ABSTRACT

Weeds compete with oil palms for essential resources such as water, nutrients, and sunlight, thereby reducing crop yield and affecting overall oil palm productivity. To overcome this problem, herbicide has become an indispensable tool in weed management strategies. In the recent years, there has been a growing emphasis on enhancing the efficacy and sustainability of herbicide applications in agricultural practices. Adjuvants can increase the efficacy of herbicides by enhancing their absorption, penetrability, spreadability, and rainfastness. This research project aims to investigate the efficacy of various adjuvants, i.e. **Aidigro PN123**, 75% Polyether Modified Trisiloxane (PMT), 30% Alkylphenol Ethoxylate (AlkE) and 60% Alcohol Ethoxylate (AlcE) in improving weed control performance when combined with herbicides, i.e., 24.5% glufosinate ammonium SL (GA) (in immature field) and 41% glyphosate isopropylammonium SL (GIPA) with 20% metsulfuron-methyl WG (MM) (in mature field) in the context of oil palm plantations. Phytotoxicity screening of the adjuvants in the nursery showed that all adjuvants used for the field trial when sprayed without added herbicides are safe to the oil palm seedlings (0% seedling mortality rate and no visible phytotoxicity symptoms). Weed control efficacy results from the field trial showed that Aidigro PN123 was mostly comparable to, if not better than, the premium adjuvant commonly used (75% PMT). In the immature field, Aidigro PN123 always gave significantly higher weed burndown percentage in palm circle at 1 Week-After-Treatment (WAT) (73.33%) compared to the other commercial adjuvants tested, which were 75% PMT (64.17%), 30% AlkE (62.50%), and 60% AlcE (67.50%). In the mature field, Aidigro PN123 also gave comparable weed burndown percentage at 2-WAT (81.11%) compared to 75% PMT (76.11%). On top of that, Aidigro PN123 provided the longest control duration in immature field (7.00 weeks), which was slightly better than 75% PMT (6.33 weeks). This study shows that Aidigro PN123 enhances efficacy of herbicides tested as well as common commercial adjuvants, if not better. Duration of control may also be slightly better.

INTRODUCTION

Weeds are unwanted plant species in plantations that compete with crops for essential resources, such as water, nutrients, and sunlight. Hence, it reduces crop productivity.

Chemical control (herbicide) is an indispensable tool in integrated weed management strategies.

In the recent years, there has been a growing emphasis on enhancing the efficacy and sustainability of herbicide applications in agricultural practices.

Adjuvants are substances added to agrochemicals to improve their performance, i.e., sticking effect, surface tension reduction, penetration, and absorption.

This research project aims to investigate the performance of Aidigro PN123 in improving weed control efficacy in immature and mature oil palm fields.

METHODOLOGY

Adjuvants: Control (no adjuvant); **Aidigro PN123;** 75% Polyether Modified Trisiloxane (PMT); 30% Alkylphenol Ethoxylate (AlkE); 60% Alcohol Ethoxylate (AlcE)

Herbicides: 24.5% Glufosinate Ammonium SL (GA) (in immature field); 41% Glyphosate Isopropylammonium SL (GIPA) + 20% Metsulfuron-Methyl WG (MM) (in mature field)

Nursery Phytotoxicity Trial

Adjuvant + herbicide mixing and spraying (oil palm seedlings foliar spraying)

↓

Observation: sprayed frond burndown (up to 4 months); phototoxicity symptoms

↓

Observation: mortality of seedlings (at the end of 4 months); phototoxicity symptoms

Field Efficacy Trial

Adjuvant + herbicide mixing and spraying (palm circle spraying)

↓

Weed burndown (%) census:
Mature field: 3-DAT, 1-WAT. 2-WAT, 3-WAT
Immature field: 3-DAT, 1-WAT, 2-WAT

↓

Weed regeneration (%) census:
Mature field: 9-WAT, 13-WAT, 21-WAT
Immature field: 4-WAT, 6-WAT, 7-WAT

Table 1: *Weed burndown visual scoring (Motooka, 2003)*

Weed Burndown (%)	Description
0	No burndown symptoms
10 - 30	Insignificant to poor weed control. Little or no burndown symptoms
40 - 60	Inadequate weed control. Moderately severe burndown symptoms
70	Adequate weed control. Severe burndown symptoms
80	Good weed control. Very severe burndown symptoms
90	Excellent weed control. Extremely severe burndown symptoms
100	Complete weed control. No sign of life

Table 2: *Weed regeneration visual scoring*

Weed Regeneration (%)	Description	Examples
0	Clean palm circle	
10 - 30	Little weed coverage in the palm circle	
40 - 60	Moderate weed coverage in the palm circle, require herbicide spraying	
70 - 100	Severe to full weed coverage in the palm circle, require immediate herbicide spraying	

RESULTS & DISCUSSION

Nursery Phytotoxicity Test

Table 3: *Mean seedling mortality (%) and burndown for sprayed frond (scoring) for nursery phytotoxicity test*

Treatment	Seedling Mortality (%)	Sprayed Frond Burndown (Scoring*)
Control (no herbicide and no adjuvant)	0	0
Aidigro PN123 only	**0**	**0**
75% PMT	0	0
30% AlkE	0	0
60% AlcE	0	0
GIPA + MM only	100	3
GIPA + MM + Aidigro PN123	**100**	**4**
GIPA + MM + 75% PMT	100	2
GIPA + MM + 30% AlkE	100	3
GIPA + MM + 60% AlcE	100	3
GA only	100	3
GA + Aidigro PN123	**100**	**4**
GA + 75% PMT	100	4
GA + 30% AlkE	100	4
GA + 60% AlcE	100	3

* 0- No burndown; 1- Slight burndown; 2- Moderately severe burndown; 3- Severe burndown; 4- Complete burndown.

Mature Field

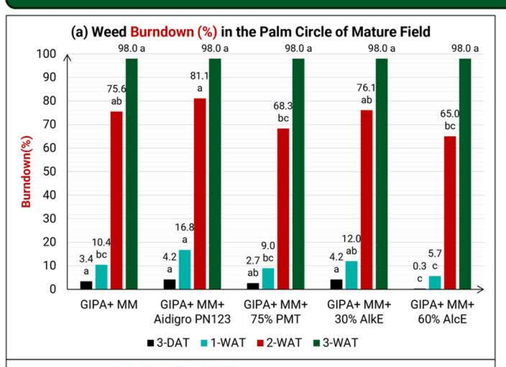


Table 4: *(%) of differences in weed burndown (%) at mature field: Aidigro PN123 compared to control (GIPA + MM only)*

Timepoint	(%) of differences: Aidigro PN123 compared to control (GIPA + MM)
3-DAT	+22.7%
1-WAT	+60.7%
2-WAT	+7.3%
3-WAT	0.0%

Table 5: *(%) of differences in weed regeneration (%) at mature field: Aidigro PN123 compared to control (GIPA + MM only)*

Timepoint	(%) of differences: Aidigro PN123 compared to control (GIPA + MM)
9-WAT	-17.1%
13-WAT	-26.9%
21-WAT	+2.7%

Figure 1: *Results of weed control census at mature field (2016 plantings). (a) Mean weed burndown (%) in palm circle; (b) Mean weed regeneration (%) in palm circle. Means that do not share the same letter are significantly different at P=0.05 under Fisher's LSD test.*

Immature Field

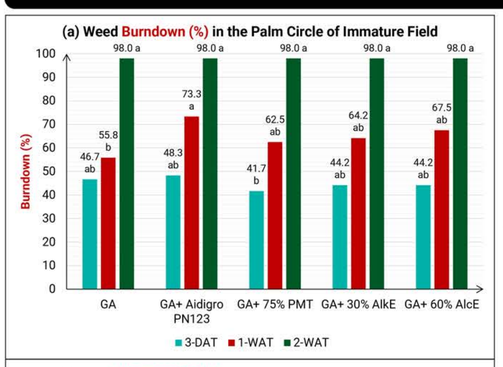


Table 6: *(%) of differences in weed burndown (%) at mature field: Aidigro PN123 compared to control (GA only)*

Timepoint	(%) of differences: Aidigro PN123 compared to control (GA)
3-DAT	+3.6%
1-WAT	+31.3%
2-WAT	0.0%

Table 7: *(%) of differences in weed regeneration (%) at mature field: Aidigro PN123 compared to control (GA only)*

Timepoint	(%) of differences: Aidigro PN123 compared to control (GA)
4-WAT	-42.8%
6-WAT	-29.8%
7-WAT	-10.5%

Figure 2: *Results of weed control census at immature field (2022 plantings). (a) Mean weed burndown (%) in palm circle; (b) Mean weed regeneration (%) in palm circle. Means that do not share the same letter are significantly different at P=0.05 under Fisher's LSD test.*

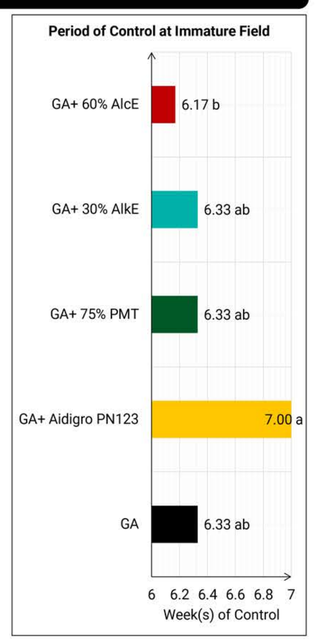


Figure 3: *Mean control period in immature field (2022 planting). Threshold for period of control: weed regeneration ≤ 50% in the palm circle. Means that do not share the same letter are significantly different at P=0.05 under Fisher's LSD test.*

Nursery Phytotoxicity Test:

- Aidigro PN123, together with other tested adjuvants, were safe to the oil palm seedlings when applied alone without herbicide(s) (0% seedling mortality rate, no burndown and no other visible phytotoxicity symptoms).

Mature Field Efficacy Trial:

- Aidigro PN123 performed the best across all tested adjuvants, which gave the highest weed burndown (%) from 3-DAT up to 3-WAT.
- In the context of suppressing weed regeneration in palm circle, Aidigro PN123 performed moderately well, whilst significantly better than the premium adjuvant commonly used (75% Polyether Modified Trisiloxane).

Immature Field Efficacy Trial:

- Aidigro PN123 consistently outperformed across all tested adjuvants, with the highest weed burndown (%) from 3-DAT up to 3-WAT, and lowest weed regeneration (%) from 4-WAT up to 7-WAT.
- Aidigro PN123 also gave the longest control duration across all tested adjuvants (7 weeks).

Conclusion:

- **This study showed that Aidigro PN123 could significantly enhance the weed control efficacy of herbicide(s) in both the mature and immature oil palm fields, and it was proven safe to oil palm seedlings (no phytotoxicity effect).**

Before Spraying	After Spraying (1-WAT)
GA + Aidigro PN123	GA + Aidigro PN123
	
GA only	GA only
	
GA + 75% Polyether Modified Trisiloxane	GA + 75% Polyether Modified Trisiloxane
	

REFERENCE

Motooka, P. (2003). Summaries of herbicide trials for pasture, range, and non-cropland weed control-2002. *Weed Control*, WC9.

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