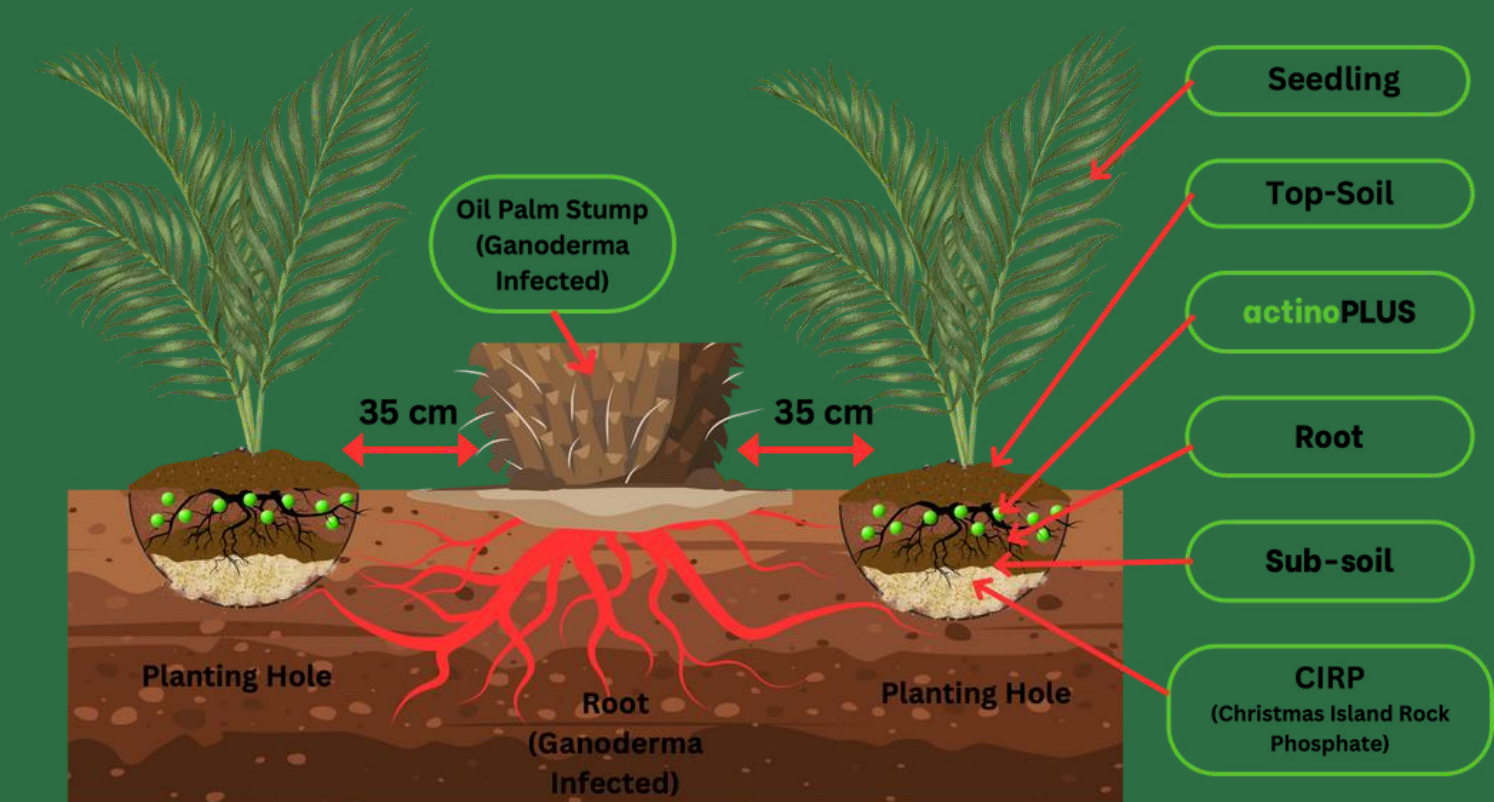
11–18%



FIELD EVALUATIONS

MPOB Teluk Intan Research Station, Perak

Seedling Baiting Technique (SBT)

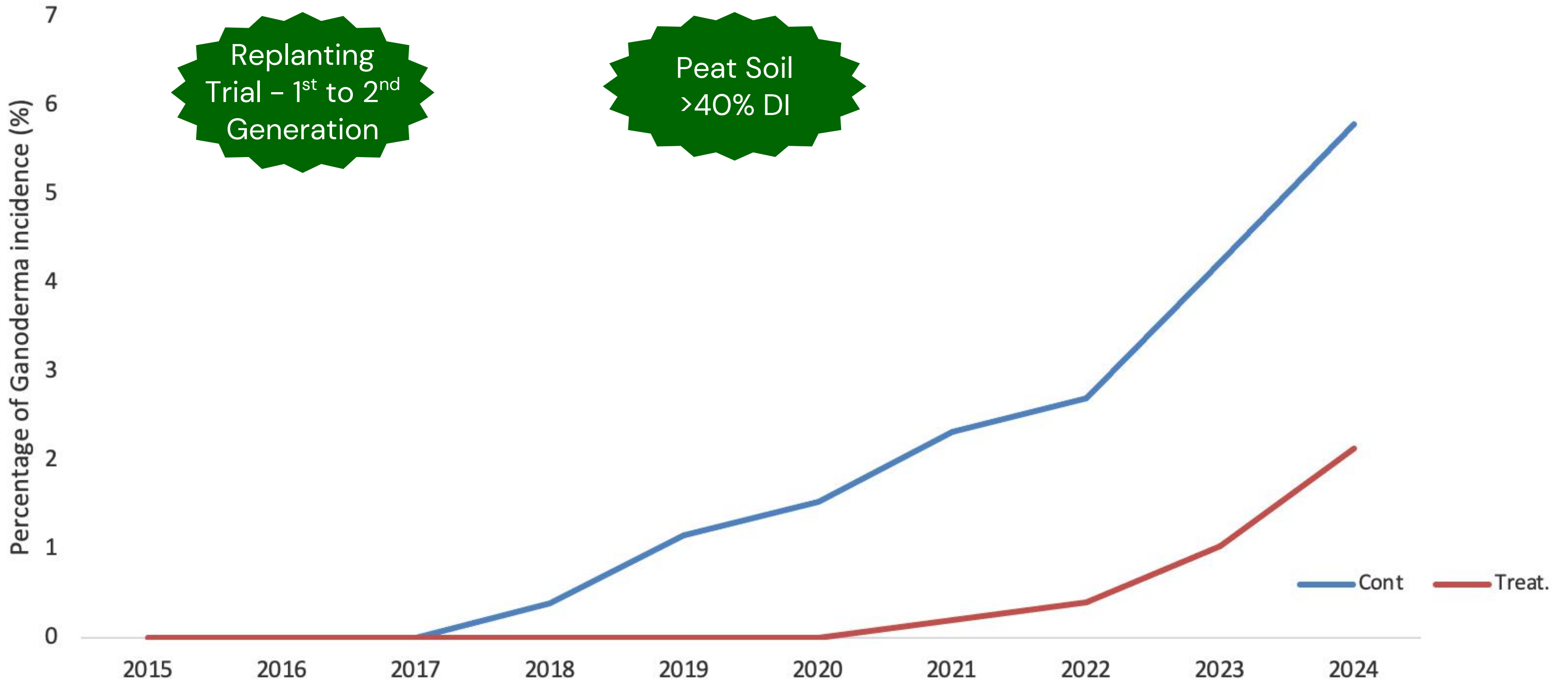


EFFECT OF *Streptomyces* GanoSA1 POWDER IN CONTROLLING *GANODERMA* DISEASE IN OIL PALM, 36 MONTHS AFTER PLANTING (MAP) USING SEEDLING BAITING TECHNIQUE

Treatments	Palms dead due to <i>Ganoderma</i> infection (%)		
	12 MAP	24 MAP	36 MAP
T1 - Untreated seedlings (control)	8 ^a	20 ^a	75.0 ^a
T2 - Seedlings treated with <i>Streptomyces</i> GanoSA1	0 ^b	3 ^b	6.6 ^b

FIELD EVALUATIONS

MPOB Teluk Intan Research Station, Perak



SKIM TANAM SEMULA SAWIT PEKEBUN KECIL (TSSPK)

2014

EMBIO® actinoPLUS launched by MOSTI Minister @ MPOB Transfer of Technology Exhibition (TOT 2014).

2015 - 2018

Supplied approximately **450K Sachets** for **1500 Smallholders**, covering 3000 Hectares in 7 States

B



D



A

2012 - 2014

Signed Research and Commercialization Agreement On Actinomycete with MPOB

C

2015

Approved by Jawatankuasa Pemandu Minyak Sawit & MOF for **RM 3.6 Million**



a return of **3.8 times** the amount of sales revenue

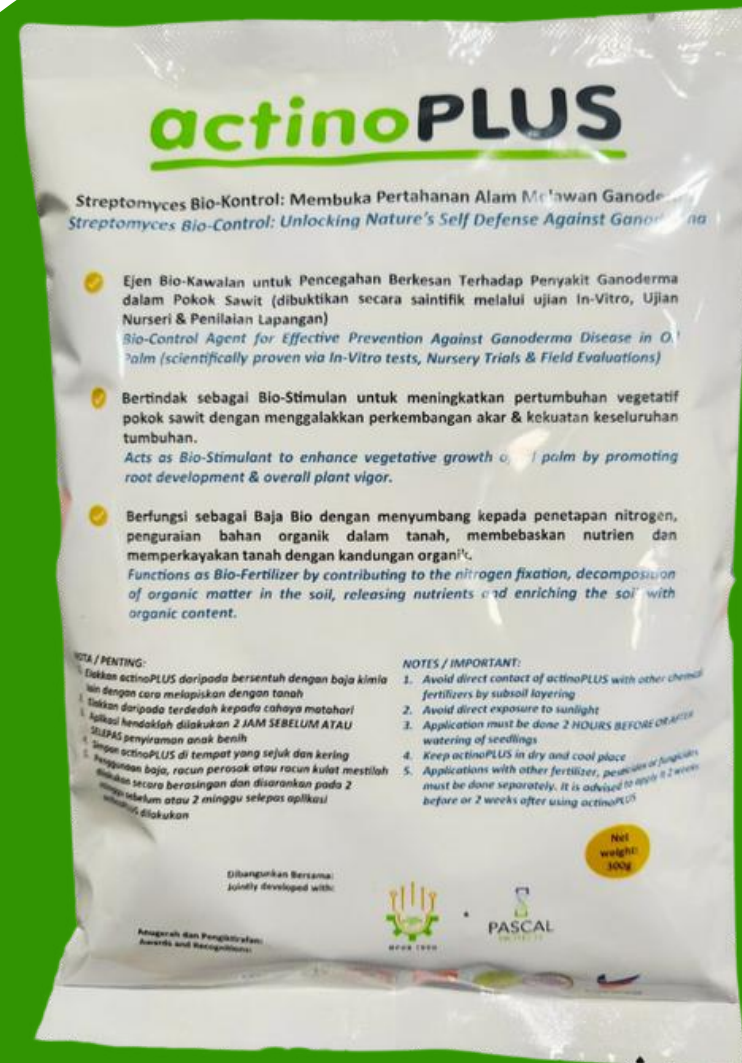


3 years after replanting, **0% disease incidence** in areas applied with ActinoPlus



Areas replanted without ActinoPlus experiencing **3-5% disease incidence**

reallygreatsite.com



APPLICATION GUIDE

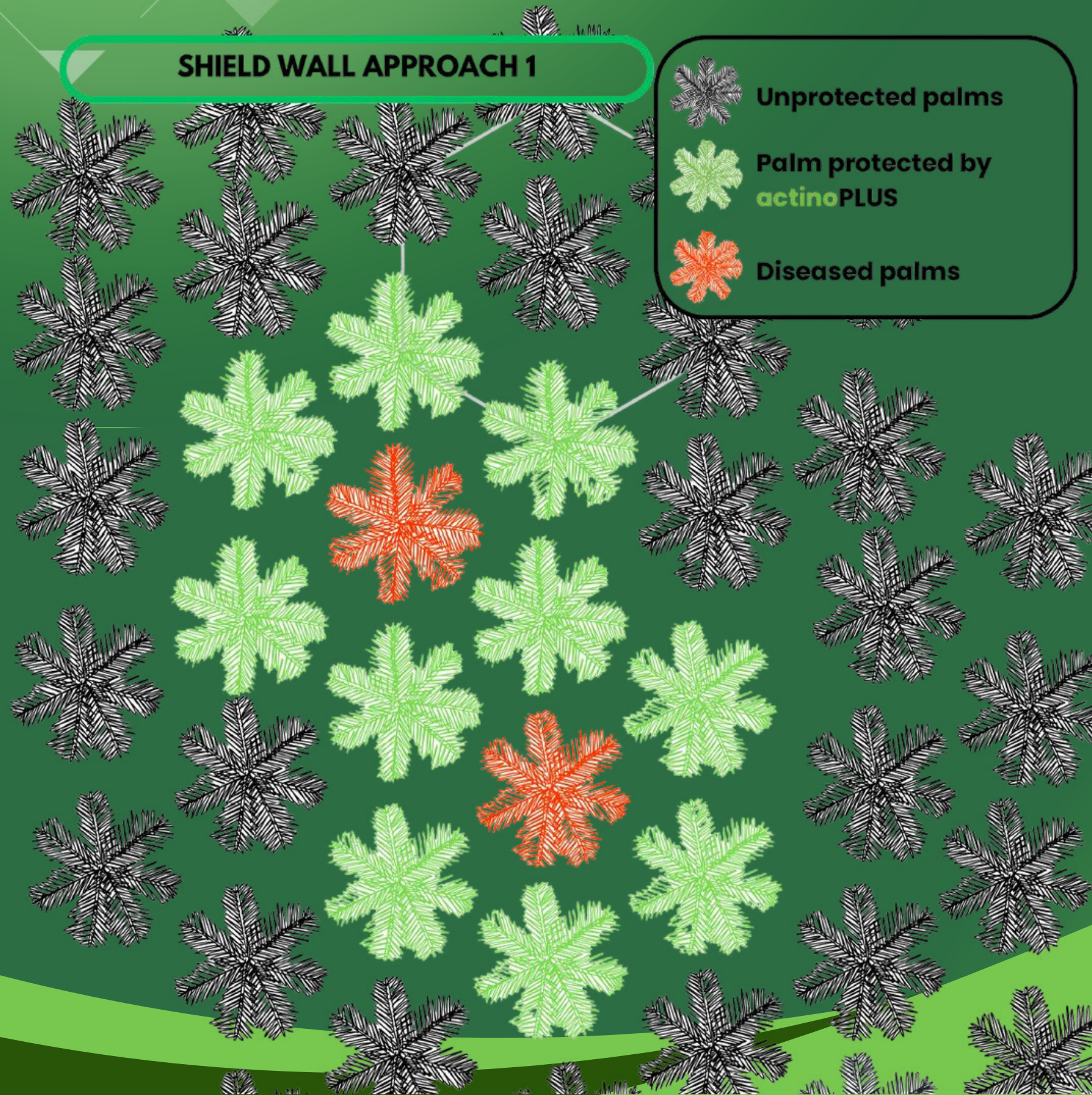


4KG

SHIELD WALL APPROACH

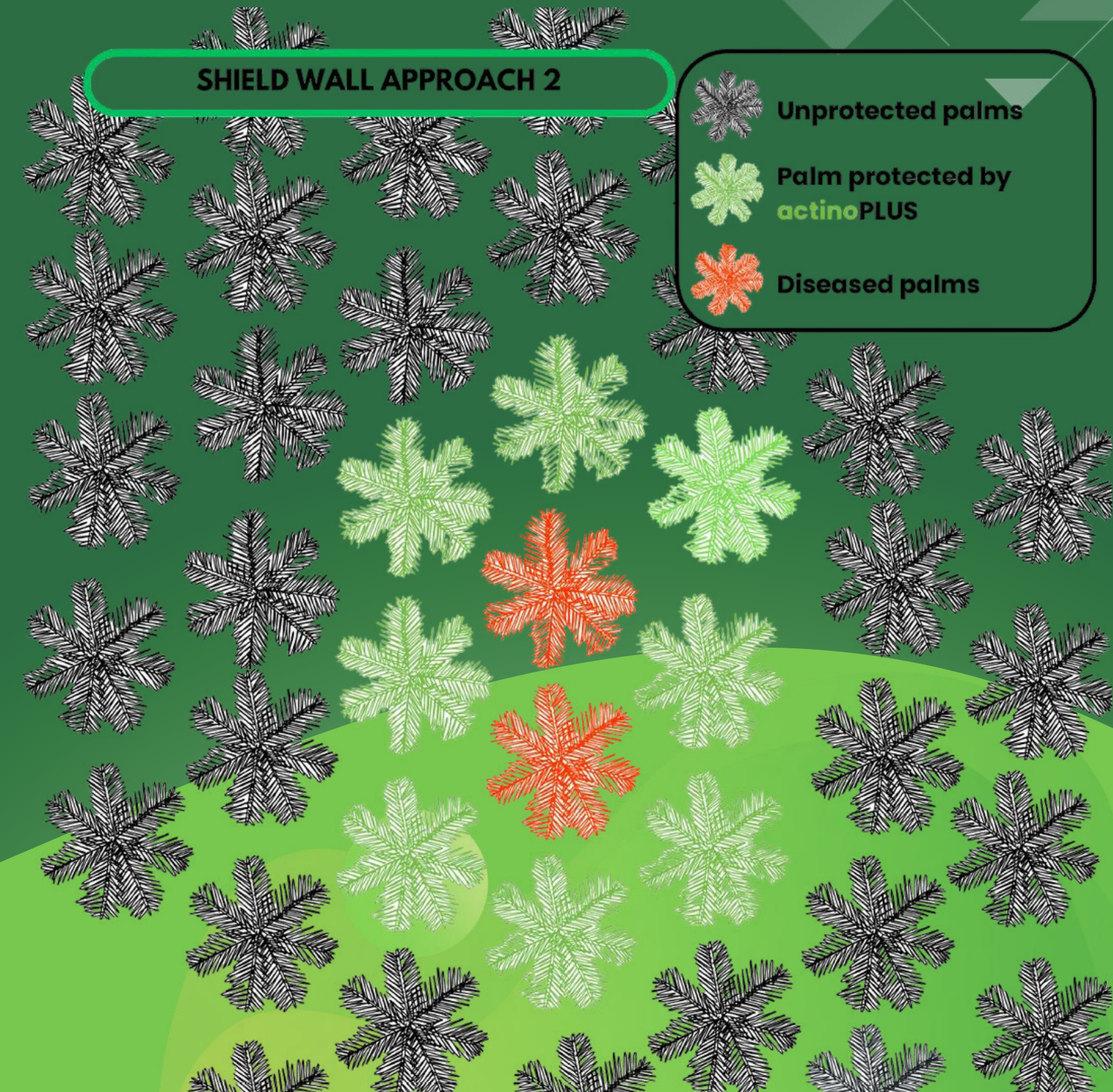
SHIELD WALL APPROACH 1

-  Unprotected palms
-  Palm protected by **actinoPLUS**
-  Diseased palms



SHIELD WALL APPROACH 2

-  Unprotected palms
-  Palm protected by **actinoPLUS**
-  Diseased palms



CURRENT DEMOPLOTS



PT Cisadane Sawit
Raya



PT Pinago Utama
Tbk



PT Merbau Jaya



PT Mazuma



PTPTN 4



PT Sinar Gunung
Sawit Raya



Anglo Eastern
Plantation



PT Surya Palma
Sejahtera (Wildan
Perkasa Group)



SAGONAULI
GROUP



PT Widya Unggul



PT PAS



Asian Agri Group



Musim Mas Group



GRUTI GROUP

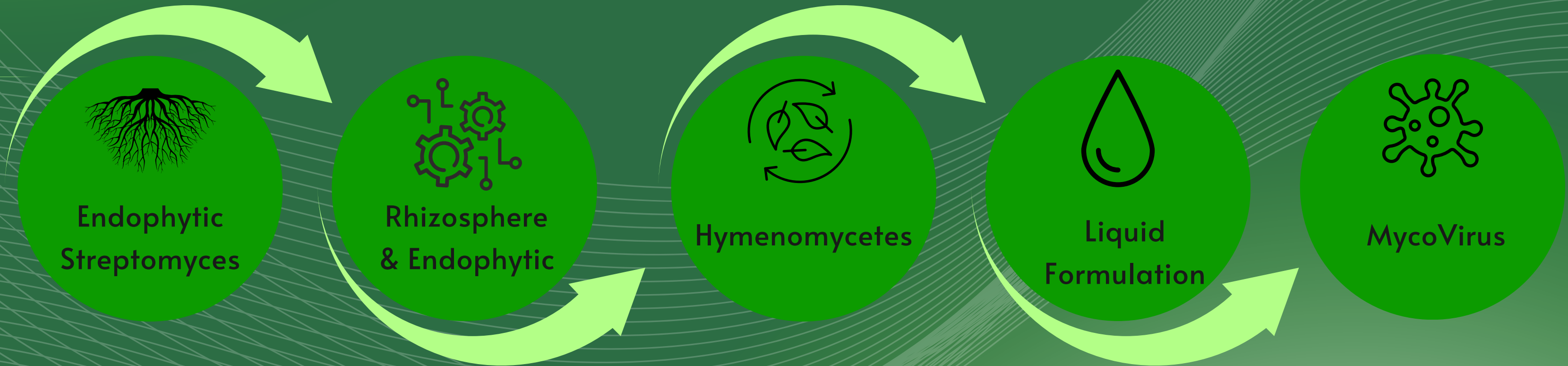


Domba Mas Group



PT Abdi Budi Mulia

Upcoming Products



Q&A SESSION



THANK YOU

P A S C A L B I O T E C H S D N B H D



PASCAL BIOTECH SDN BHD

OUR CONTACT



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70200 Seremban, Negeri Sembilan



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	Nursery Trial	
Measurement	Vegetative Growth	<i>Ganoderma</i> Disease Control
Location	MPOB-UKM Research Station, Bangi, Selangor	
Profile	Nursery conditions under a shaded area with 30 per cent light absorbance.	
Duration	9 Months	
Planting material	3 months old DxP seedlings	
Number of Seedlings	Two treatments were evaluated with 30 seedlings per treatment	
Inoculation Method	Actinomycetes powder was applied through soil mixing. No <i>Ganoderma</i> inoculation.	Actinomycetes powder was applied through soil mixing. <i>Ganoderma</i> was inoculated through the rubber wood block (RWB) sitting technique.
Design	RCBD	
Dosages	Pretreatment: 50 g/seedling Booster (7 days after pretreatment): 50g/seedling	Pretreatment: 50 g/seedling Booster (7 days after pretreatment): 50g/seedling
Assessment Parameter	No. of fronds production, seedling height and width, leaf areas, SPAD for chlorophyll reading	Disease incidence (DI), Severity of foliar symptoms (SFS), Dead seedlings (DS), Disease Severity Index (DSI, external and internal)
Data collection	Monthly observation on the vegetative growth	Monthly observation of the external symptoms. Internal symptoms were observed through cross-section at the end of the experiment
Results	Btw 11-18% enhancement	65.2% disease reduction

	Field Trial	
Plot	Existing planting area	Replanting area
Location	MPOB <u>Teluk Intan</u> Research Station, Perak	MPOB <u>Teluk Intan</u> Research Station, Perak
Profile	25-year-old palm (severely infected & peat)	25-year-old palm (severely infected >40%, peat soil & going into 2 nd Generation
Duration	36 Months	9 Years (still ongoing)
Inoculation Method	Seedling Baiting Technique	Soil mixing at the planting hole
Number of Seedlings	Two treatments were evaluated with 30 seedlings per treatment	A replanting of 1260 Oil Palms seedlings. 1001 seedlings were treated whilst the remaining 259 seedlings were considered the control
Dosages	Pretreatment: 50g/seedling at 4-, 6- and 9-month-old) Planting hole: 250 g/hole approximately 35 cm away from the infected stump	Pretreatment: 50g/seedling at 4-, 6- and 9-month-old) Planting hole: 250 g/hole
Assessment Parameter	Disease incidence (absent or present of infection based on external symptoms)	Disease incidence (absent or present of infection based on external symptoms)
Data collection	3-monthly intervals for 36 months.	Yearly (annual census)
Results	75 per cent of untreated seedlings were dead compared 6.6% in treated	On the 3rd year after replanting, untreated seedlings started showing signs of infection compared to 6 th year for the treated palms.