



Effectiveness of isopropyl amine glyphosate herbicide 486 g/l for weed control in cultivation of immature oil Palm plants (*Elaeis guineensis* Jacq.)

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Abstract

Oil palm (*Elaeis guineensis* Jacq.) is a plantation commodity that has great prospects in Indonesia because it contributes to the country's foreign exchange and national economic development. Oil palm productivity is often hampered by the presence of weeds, especially in the immature plant phase. This study aims to evaluate the effectiveness of the herbicide Isopropyl Amine Glyphosate 486 g/l in controlling various types of weeds on immature plant phase oil palm. This research was conducted at an oil palm plantation in Pakenjeng District, Garut Regency, West Java Province, from December 2023 to April 2024. The experimental design used was a Randomized Group Design (RAK) with four replications and seven herbicide dose treatments, namely a dose of 1.5 l/ha; 2.0 l/ha; 2.5 l/ha; 3.0 l/ha; 3.5 l/ha; Manual weeding; and control (without treatment). The research results showed that a dose of 1.5 – 3.5 l/ha of Isopropyl Amine Glyphosate herbicide 486 g/l was effective in controlling the weeds *Synedrella nodiflora*, *Urena lobata*, *Cyperus rotundus*, and *Pueraria montana*. However, this herbicide is less effective against *Stachytarpheta jamaicensis* and is only effective against *Oplismenus compositus* up to 4 weeks after application (weeks). Overall, this herbicide application showed effective total weed control at 4, 8, to 12 weeks without causing phytotoxicity in immature plant phase oil palm plants. This research concludes that the herbicide Isopropyl Amine Glyphosate 486 g/l can be used as an efficient weed control method in immature plant phase oil palm cultivation.

Keywords: Oil palm, Weeds, Herbicide Isopropyl Amine Glyphosate 486 g/l

Introduction

Palm Oil (*Elaeis guineensis* Jacq.) is a plantation crop originating from South America and Africa (Guenia). This commodity has quite broad development prospects in Indonesia because it can help generate the country's largest foreign exchange, encourage the development of the national economic sector, and create energy sovereignty (Purba et al., 2018) ^[1]. The palm oil industry in Indonesia has an important contribution to the country's foreign exchange because it has a high trade balance surplus (Sehusman et al., 2022) ^[2]. Based on data from the Central Statistics Agency (2021), in several provinces in Indonesia there has been a decline in oil palm production. The cause of low oil palm productivity in Indonesia can be caused by the high level of weed competition when the plants are still young. The immature plant phase in oil palm is the phase before harvest which is calculated from planting until the first harvest. The immature plant phase in oil palm requires intensive maintenance because the plant does not yet have a canopy and the number of fronds, shoots and plant leaves is relatively small. This results in sunlight being able to enter the oil palm cultivation land easily and resulting in the growth of various types of weeds in the planting area.

Weeds can inhibit growth in oil palm cultivation because they result in competition for nutrients, sunlight and water (Khasanah et al., 2015) ^[3]. Therefore, effective and efficient weed control activities are needed to help increase oil palm production. Of the various existing control techniques, chemical control is a practice that is often used in oil palm cultivation because it can provide effectiveness and standardized control results (Khasanah et al., 2015) ^[3]. Chemical control can be done by using chemical compounds in the form of herbicides which can help inhibit and kill weed growth (Fuadi et al., 2018) ^[4].

Glyphosate herbicide is a herbicide that is often used because it has systemic properties so it can kill all parts of the weed by translocating the herbicide to all parts of the plant (Duke et al., 2012) ^[5]. The active ingredient glyphosate is known to kill target weeds if given in effective doses so that it can cause weed death. This research was conducted to examine weed control using the active ingredient Isopropyl Amine Glyphosate 486 g/l on the growth and yield of oil palm plants.

Methods

This research will begin in December 2023 to April 2024. The research location is located in the Palm Oil Plantation, Pakenjeng District, Garut Regency, West Java Province. The location is around 130 meters above sea level. Drying and analysis of weeds is carried out in the weed laboratory, Agricultural Cultivation Building, Faculty of Agriculture, Padjadjaran University. The equipment used in this research included a semi-automatic knapsack sprayer and T-jet nozzle, measuring cup, oven, scales, stationery, notebook, scissors and documentation tools. The materials used in this research were 2 year old Marihat Klom (MK) cultivar oil palm (immature plant phase), ZA fertilizer, TSP fertilizer, MOP fertilizer, kieserite fertilizer, pesticide, insecticide and herbicide JOEWUP 486 SL SL (Isopropyl Amine Glyphosate 486 g/l). The experimental design used in the field was a Randomized Block Design (RAK) which consisted of 7 treatments with 4 replications to obtain 28 experimental plots. The plot unit consists of 3 oil palm plants, each with a radius of 1–1.5 m. The distance between treatment plot units is one oil palm plant. Palm oil planting distance 9 m x 9 m x 9 m or according to local conditions. The treatments carried out and observed can be seen in table 1.

Table 1: Research Codes and Treatments

Code	Treatments	Dose (l/ha)
A	Herbisida Isopropil Amina Glifosat 486 g/l	1,50
B	Herbisida Isopropil Amina Glifosat 486 g/l	2,00
C	Herbisida Isopropil Amina Glifosat 486 g/l	2,50
D	Herbisida Isopropil Amina Glifosat 486 g/l	3,00
E	Herbisida Isopropil Amina Glifosat 486 g/l	3,50
F	Manual Weeding	
G	Control	

Application of the herbicide Isopropyl Amine Glyphosate 486 g/l is carried out once when weed coverage has reached 75%. Observation of the dry weight of weeds was carried out by cutting fresh weeds to exactly the level of the soil surface and separating each species. Then the weed is dried at a temperature of 80°C for 48 hours or until it reaches a constant dry weight, then weighed. Phytotoxicity or poisoning levels were observed visually in treatment plots and determined randomly. All observations will be observed at 4, 8, and 12 weeks.

Results and Discussion

Dry Weight of Weed *Synedrella Nodiflora*

Synedrella nodiflora is a type of broadleaf weed found in oil palm cultivation plants. Table 2 shows the results of dry weight data for the *Synedrella nodiflora* weed at 4 weeks conditions of treatment with various doses of the herbicide isopropyl amine glyphosate against the *Synedrella nodiflora*

weed, showing results that are not significantly different from the control. At 8 weeks conditions, isopropyl amine glyphosate herbicide with various doses of treatment showed significantly different results from the control treatment. The treatment dose of 1.5 l/ha at 8 weeks also showed a scoring result of 0, indicating that the herbicide isopropyl amine glyphosate at that dose was able to control the weed *Synedrella nodiflora*. The 12 weeks conditions in the table show that there are real differences between the various dose treatments and the control treatment. Based on the data in the table, it can be concluded that the herbicide treatment isopropyl amine glyphosate 486 g/l at a dose of 1.5 – 3.5 l/ha can control the weed *Synedrella nodiflora* effectively at 8-12 weeks. This is in line with the statement by the Pesticides Commission (2011), namely that glyphosate herbicide can control the weed *Synedrella nodiflora*.

Table 2: Data on dry weight of weed *Synedrella nodiflora*

	Treatment	Dose l/ha	Dry Weight (g)		
			4 Weeks	8 Weeks	12 Weeks
A	Isopropil Amina Glifosat 486 g/l	1,5	0,36a	0,00a	0,26a
B	Isopropil Amina Glifosat 486 g/l	2,0	0,00a	0,00a	0,04a
C	Isopropil Amina Glifosat 486 g/l	2,5	0,00a	0,09ab	0,25a
D	Isopropil Amina Glifosat 486 g/l	3,0	0,00a	0,03a	0,20a
E	Isopropil Amina Glifosat 486 g/l	3,5	0,00a	0,00a	0,33a
F	Manual Weeding		0,31a	0,35b	0,60a
G	Control		1,44a	1,89c	2,90b

Note: Results marked with the same letter in the same column indicate results that are not significantly different based on the Duncan Multiple Range Test at the 5% level.

Dry Weight of *Urena Lobata* Weed

Based on table 3, at 4 weeks conditions, treatment with various doses of the herbicide isopropyl amine glyphosate on the *Urena lobata* weed showed significantly different results from the control treatment. Apart from that, at a dose of 1.5-3.5 l/ha the scoring showed 0, which means the herbicide was able to control the *Urena lobata* weed well. Meanwhile, in conditions of 8 weeks, various dose treatments had significantly different results from manual weeding. According to Siregar et al (2021) [7], this weed is generally found in oil palm cultivation plants and is a type of weed that is few and difficult to find on land. At 8 weeks

of the control treatment, no *Urena lobata* weed was found in the field so the scoring showed the number 0. Apart from that, the herbicide can be said to be effective when compared with a better control and when compared with manual weeding it is the same or better. At 12 weeks conditions, the data showed that treatment with various doses of the herbicide isopropyl amine glyphosate did not show significant differences with the control treatment and manual weeding. So it can be concluded that the herbicide Isopropyl Amine Glyphosate 486 g/l at a dose of 1.5-3.5 l/ha is able to control the *Urena lobata* weed effectively at 4-8 weeks.

Table 3: Data on dry weight of *Urena Lobata* weed

	Treatment	Dose l/ha	Dry Weight (g)		
			4 Weeks	8 Weeks	12 Weeks
A	Isopropil Amina Glifosat 486 g/l	1,5	0,00a	0,00a	0,12a
B	Isopropil Amina Glifosat 486 g/l	2,0	0,00a	0,00a	0,00a
C	Isopropil Amina Glifosat 486 g/l	2,5	0,00a	0,00a	0,00a

D	Isopropil Amina Glifosat 486 g/l	3,0	0,00a	0,00a	0,00a
E	Isopropil Amina Glifosat 486 g/l	3,5	0,00a	0,00a	0,00a
F	Penyiangan Manual		0,06a	0,10b	0,14a
G	Kontrol		1,75b	0,00a	0,60a

Note: Results marked with the same letter in the same column indicate results that are not significantly different based on the Duncan Multiple Range Test at the 5% level.

Dry Weight of *Cyperus Rotundus* Weed

Cyperus Rotundus is a weed that is able to survive in various environmental conditions so it is considered a nuisance in agricultural areas. Table 4 shows the data results and dry weight of using various treatments of the herbicide Isopropyl Amine Glyphosate 486 g/l against the weed *Cyperus Rotundus* in oil palm plantations. In the 4 weeks condition, *Cyperus Rotundus* did not show any significant differences between each treatment. Meanwhile, in conditions of 8 and 12 weeks, the data showed that the

herbicide treatment dose of 1.5 – 3.5 l/ha Isopropyl Amine Glyphosate 486 g/l had significantly different results from the control treatment. So it can be concluded that the herbicide Isopropyl Amine Glyphosate 486 g/l at a dose of 1.5-3.5 l/ha can control *Cyperus Rotundus* weeds effectively at 8 and 12 weeks. This is in accordance with research by Oktavia (2019) ^[12] which states that the herbicide isopropyl amine glyphosate at a dose of 1080 – 2520 g ha⁻¹ can control the weed class *Cyperus Rotundus*.

Table 4: Data on Dry Weight of *Cyperus Rotundus* Weed

	Treatment	Dose l/ha	Dry Weight (g)		
			4 Weeks	8 Weeks	12 Weeks
A	Isopropil Amina Glifosat 486 g/l	1,5	0,24a	0,00a	0,35a
B	Isopropil Amina Glifosat 486 g/l	2,0	0,34a	0,15a	0,38a
C	Isopropil Amina Glifosat 486 g/l	2,5	0,53a	0,21a	0,00a
D	Isopropil Amina Glifosat 486 g/l	3,0	0,19a	0,10a	0,08a
E	Isopropil Amina Glifosat 486 g/l	3,5	0,00a	0,12a	0,00a
F	Penyiangan Manual		0,12a	0,13a	0,48a
G	Kontrol		0,41a	1,02b	2,28b

Note: Results marked with the same letter in the same column indicate results that are not significantly different based on the Duncan Multiple Range Test at the 5% level.

Dry Weight of Weed *Oplismenus Composite*

Oplismenus compositus is a grass class weed that generally grows on oil palm, rubber or coffee plantations. Table 5 is the data and dry weight results of using various treatments of the herbicide Isopropyl Amine Glyphosate 486 g/l against the weed *Oplismenus Composite* at 4, 8 and 12 weeks. The results showed that in the 4 weeks condition there were

significant differences between the various dose treatments and the control treatment. Meanwhile, at 8 and 12 weeks, the data showed that there were no real differences between the treatments. This shows that the herbicide Isopropyl amine glyphosate at a dose of 1.5 -3.5 l/ha is effective for controlling the grass class weed *Oplismenus compositus* optimally only at 4 weeks.

Table 5: Data on Dry Weight of Weed *Oplismenus Composite*

	Treatment	Dose l/ha	Dry Weight (g)		
			4 Weeks	8 Weeks	12 Weeks
A	Isopropil Amina Glifosat 486 g/l	1,5	0,16a	0,08a	0,24a
B	Isopropil Amina Glifosat 486 g/l	2,0	0,52a	0,16a	0,25a
C	Isopropil Amina Glifosat 486 g/l	2,5	0,00a	0,11a	0,17a
D	Isopropil Amina Glifosat 486 g/l	3,0	0,06a	0,07a	0,19a
E	Isopropil Amina Glifosat 486 g/l	3,5	0,00a	0,03a	0,10a
F	Penyiangan Manual		0,13a	0,23a	0,34a
G	Kontrol		1,42b	0,38a	1,65a

Note: Results marked with the same letter in the same column indicate results that are not significantly different based on the Duncan Multiple Range Test at the 5% level.

Dry Weight of Weed *Stachytarpheta Jamaicensis*

Stachytarpheta Jamaicensis is a broadleaf weed that often grows on cultivated plants and can produce allelopathic compounds that can inhibit the growth of other species (Solikin, 2016) ^[8]. Table 6 shows the data results and dry weight of using various treatments of the herbicide Isopropyl Amine Glyphosate 486 g/l against the weed *Stachytarpheta Jamaicensis*. Under conditions of 4, 8, and 12 weeks, the herbicide isopropyl amine glyphosate had no

significant differences between various dose treatments with manual weeding and control treatments. This shows that herbicides containing isopropyl amine glyphosate are less effective in controlling the weed *Stachytarpheta Jamaicensis*. The results of research by Supawan et al (2014) ^[9] show that the use of the herbicide isopropyl amine glyphosate on broad-leaved weeds can be less effective due to different responses from one weed to another and the uneven distribution of weeds.

Table 6: Dry Weight Data for Weed *Stracytarpeta Jamaicaensis*

	Treatment	Dose l/ha	Dry Weight (g)		
			4 Weeks	8 Weeks	12 Weeks
A	Isopropil Amina Glifosat 486 g/l	1,5	1,14a	0,30a	0,00a
B	Isopropil Amina Glifosat 486 g/l	2,0	0,20a	0,13a	0,00a
C	Isopropil Amina Glifosat 486 g/l	2,5	0,16a	0,06a	0,00a
D	Isopropil Amina Glifosat 486 g/l	3,0	0,00a	0,14a	0,00a
E	Isopropil Amina Glifosat 486 g/l	3,5	0,00a	0,04a	0,00a
F	Penyiangan Manual		0,22a	0,00a	0,16a
G	Kontrol		0,00a	0,97a	1,59a

Note: Results marked with the same letter in the same column indicate results that are not significantly different based on the Duncan Multiple Range Test at the 5% level.

Pueraria Montana Weed Dry Weight

Pueraria montana is a broad-leaf weed that can spread rapidly, even up to six times faster than initial vegetative spread. Table 7 is the data and dry weight results of using various treatments of the herbicide Isopropyl Amine Glyphosate 486 g/l against the *Pueraria Montana* weed. In the table it is known that the administration of the herbicide isopropyl amine glyphosate 486 g/l has a significant

difference between various dose treatments and the control treatment at 4 and 8 weeks. Meanwhile, at 12 weeks, there were no significant differences between the various dose treatments and the manual weeding treatment and the control. This shows that the herbicide isopropyl amine glyphosate 486 g/l at a dose of 1.5 – 3.5 l/ha can control *Pueraria Montana* weeds effectively only at 4 to 8 weeks.

Table 7: Data on Dry Weight of Weed *Pueraria Montana*

	Treatment	Dose l/ha	Dry Weight (g)		
			4 Weeks	8 Weeks	12 Weeks
A	Isopropil Amina Glifosat 486 g/l	1,5	0,00a	0,00a	0,00a
B	Isopropil Amina Glifosat 486 g/l	2,0	0,00a	0,00a	0,00a
C	Isopropil Amina Glifosat 486 g/l	2,5	0,00a	0,00a	0,00a
D	Isopropil Amina Glifosat 486 g/l	3,0	0,00a	0,05a	0,09a
E	Isopropil Amina Glifosat 486 g/l	3,5	0,00a	0,02a	0,03a
F	Penyiangan Manual		0,00a	0,06a	0,12a
G	Kontrol		2,67b	1,38b	0,08a

Note: Results marked with the same letter in the same column indicate results that are not significantly different based on the Duncan Multiple Range Test at the 5% level.

Total Weed Dry Weight

Table 8 shows the treatment of various doses of the herbicide isopropyl amine glyphosate, manual weeding, and control of the total weeds in the study. Based on the table, the herbicide isopropyl amine glyphosate at a dose of 1.5 – 3.5 l/ha has an average dry weight value that is different from the control treatment. This is in line with the statement by Kanissery et al (2019) [13] who said that herbicides

containing glyphosate can control more than 150 types of weed species because of their systemic nature. This is in line with research by Hermanto et al (2020) [10] which shows that the herbicide isopropyl amine glyphosate at a dose of 2.00 – 3.00 l/ha can control weeds and result in the death of weeds in immature oil palm plants within a short period of time. 6 days after application.

Table 8: Total Weed Dry Weight Data

	Treatment	Dose l/ha	Dry Weight (g)		
			4 Weeks	8 Weeks	12 Weeks
A	Isopropil Amina Glifosat 486 g/l	1,5	2,05c	0,52ab	0,98ab
B	Isopropil Amina Glifosat 486 g/l	2,0	1,19bc	0,51ab	0,76ab
C	Isopropil Amina Glifosat 486 g/l	2,5	1,13bc	0,52ab	0,46a
D	Isopropil Amina Glifosat 486 g/l	3,0	0,52ab	0,38ab	0,53a
E	Isopropil Amina Glifosat 486 g/l	3,5	0,00a	0,23a	0,45a
F	Penyiangan Manual		1,44bc	0,86b	1,83b
G	Kontrol		14,04d	4,25c	9,09c

Note: Results marked with the same letter in the same column indicate results that are not significantly different based on the Duncan Multiple Range Test at the 5% level.

Phytotoxicity of Immature Plant Phase Oil Palm Plants

Observations on the effect of the phytotoxicity level of the herbicide Isopropyl Amine Glyphosate 486 g/l on oil palm plants can be seen in table 14. Phytotoxicity is the main observation carried out with the aim of determining the effect of using the herbicide isopropyl amine glyphosate on

oil palm cultivated plants. Based on the table, various doses of the IPA herbicide Glyphosate 486 g/l do not cause symptoms of poisoning in oil palm plants. The poisoning score level for oil palm plants which was carried out visually at 4, 8, and 12 weeks showed a result of 0. Good

herbicide application, such as using the exact dosage used on oil palm plants, can make the herbicide safe to apply to immature oil palm plants. The research results of Yaman et

al (2021)^[11] also show that the application of the herbicide isopropyl amine glyphosate does not cause poisoning in oil palm plants.

Table 9: Table of Effect of Isopropyl Amine Glyphosate Herbicide 486 g/l on Palm Oil Phytotoxicity

	Treatment	Dose l/ha	4 Weeks	8 Weeks	12 Weeks
A	Isopropil Amina Glifosat 486 g/l	1,5	0	0	0
B	Isopropil Amina Glifosat 486 g/l	2,0	0	0	0
C	Isopropil Amina Glifosat 486 g/l	2,5	0	0	0
D	Isopropil Amina Glifosat 486 g/l	3,0	0	0	0
E	Isopropil Amina Glifosat 486 g/l	3,5	0	0	0
F	Penyiangan Manual		0	0	0
G	Kontrol		0	0	0

Note: Results marked with the same letter in the same column indicate results that are not significantly different based on the Duncan Multiple Range Test at the 5% level.

Conclusion

Based on the experimental results, it can be concluded that the herbicide treatment isopropyl amine glyphosate 486 g/l with doses starting from 1.5 l/ha is effective for controlling *Urena lobata* and *Pueraria Montana* weeds up to 8 weeks. In addition, the application of the herbicide isopropyl amine glyphosate 486 g/l is effective for controlling the weeds *Synedrella nodiflora* and *Cyperus Rotundus* at doses starting from 1.5 l/ha. Meanwhile, the *Oplismenus compositus* weed can only be controlled effectively up to 4 weeks. Meanwhile, the herbicide treatment of isopropyl amine glyphosate 486 g/l against the weed *Stachytarpheta Jamaicensis* was considered ineffective because it showed significant differences between the various dose treatments and the control treatment. Overall, the herbicide isopropyl amine glyphosate 486 g/l was effective for controlling total weeds on research fields at 4, 8, to 12 weeks. The results of research on the phytotoxicity of oil palm also showed that treatment with various doses of herbicide did not result in poisoning of oil palm plants.

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