

## The effectiveness of glyphosate isopropyl amine herbicide to control weeds in immature oil palm (*Elaeis guineensis* jacq.) plantations

Yayan Sumekar\*, Dani Riswandi, Denny Kurniadie

Faculty of Agriculture, Padjadjaran University, Jl Raya Bandung Sumedang KM 21, West Java, Indonesia

### Abstract

Oil palm (*Elaeis guineensis* Jacq.) Is a mainstay of industrial crops for the Indonesian economy which has survived during a prolonged economic crisis and is one of the plantation commodities that contribute a large foreign exchange to the country. Oil palm cultivation is faced with the presence of plant-disturbing organisms which are a problem. One of the plant-disturbing organisms in oil palm cultivation is the presence of weeds. The presence of weeds can cause many losses, including reducing production, reducing the quality of production, disturbing the work of farmers, etc. This study aims to determine the effectiveness of the Isopropyl Amine Glyphosate herbicide for weed control in oil palm plants. This study aims to determine the effectiveness of the herbicide Isopropyl Amine Glyphosate for weed control in oil palm plants. The research was conducted in Cinta Mekar Village, Serang Panjang District, Subang Regency, West Java Province from December 2019 to March 2020. This experiment used an experimental method with a randomized block design consisting of 7 treatments and 4 replications. The treatments consisted of the herbicide Isopropyl Amine Glyphosate at a dose of 360 g/ha; 480 g/ha; 600 g/ha; 720 g/ha; 840 g/ha; manual weeding; and Control. The results showed that the Isopropyl Amine Glyphosate herbicide dosage 360 - 840 g / ha was an effective herbicide in controlling broadleaf weeds such as *Borreria alata* and narrow leaf weeds such as *Axonopus compressus* and *Ottochloa nodosa* in oil palm cultivation. Herbicide Isopropyl Amine Glyphosate at all doses did not show symptoms of poisoning in immature oil palm plants.

**Keywords:** efficacy, isopropyl amine glyphosate, weeds, oil palm

### Introduction

Oil palm (*Elaeis guineensis*) is a mainstay of industrial crops for the Indonesian economy which has survived during a prolonged economic crisis and is one of the plantation commodities that contribute a large amount of foreign exchange for the country (Krismawati and Ahdia, 2013) [6]. Indonesia is the second largest producer of palm oil in the world after Malaysia. In the 2009/10 harvest season, this archipelago country produced 21 million tonnes of palm oil, which is nearly half of the world's palm oil production of 45 million tonnes. Another 18 million tonnes came from Malaysia. The projection for the next few years is estimated that Indonesia will occupy the first position. The market prospects for processed palm oil are promising, because the demand from year to year has increased quite significantly, not only domestically but also abroad (Purwanto, 2011) [9].

Oil palm (*Elaeis guineensis*) is an important plantation commodity in Indonesia and still has bright prospects for development. Oil palm is a crop with high economic value. The production of palm oil from year to year has increased this is accompanied by an increase in the area of oil palm, and of course the increase in production costs so that proper and efficient plantation management is needed to increase the quality and productivity of oil palm.

One of the efforts made to improve the quality and productivity of oil palm is by intensifying the land, however in land intensification there are obstacles, namely cultivation problems. The main obstacle that hinders oil palm productivity is the presence of weeds. Weed is a plant whose growth is undesirable and detrimental to farmers, so it needs to be controlled. The disadvantages caused by the

presence of weeds in general are competition in terms of nutrition, living space, CO<sub>2</sub>, water and sunlight. The losses will be even greater if weeds produce allelopathic substances that can suppress the growth of cultivated plants. Weed control that is often carried out on smallholder or state and private plantations includes manual, mechanical and chemical control (Sembodo, 2010) [11]. Weed control in immature oil palm plantations is generally carried out chemically using herbicides.

The herbicide that is often used in immature oil palm plates is the herbicide with the active ingredient glyphosate. The herbicide glyphosate is an herbicide that has a broad spectrum of control that is non-selective. The effectiveness of herbicides is determined by the dosage. The right dose of herbicide can kill target weeds, but if the dose is too high it will damage cultivated crops (Nurjannah, 2003) [7]. This study aims to determine the dosage of the herbicide Isopropyl Amine Glyphosate which is effective for controlling the total dry weight of weeds and group weeds on immature oil palm plant plates, changes in the composition of weeds on immature oil palm plant plates after the application of the Isopropyl Amine Glyphosate herbicide, and herbicide toxicity. Isopropyl Amine Glyphosate in oil palm plants is immature.

### Materials and Methods

The experiment was carried out at a Palm Oil Plantation in Cinta Mekar Village, Serang Panjang District, Subang Regency, West Java Province from December 2019 to March 2020. The material used in this experiment was the herbicide HAQUU 480 SL (Isopropyl Amina Glifosate 480 g / l). The oil palm cultivar used is Marihat Klon (MK) or

all recommended oil palm clones in oil palm plantations 1-4 years old. Fertilization using ZA: 750 g / tree; TSP: 300 g / tree; MOP: 1 kg / tree; kieserite 750 g / tree or adapted to cultivar needs and local plantation recommendations.

The experimental design used in this study was a randomized block design with 8 treatments and 4 replications.

Data processing is done with a variety analysis method. If the treatment shows a significant effect, then a further test is carried out on the difference in the average value at the 5% confidence level.

**Table 1:** Experiment Treatment

No	Treatment	Dose (g/ha)
1	Isopropil Amina Glifosat	360
2	Isopropil Amina Glifosat	480
3	Isopropil Amina Glifosat	600
4	Isopropil Amina Glifosat	720
5	Isopropil Amina Glifosat	840
6	Manual weeding	-
7	Control (no weeding)	-

Herbicides are applied using a semi-automatic knapsack sprayer and a T-zet nozzle with a pressure of kg/cm<sup>2</sup> (15-20 p.s.i). The volume of water used is 500 l/ha. The application of the herbicide Isopropyl Amine Glyphosate was carried out when weed coverage reached a minimum of 75%. The herbicide application is carried out only once.

#### Weed observation

Weed biomass sample data in each treatment plot unit were observed in two squares, using a square Amarade measuring 0.5 mx 0.5 m. The layout of the squares is determined systematically.

- Before application Weed sampling for biomass, density and frequency data was carried out before the application of the herbicide Isopropyl Amine Glyphosate, which is intended to analyze vegetation using the sum dominance ratio (SDR) technique.
- After application Weed sampling for biomass data was carried out at 4, 8 and 12 weeks after application. Examples of weeds taken are target weeds, namely weed species that are the target of the herbicide Isopropyl Amine Glyphosate such as broad-leaved weeds and narrow-leaved gilma. Fresh weeds are cut to the level of the soil surface, then separated each species. Furthermore, the weeds are dried at a temperature of 800C for 48 hours or until they reach a constant dry weight, then weighed.

#### Phytotoxicity

Toxicity levels were visually assessed against the cultivar population in treatment plots, observed at 2, 4 and 6 weeks after application. The scoring is as follows:

0 = No poisoning, 0 - 5% the shape and / or color of the leaves and or the growth of the oil palm plant is not normal.

1 = mild poisoning, > 5 - 20% leaf shape and / or color and / or growth of oil palm plants is not normal.

2 = moderate poisoning, > 20 - 50% the shape and / or color of the leaves and or the growth of the oil palm plant is not normal.

3 = severe poisoning, > 50 - 75% of the shape and / or color of the leaves and or the growth of the oil palm plant is not normal.

4 = very severe poisoning, > 75% of the shape and / or color of the leaves and / or growth of the oil palm plant is not normal.

## Results and Discussion

### Weed Composition before Application

Based on the results of the vegetation analysis, it was known that the vegetation composition of the target weeds consisted of 1 species of broadleaf weeds, namely *Borreria alata* (24.80%) and 2 species of narrow-leaved weeds, namely *Axonopus compressus* (15.81%), and *Ottlochloa nodosa* (18.34%).

**Table 2:** Composition of Dominant Weeds before Experiment

Weed name	Summed Dominan Ratio
<i>Borreria alata</i>	24.80
<i>Axonopus compressus</i>	15.81
<i>Ottlochloa nodosa</i>	18.34
<i>Ageratum conyzoides</i>	13.66
<i>Cleome ruidosperma</i>	9.12
<i>Synedrella nodiflora</i>	8.95
<i>Paspalum conjugatum</i>	9.33
Total	100.00

### Weed Dry Weight after Weed Application

#### *Borreria alata* weed

Based on the results of statistical analysis in Table 3, the treatment of the Isopropyl Amine Glyphosate herbicide at doses of 360-840 g/ha shows that the average dry weight of *Borreria alata* weeds is significantly different than that of the control treatment until observation 12 weeks after application. This shows that the treatment of the Isopropyl Amine Glyphosate herbicide in a dose of 360-840 g/ha is effective in controlling *Borreria alata* weeds. According to Nurjannah (2003) [7], the glyphosate herbicide has been translocated to all parts of the weed, especially the roots, which can cause weed death more effectively.

**Table 3:** Average dry weight of *Borreria alata* weeds

Treatment	Observation time (Weeks After Application)		
	4	8	12
A (Isopropil Amina Glifosat 360 g/ha)	2.13 b	2.27 b	2.47 b
B (Isopropil Amina Glifosat 480 g/ha)	0.17 a	0.28 a	0.39 a
C (Isopropil Amina Glifosat 600 g/ha)	0.10 a	0.15 a	0.12 a
D (Isopropil Amina Glifosat 720 g/ha)	0.08 a	0.12 a	0.12 a
E (Isopropil Amina Glifosat 840 g/ha)	0.06 a	0.10 a	0.09 a
F (Manual weeding)	1.39 b	2.06 b	3.64 b
G (Control)	11.37 c	14.43 c	18.29 c

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test

#### *Axonopus compressus* weed

The results of the observations in Table 4 show that the treatment of the Isopropyl Amine Glyphosate herbicide at doses of 360-840 g/ha shows that the average dry weight of *Axonopus compressus* weeds is significantly different compared to the control treatment at 4-12 weeks after application. This shows that the application of the Isopropyl Amine Glyphosate herbicide is effective in controlling *Axonopus compressus* weeds, this is because the glyphosate herbicide can last a long time in the soil and remain active so that it can suppress weed growth longer (Hermawan *et al.*, 1995) [4].

**Table 4:** Average dry weight of *Axonopus compressus* weeds

Treatment	Observation time (Weeks After Application)		
	4	8	12
A (Isopropil Amina Glifosat 360 g/ha)	0.11 a	0.04 a	0.00 a
B (Isopropil Amina Glifosat 480 g/ha)	0.03 a	0.00 a	0.00 a
C (Isopropil Amina Glifosat 600 g/ha)	0.00 a	0.00 a	0.00 a
D (Isopropil Amina Glifosat 720 g/ha)	0.00 a	0.00 a	0.00 a
E (Isopropil Amina Glifosat 840 g/ha)	0.00 a	0.00 a	0.00 a
F (Manual weeding)	0.68 a	0.00 a	2.67 b
G (Control)	6.88 b	7.55 b	8.96 c

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test

***Ottochloa nodosa* weed**

The results of statistical analysis showed that the treatment of Isopropyl Amine Glyphosate herbicide 360-840 g/ha was able to suppress the growth of *Ottochloa nodosa* weeds in the field. This can be seen from the average dry weight of weeds which was significantly different from the control treatment until the observation 12 weeks after application (Table 5). This is because glyphosate is an herbicide that has a broad spectrum of control, is applied post-growth, and is systemic in nature (Jatsiyah and Hermanto, 2020) [5].

**Table 5:** Average dry weight of *Ottochloa nodosa* weeds

Treatment	Observation time (Weeks After Application)		
	4	8	12
A (Isopropil Amina Glifosat 360 g/ha)	0.00 a	0.00 a	0.00 a
B (Isopropil Amina Glifosat 480 g/ha)	0.00 a	0.00 a	0.00 a
C (Isopropil Amina Glifosat 600 g/ha)	0.00 a	0.00 a	0.00 a
D (Isopropil Amina Glifosat 720 g/ha)	0.00 a	0.00 a	0.00 a
E (Isopropil Amina Glifosat 840 g/ha)	0.00 a	0.00 a	0.00 a
F (Manual weeding)	0.36 a	0.82 b	2.90 b
G (Control)	5.26 b	6.42 c	9.31 c

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test

**Other Weeds**

Another weed that grows on oil palm plantations is *Ageratum conyzoides*, *Cleome ruidosperma*, *Synedrella nodiflora*, and *Paspalum conjugatum*.

The results of the analysis conducted showed that the treatment of Isopropyl Amine Glyphosate herbicide dose 360-840 g/ha was able to suppress the growth of other weeds in oil palm plantations. This can be seen from the average dry weight of weeds which was significantly different from the control treatment until observation 12 weeks after application (Table 6).

**Table 6:** Average dry weight of other weeds

Treatment	Observation time (Weeks After Application)		
	4	8	12
A (Isopropil Amina Glifosat 360 g/ha)	0.00 a	0.00 a	0.00 a
B (Isopropil Amina Glifosat 480 g/ha)	0.00 a	0.00 a	0.00 a
C (Isopropil Amina Glifosat 600 g/ha)	0.00 a	0.00 a	0.00 a
D (Isopropil Amina Glifosat 720 g/ha)	0.00 a	0.00 a	0.00 a
E (Isopropil Amina Glifosat 840 g/ha)	0.00 a	0.00 a	0.00 a
F (Manual weeding)	0.12 a	0.49 a	2.07 b
G (Control)	4.45 b	5.38 b	7.14 c

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test

**Total Weeds**

The total weed dry weight is the dry weight of all weed species found in the test plot at the time of observation. The results of observations of total dry weight of weeds are presented in Table 7. The results of observations in Table 7 show that the treatment of Isopropyl Amine Glyphosate herbicide dose 360-840 g/ha shows the average total dry weight of weeds is significantly different compared to the control treatment at 4-12 weeks after application. This shows that the application of the Isopropyl Amine Glyphosate herbicide is effective in controlling total weeds, this is because glyphosate herbicide has a broad spectrum of control, is applied post-growth, and is systemic (Baillie, Thompson, & Little, 2017).

**Table 7:** Average total weed dry weight

Treatment	Observation time (Weeks After Application)		
	4	8	12
A (Isopropil Amina Glifosat 360 g/ha)	0.32 b	0.33 a	0.35 a
B (Isopropil Amina Glifosat 480 g/ha)	0.03 a	0.04 a	0.06 a
C (Isopropil Amina Glifosat 600 g/ha)	0.02 a	0.02 a	0.02 a
D (Isopropil Amina Glifosat 720 g/ha)	0.01 a	0.02 a	0.02 a
E (Isopropil Amina Glifosat 840 g/ha)	0.01 a	0.02 a	0.02 a
F (Manual weeding)	0.41 b	0.90 a	2.50 b
G (Control)	5.90 c	7.13 b	9.30 c

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test

**Phytotoxicity of Oil Palm Plants**

Phytotoxicity is an observation made on oil palm plants to determine the response of plants arising from exposure to herbicides. Plants that are poisoned will show symptoms such as chlorosis, necrosis, Abnormal growth or at a further stage the plant will experience death. Observation of the level of plant poisoning was carried out at 2, 4 and 6 weeks after application, this was done to determine the effect of herbicide doses on plant phytotoxicity. From Table 8, it can be seen that the application of the Isopropyl Amine Glyphosate herbicide at a dose of 360-840 g/ha does not show any symptoms of poisoning in immature mustard palm plants.

**Table 8:** Average Phytotoxicity of oil palm plants

Treatment	Observation time (Weeks After Application)		
	2	4	6
A (Isopropil Amina Glifosat 360 g/ha)	0	0	0
B (Isopropil Amina Glifosat 480 g/ha)	0	0	0
C (Isopropil Amina Glifosat 600 g/ha)	0	0	0
D (Isopropil Amina Glifosat 720 g/ha)	0	0	0
E (Isopropil Amina Glifosat 840 g/ha)	0	0	0
F (Manual weeding)	0	0	0
G (Control)	0	0	0

**Conclusion**

The Isopropyl Amine Glyphosate herbicide at dose 360 - 840 g/ha is an effective herbicide in controlling broadleaf weeds such as *Borreria alata* and narrow leaf weeds such as *Axonopus compressus* and *Ottochloa nodosa* in oil palm cultivation.

The Isopropyl Amine Glyphosate herbicide at all tested doses showed no symptoms of poisoning in immature oil palm plants.

**References**

1. Anjani ND. Resistensi Gulma Rumput *Axonopus compressus*, *Eleusine indica*, dan *Ottochloa nodosa* Asal Perkebunan Kelapa Sawit Lampung Selatan terhadap Glifosat. Fakultas Pertanian. Universitas Lampung, 2018.
2. Baillie BR, Thompson DG, Little KM. The Risk Associated with Glyphosate-Based Herbicide Use in Planted Forest. *Forest Journal*, 2017; 8(208):1-25.
3. Barus E. Pengendalian Gulma di Perkebunan: Efektivitas dan Efisiensi Aplikasi Herbisida. Kanisius. Yogyakarta, 2007, 105 hlm.
4. Hermawan W, Djulkarnain W, Pasaribu A, danTuharto. Efikasi beberapa campuran antaraherbisida glifosat 18% dengan herbisida selektiflainnya terhdap pengendalian gulma pada padisawah tanpa olah tanah. Prosiding Seminar Nasional V.: Budidaya Pertanian Tanpa Olah Tanah. Mei 1995. Bandar Lampung. Hlm. 1995; 8-9:1-4.
5. Jatsiyah V, dan SR Hermanto. Efikasi Herbisida Isopropilamina Glifosat terhadap Pengendalian Gulma Kelapa Sawit Belum Menghasilkan. *Agrovigor*. 2020; 13(1):22-28.
6. Krismawati Reni, Rizky Ahdia. Pengolahan Efluen Pond Fakultatif Anaerobik Ipal Industri Kelapa Sawit secara Fakultatif Anaerobik Fitoremediasi sebagai Preatment Media Tumbuh Algae. *Jurnal Teknologi kimia dan industri*. Semarang: Universitas Diponegoro, 2013.
7. Nurjannah U. Pengaruh dosis herbisida glifosat dan 2, 4 D terhadap pergeseran gulma dan tanaman kedelai tanpa olah tanah. *J. Ilmu-Ilmu Pertanian Indonesia*. 2003; 5(1):27-33.
8. Pardamean M. *Kupas Tuntas Agribisnis Kelapa Sawit*. Jakarta: Penebar Swadaya, 2017.
9. Purwanto Djoko. Arang Dari Limbah Tempurung Kelapa Sawit. *Banjarbaru: Jurnal Penelitian Hasil Hutan*, 2011.
10. Sastrosayono S. *Budidaya Kelapa Sawit*. Agromedia Pustaka. Jakarta. 60 hal, 2006.
11. Sembodo DRJ. *Gulma dan Pengelolaannya*. Yogyakarta. Graha Ilmu, 2010.
12. Wahyuni M. *Botani Dan Morfologi Kelapa Sawit*. Bahan Ajar Sekolah Tinggi Ilmu Pertanian Agrobisnis Perkebunan. Medan, 2007.