

Sustainable Weed Control in Immature Oil Palm: Assessing Herbicide Performance and Economic Benefits

*Kamil Haiyat Muhammad Razak, Muhamed Ramdhan Ab Latiff, Ts Elya Masya Mohd Fishal, Dr Cik Mohd. Rizuan Zainal Abidin, Nor Azman Umar and Dr Kamalul Adham Che Ruzlan

Green Technology & Microbial Solutions Department, FGV R&D Sdn Bhd, PT35377, Lengku Teknologi, 71760 Bandar Enstek, Negeri Sembilan

Corresponding Author Email*: kamil.mr@fgvholdings.com



1 INTRODUCTION

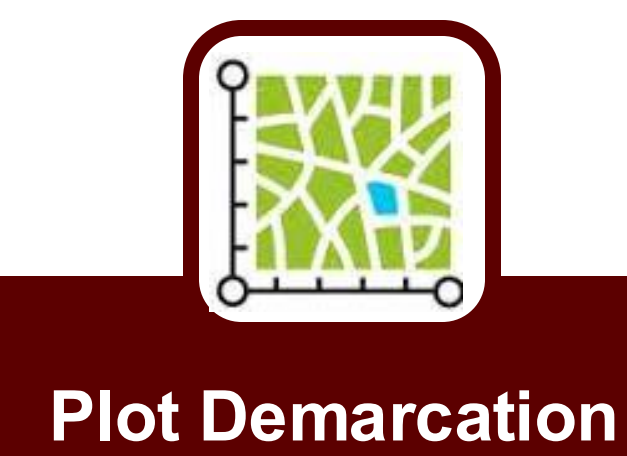


- Weed management plays a key role in helping young oil palms grow well by reducing competition for nutrients and water.
- This study evaluates herbicide combinations integrated with **2-sodium amine**, a **reducing-type adjuvant** that enhances herbicide stability and absorption, enabling lower dosages for effective and sustainable weed control.
- The objective is to **identify optimal combinations** and application techniques that **prolong weed suppression**, reduce chemical input, and improve economic returns in immature oil palm plantations.

2 PROBLEM STATEMENT

- Frequent** post-emergence herbicide spraying increases cost, labour, and herbicide resistance risk.
- Limited understanding** of the efficacy of herbicides with the combination of reductant adjuvant synergy in immature oil palm systems.
- Need for sustainable, cost-efficient, and environmentally friendly weed management practices.

3 MATERIALS & METHODS



Plot Demarcation

- Location:** Pusat Penyelidikan Pertanian Tun Razak, Jerantut, Pahang
- Oil Palm Age:** October 2022 (11 months) during trial
- Area:** 6.92 Ha



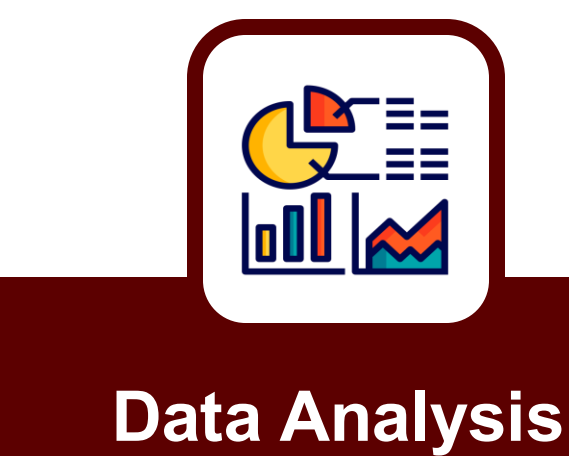
Treatment Application

- Treatments:** Herbicide preparation according to the manufacturing recommendation.
- Application:** Single herbicide application using knapsack sprayer (fan jet nozzle).
- Spray volume:** 200 L/ha.
- Design:** Randomised Complete Block Design (RCBD) (3 replications).



Observation

- Assessed Parameter:** Weed regeneration and phytotoxicity observed at palm circle.
- Pre-emergence - 180 days** after application (DAA)
- Post-emergence - 90 DAA**



Data Analysis

- ANOVA** was performed to determine the significant differences among treatment means.
- Tukey's Honest Significant Difference (HSD)** test was applied to compare treatments at a 95% confidence level.
- A **heatmap** was used to rank the overall performance of the top treatments based on their efficacy over time.

Data Interpretation

4 RESULT & DISCUSSION

PRE-EMERGENCE TESTING

- Pre-emergence testing** was evaluated **Indaziflam** combined with commonly used herbicides in immature oil palm to observe weed suppression effectiveness and the duration of prolonged weed control hence reducing the need for frequent spraying.
- MSMA 39.5% + Diuron 7.8% + Indaziflam 45.5%** provided the longest residual weed control (up to 180 days), effectively suppressing broadleaf and grassy weeds without phytotoxicity, making it the most efficient and sustainable pre-emergence treatment.

Treatment	Efficacy of Herbicides at Pre-emergence Testing in Immature Stage											Ranking
	Days After Application (DAA)											
	3	7	14	30	45	60	75	90	120	150	180	
Glufosinate ammonium 24.5% + Indaziflam 45.5%	38 _a	59 _{ab}	82 _b	98 _a	-6 _a	-9 _{ab}	-18 _b	-25 _a	-48 _a	-63 _a	-100 _a	2
Glufosinate ammonium 13.5% + Indaziflam 45.5%	34 _a	57 _b	84 _{ab}	89 _b	-13 _b	-16 _b	-21 _b	-27 _a	-48 _a	-64 _a	-100 _a	3
MSMA 39.5% + Diuron 7.8% + Indaziflam 45.5%	36 _a	65 _a	85 _a	99 _a	-5 _a	-8 _a	-15 _a	-21 _a	-45 _a	-61 _a	-100 _a	1

POST-EMERGENCE TESTING

- Post-emergence testing** evaluated the combinations of commonly used herbicides in immature oil palm with **2-sodium amine** to assess its efficacy in maintaining weed suppression at half the herbicide dosage compared to the recommended rate.
- 2-sodium amine** enhanced herbicides active ingredient efficacy, sustaining effective broadleaf and grassy weeds suppression up to 90 days, even at **50% of the standard application rate**.

Treatment	Efficacy of Herbicides in Post-emergence Testing at Immature Stage									Ranking
	Days After Applications (DAA)									
	3	7	14	30	45	60	75	90		
Glufosinate ammonium 13.5% (FGV Standard Practice)	34.72 _a	66.61 _a	84.56 _a	88.28 _a	-24.33 _a	-43.94 _b	-73.39 _b	-97.72 _b	6	
Glyphosate potassium 48.7%	34.06 _a	63.17 _{ab}	85.33 _a	91.22 _a	-24.56 _a	-33.50 _a	-43.56 _a	-54.72 _a	3	
Glyphosate dimethylammonium 52%	33.50 _a	62.48 _{ab}	85.30 _a	94.00 _a	-25.44 _a	-39.61 _{ab}	-47.94 _a	-56.44 _a	4	
50% of Glufosinate ammonium 13.5% + 2-Sodium amine	34.94 _a	61.11 _b	83.50 _a	94.06 _a	-24.94 _a	-46.78 _b	-71.56 _b	-98.11 _b	5	
50% of Glyphosate potassium 48.7% + 2-Sodium amine	37.28 _a	56.33 _b	83.22 _a	95.00 _a	-26.00 _a	-33.61 _a	-44.17 _a	-52.72 _a	2	
50% of Glyphosate dimethylammonium 52% + 2-Sodium amine	35.33 _a	56.89 _b	82.89 _a	95.33 _a	-25.11 _a	-31.06 _a	-42.17 _a	-50.72 _a	1	



Cost Benefit Analysis

Pre-emergence (RM/ha)	Post-emergence (RM/ha)
RM1,100.14 8 application rounds FGV Standard Practice	RM336.85 3 application rounds MSMA 39.5% + Diuron 7.8% + Indaziflam 45.5%
	RM1,100.14 8 application rounds FGV Standard Practice
42% of cost reduction RM636.23	69% of cost reduction RM336.85
	RM336.85 3 application rounds 50% of Glyphosate dimethylammonium 52% + 2-Sodium amine

5 CONCLUSION

- Indaziflam combinations provided longer residual control up to 180 DAA, with MSMA + Diuron + Indaziflam showing the best performance.
- Glyphosate + 2-Sodium amine achieved the highest post-emergence efficacy and prolonged activity up to 90 DAA.
- Combined use reduced application frequency and cost by up to 42% compared to the standard practice.

6 POTENTIAL BENEFITS

- Efficiency:** Fewer applications reduce labour, time, and input costs.
- Productivity:** Extended weed control improves crop growth and yield potential.
- Sustainability:** Supports scalable, eco-friendly weed management practices.

ACKNOWLEDGEMENT

Special appreciation is extended to the Crop Protection and Green Technology & Microbial Solutions teams for their invaluable technical and research support. Sincere thanks to FGV Plantation (Malaysia) Sdn. Bhd., and FGV Agri Services Sdn. Bhd. for their financial and field support. Deep gratitude to FGV R&D Sdn. Bhd. for providing the opportunity and platform to present this study.



Move toward efficient, long-lasting weed management in oil palm plantations.

