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Analysis the Use of Gempur 480 SL Chemicals on the Mortality of Weed Types

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Abstract: This study aims to determine the types of weeds that can be controlled or destroyed using the chemical Gempur 480 SL at PT. Toba Pulp Lestari Estate Tele. The method used in this research is a field survey method at 3 different masl by means of purposive sampling. Based on the research that has been done, it shows that the treatment of weed types found in Estate Tele is dominated by sedge weeds such as Cyperus rotundus and broad leaf weeds such as Boreria latifolia, Climedia hirta and Melastoma malabathtricum, while narrow leaf weeds such as Petridium (elephant fern), Stenochlaena (Vegetable ferns), Dicranopteris linearis (Wire ferns) are relatively few compared to sedge weeds and broadleaf weeds. The use of the concentration of the hebicide Gempur 480 SL of 1.25% can suppress weed growth where the percentage of dead weeds is higher. Weeding rounds have a significant effect on the percentage of weeds thatdie and the percentage of weeds that don't die. The highest percentage of weeds that died was in Weeding Round 3 (WR3). The interaction of herbicide concentrations and weeding rounds had a significant effect on the percentage of live weeds and the percentage of weeds that were not alive. The increase in the percentage of deadweeds will increase with the increasing concentration of the herbicide Gempur 480 SL, especially if the increased concentration of the herbicide Gempur is combined with Weeding Round 2 (WR2).

Keywords: Chemicals; Gempur 480 SL; Mortality of Weed

Introduction

The forestry sector is one of the important sectors that contributes to changes in greenhouse gas emissions in Indonesia (Kurniawan et al., 2022; Malahayati & Masui, 2019; Tacconi & Muttaqin, 2019). The results of the greenhouse gas (GHG) inventory carried out in the context of preparing the Second National Communication (SNC), shows that the Land use and Land Use Change in Forestry (LULUCF) sector contributes 48% of Indonesia's total emissions without peat fires (Adinugroho et al., 2019). Nonetheless, this sector has great potential to absorb carbon (sink) through forest growth and planting.

The amount of sector emissions that generally occur from deforestation, degradation, forests and fires can be reduced through efforts to reduce deforestation rates and control fires, especially on peatlands (Indartik et al., 2011; Meehan et al., 2019; Mishra et al., 2021; Saputra, 2019). Increasing the need for wood, both in quantity and quality, can no longer rely on natural forests alone. In line with that, the ever-increasing demand for wood from other sectors within the framework of national development has reduced the potential for natural conservation quantitatively. This situation demands that the government, in this case the Ministry of Forestry, need to take one step so that the timber market strategy can be fulfilled. Therefore, the government is prioritizing the development of Industrial Planted Forests (Azhar et al., 2020) with PT. Toba Pulp Lestari, Tbk as a manager, with the intention of increasing forest production as a provider of raw materials for the timber industry and expanding employment opportunities (Sitorus, 2006).

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Toba Pulp Lestari is a company engaged in the field of Industrial Planted Forests in the processing of pulp (pulp) from eucalyptus which is marketed domestically and abroad. PT. Toba Pulp Lestari, Tbk manages forests that are responsible for potential environmental risks that contribute to business and benefit employees, customers, shareholders and other stakeholders. PT. Toba Pulp Lesatari is a leading global company in the processing of Industrial Planted Forests and pulp production which has permits to manage 167,912 Ha of Industrial Planted Forests in North Sumatra located in five locations in North Sumatra, namely: Aek Nauli (20,360 Ha), Habinsaran (26,765 Ha), Tapanuli Selatan (28,340 Ha), Aek Raja (45,562 Ha), and Tele (46,885 Ha).

Herbicides are chemical substances or chemicals that suppress the growth of weeds and even kill them. Weed control by using herbicides is in great demand, especially for large areas of land, this is because herbicides are more effective at killing and controlling annual weeds and shrubs and increasing yields on staple crops compared to regular weeding. There are several advantages to using herbicides, namely: being able to control weeds before they interfere with staple crops, preventing damage to staple crop roots, being more effective in killing and controlling weeds, increasing staple crop production.

Systemic herbicides have types based on their active ingredients and trademarks (Heller et al., 2020; Nagy et al., 2020; Nefed'eva et al., 2021), including: Isopropylamine Glyphosate with trademarks such as; Bablass 490 SL, Bio Up 490 SL, Basmilang 480 SL. Round Up 486 SL. Gempur 480SL is a post-emergence systemic herbicide which is a herbicide used to control weeds that have grown and developed, both broad leaf weeds and narrow leaf weeds. Gempur 480SL herbicide in the form of a solution that dissolves in water with the active ingredient Isopropylamine Glyphosate 480 gram/liter, for controlling weeds in Industrial Plantation Forest, Cocoa Plantation, Rubber Plantation, Oil Palm Plantation, Coffee Plantation, as well as land without plants to prepare land for corn cultivation and tea.

Weeds are plants that grow in the planting area and are detrimental because they can cause a decrease in crop production (Colbach et al., 2019; Colbach et al., 2020; MacLaren et al., 2020). In addition, weeds can release allelochemical compounds which inhibit the growth of staple crops (Farooq et al., 2020; Scavo & Mauromicale, 2021). Weeds are divided into 3 groups, namely: sedge weeds, broadleaf weeds, and grass groups (Farida et al., 2022; Ummah, 2022).

Nutweed is a family of Cyperceae, which spreads the fastest and is difficult to control and/or eradicate (Amna et al., 2019; Widaryanto et al., 2021; Winarsih, 2020) because the breeding system for weeds in the puzzle group can be generative, i.e. propagating through seeds and vegetative, i.e. can reproduce through tubers or rhizomes, an example of weeds. principal at Pt. Toba Pulp Lestari in the Tele estate is Cyperus rotundus, a weed that is commonly found in open fields. Cyperus rotundus weed is highly adaptive and therefore a difficult weed to control (Hafsah et al., 2020; Kusnayadi et al., 2021). This is due to tubers or tubers which are modifications of the stems of these weeds that can reach a depth of one meter so that they can avoid chemical sprays. Apart Weed puzzle-tekian (Cyperus rotundus), several weeds that interfere with staple crops at PT. Toba Pulp Lestari on Tele Estate which are the main weeds include: Imperata cilindrica (Lalang), Ageratum conizoides (Bandotan), Lantara camara (Weeds with red flowers), Clidemia hirta (Sea urchins), Chromolaena odorata (White weed), Axonopus compressus (sweet grass weed), Boreria (potato weed), Petridium (elephant fern weed), Stenochlaena (vegetable fern weed), Dicranopteris linearis (Kawit fern weed), Melastoma malabathricum (Senduduk weed) (Smart book PT. TPL, Tbk).

Toba Pulp Lestari is a company engaged in the field of Industrial Planted Forests (HTI) in the processing of pulp (pulp) from eucalyptus which is marketed domestically and abroad (Tarigan et al., 2019). PT. Toba Pulp Lestari, Tbk manages forests responsibly against potential environmental risks contributing to business and profits for employees, customers, shareholders and other stakeholders.

For this reason, it is necessary to carry out an operation or activity for planting and maintaining plants safely by considering aspects of occupational safety and health. Planting is the core of success in obtaining the quality or quantity of eucalyptus that is ready for production. In line with that, there are many challenges faced from planting to ongoing maintenance such as: pest and disease disturbances, weeds or internal factors that result in disruption of optimal eucalyptus plant growth. Uncontrolled weed growth can inhibit the growth of eucalyptus plants, especially at a young age, because weeds can increase competition for nutrients from the soil, narrowing the space for eucalyptus plants to grow. Therefore, weed growth is important to be controlled and even destroyed to avoid stunting the growth of staple crops.

Weed control can be carried out through technical culture, mechanisms, physical, chemical and integrated control. One of the proper controls is by chemical control, among the existing weed control, chemical control is a quick control to kill target weeds. Chemical control uses chemicals in the form of selective herbicides to inhibit and kill weed growth (Fuadi & Wicaksono, 2018).

Method

Field research was carried out in the HPHTI area. PT.Toba Pulp Lestari, tbk North Tele sector, Dairi district, North Sumatra province. The location of the area (compartment) where the spraying research was carried out/carried out is: Compt. D047, Compt. D056, Compt. D143, Compt. D108, Compt. C029 and Compt C016. To observe the types of weeds that grow after no herbicide spraying (after 30 months). This research was conducted from August to September 2022.

The tools and materials used in this study included the Alpha 16 sprayer, the yellow Yamaha nozzle to be used for weeding rounds (wr) 1 to 5, the vunzet nozzle to be used for weeding d (wr) 6, baltank 1000 liters, drums, poison stirrers, rubber gloves, chemical masks, spray masks, work maps, paints, brushes, neat ropes, stationery, sheet straps, research area marks (compartments) and meters.

This study used a factorial randomized block design (RAF) with two treatment factors (da Silva Júnior et al., 2023). The first factor was the concentration of the herbicide Gempur (G) and the second factor was the Weeding Round. The data collection stage was used with a purposive sample, where the sample was determined by researchers who could represent (representative) the existing population of weed species (Ebitu et al., 2021). Each compartment consists of 3 research samples or plots with a size of 9 m x 8 m each. The number of compartments to be observed is 7 compartments, so the number of study plots is 21 plots.

Observation of weed mortality was carried out on all types of weeds in the research plot where what was observed on the weeds was the response of the weeds after the application of the herbicide demolished, in the form of dead weed leaves due to contact with the herbicide demolished. The more weed leaves that die as a result of the herbicide crushing, the higher the death rate of the weeds, this also results in disruption of the process of photosynthesis, absorption of nutrients by weeds from the soil. Observations were carried out from 10, 14 and 21 days after the application of the herbicide demolished.

Result and Discussion

General Conditions of Research Locations

In general PT. Toba Pulp Lestari Tbk. divided into 5 sectors which include the Aek Nauli sector with an area of 20,360 Ha, the Habinsaran Sector with an area of 26,765 Ha, the Tele Sector with an area of 46,885 Ha, the Aek Raja Sector with an area of 45,562 Ha and the Padang Sidempuan Sector with an area of 28,340 Ha.

Industrial Plantation Forest PT. Toba Pulp Lestari is a sustainably managed pulp company. In general, the operational activities of the 5 sectors include planting and harvesting activities. In addition to the 5 sectors contained in the company PT. Toba Pulp Lestari Tbk, we can also find 1 factory where eucalyptus sp wood is processed to be used as pulp which is located in Porsea Sosor padang village, Parmaksian sub-district, Toba district.

Field research was carried out in the HPHTI area. PT.Toba Pulp Lestari, tbk North Tele sector, Dairi district, North Sumatra province. The location of the area (compartment) where the spraying research was carried out/carried out is: Compt. D047, Compt. D056, Compt. D143, Compt. D108, Compt. C029 and Compt C016. To observe the types of weeds that grow after no herbicide spraying (after 30 months). This research was conducted from August to September 2022.

Each compartment consists of 3 research samples or plots with a size of 9 m x 8 m each. The number of compartments to be observed is 7 compartments, so the number of study plots is 21 plots. The results of the observations show that there are different types of weeds in each different plot on the study area which are presented in Table 1.

The highest number of weeds prior to herbicide application was found in plot G0WR1 with 667 weeds, while the least number of weeds was found in plot G1WR5 with 356 weeds. In each plot weeds are generally dominated by sedge weeds such as Cyperus rotundus and broad leaf weeds such as Boreria latifolia, Climedia hirta and Melastoma malabathtricum, while narrow leaf weeds such as Petridium (elephant fern), Stenochlaena (vegetable fern), Dicranopteris linearis (wire fern) are classified as less than the tekia weeds and broadleaf weeds.

Furthermore, after calculating the type and number of weeds in each treatment plot, spraying the herbicide Gempur 480 SL was carried out according to the predetermined treatment. From the results of the application of the herbicide Gempur 480 SL, the percentage of weeds that died and the percentage of weeds that were resistant were calculated.

Percentage of Dead Weeds (%)

Data on the percentage of weeds that died due to the influence of the herbicide concentration treatment of Gempur 480 SL and Weeding Round at the age of 21 days after spraying (HSP)

Table 1. Types of Weeds in PT. Toba Pulp Lestarik Tbk, Estate Tele

Treatment	Types of Weeds	Block I			Block II			Block III			Amount
		1	2	3	1	2	3	1	2	3	
G_0WR_1	Cyperus rotundus	15	22	32	32	15	15	9	12	4	156
	Boreria latifolia	24	18	3	25	4	9	5	10	12	110
	Climedia hirta	25	9	5	14	15	8	10	8	12	106
	Melastoma malabathtricum	32	7	15	12	12	12	6	2	17	115
	Chromolaena odorata	5	14	12	8	24	6	5	6	22	102
	Petridium	12	12	5	9	21	7	12	10	15	103
	Stenochlaena	10	9	3	2	13	12	2	4	3	58
	Dicranopteris linearis	9	5	12	3	15	10	8	5	6	73
	Total	117	74	55	73	104	64	48	45	87	667
G_0WR_2	Cyperus rotundus	9	15	15	9	9	10	6	9	7	89
	Boreria latifolia	8	18	13	8	7	11	7	9	8	89
	Climedia hirta	10	20	10	10	8	12	8	8	7	93
	Melastoma malabathtricum	12	22	9	8	9	9	9	8	9	95
	Chromolaena odorata	8	12	7	9	9	8	7	6	8	74
	Petridium	9	9	8	10	7	9	6	8	7	73
	Stenochlaena	13	8	12	12	6	7	7	9	7	81
	Dicranopteris linearis	2	10	10	10	8	9	9	10	7	75
	Total	62	99	69	67	54	65	53	58	53	580
G_0WR_3	Cyperus rotundus	12	9	15	15	21	10	12	8	9	111
	Boreria latifolia	9	9	8	12	4	9	5	10	12	78
	Climedia hirta	8	8	8	10	15	8	10	8	12	87
	Melastoma malabathtricum	7	7	9	10	12	12	6	2	17	82
	Chromolaena odorata	8	8	10	7	24	6	5	6	10	84
	Petridium	9	9	9	8	21	7	12	3	15	93
	Stenochlaena	8	9	8	9	13	12	2	5	6	72
	Dicranopteris linearis	9	9	10	5	15	10	8	4	5	75
	Total	58	59	62	61	104	64	48	38	77	571
G_0WR_4	Cyperus rotundus	8	12	8	8	9	8	11	7	8	79
	Boreria latifolia	9	15	8	6	8	8	12	7	7	80
	Climedia hirta	7	10	7	7	8	8	8	8	6	69
	Melastoma malabathtricum	5	11	6	7	5	8	7	6	6	61
	Chromolaena odorata	6	6	6	6	6	7	9	6	7	59
	Petridium	7	7	6	6	6	7	7	7	8	61
	Stenochlaena	8	6	7	7	7	9	6	8	7	65
	Dicranopteris linearis	9	7	8	7	8	6	6	7	9	67
	Total	51	62	48	46	48	53	55	49	50	462

Table 2. Percentage of Weeds that Died (%) Due to the Concentration of Gempur Herbicide

Treatment	WR_1	WR_2	WR_3	WR_4	WR_5	WR_6	Average
G_0	63.29abcd	58.04abc	76.26cdef	55.99ab	50.83a	58.97abcd	60.56a
G_1	77.56def	60.66abcd	62.68abcd	67.68abcde	71.00bcdef	69.17abcdef	68.13b
G_2	77.54def	87.59f	84.54ef	72.15bcdef	71.85bcdef	71.91bcdef	77.60c
Average	72.80bc	68.76ab	74.49c	65.27a	64.56a	66.69a	

BNJ $(G)_{0.05}$ = 5.07 BNJ $(WR)_{0.05}$ = 8.87 BNJ $(GxWR)_{0.05}$ = 19.21

The higher the concentration of the herbicide Gempur 480 SL used, the percentage of dead weeds increased following a positive linear regression curve. An increase in the concentration of the herbicide Gempur 480 SL by 0.25% will increase the percentage of dead weeds by 34.08%.

Table 2 shows that Weeding Round, the highest percentage of dead weeds was found in the WR3 treatment which was significantly different from WR4, WR5 and WR6 and WR2, but not significantly different from WR1. The percentage of dead weeds in the WR1 treatment was significantly different from WR4, WR5 and WR6, but not significantly different from WR2. The percentage of weeds that died between the WR4, WR5 and WR6 treatments was not significantly different. Effect of Weeding Round on the percentage of dead weeds.

Percentage of Weeds That Didn't Die (%)

Data on the percentage of weeds that did not die due to the influence of the concentration of the herbicide Gempur 480 SL and Weeding Round at the age of 21 days after spraying (HSP).

Table 3. Percentage of Weeds That Are Not Dead (%) Due to the Concentration of Gempur 480 SL and Weeding Round Herbicide

Treatment	WR_1	WR_2	WR_3	WR_4	WR_5	WR_6	Average
G_0	36.71	41.96	23.74	44.01	49.17	41.03	39.44c
G_1	22.44	39.34	37.32	32.33	29.00	30.83	31.87b
G_2	22.46	12.41	15.46	27.85	28.15	28.09	22.40a
Average	27.20ab	31.24bc	25.51a	34.73bc	35.44c	33.31abc	
BNJ $(G)_{0.05}$ = 5.07	BNJ $(WR)_{0.05}$ = 8.87		BNJ $(GxWR)_{0.05}$ = 19.21				

Based on Table 3 and Figure 2, information is obtained which includes the following: the higher the concentration of Gempur 480 SL herbicide used, the percentage of weeds that do not die decreases following a negative linear regression curve. The increase in the concentration of the herbicide Gempur 480 SL was 0.25 % will reduce the percentage of weeds that do not die by 34.08%. Table 3 shows that Weeding Round, the lowest percentage of weeds that did not die was found in the WR3 treatment which was significantly different from WR4, WR5 and WR6 and WR2, but not significantly different from WR1. The percentage of weeds that did not die in the WR1 treatment was significantly different from WR4, WR5 and WR6, but not significantly different from WR2. The percentage of weeds that did not die between the WR4, WR5 and WR6 treatments was not significantly different

The results of the test of variance showed that herbicide concentrations had a significant effect on the mortality of various types of weeds at PT. Sustainable Toba Pulp. Increasing the concentration of herbicides will increase the death of various types of weeds. The types of weeds found in Estate Tele are dominated by sedge weeds such as Cyperus rotundus and broad leaf weeds such as Boreria latifolia, Climedia hirta and Melastoma malabathtricum, while narrow leafed weeds such as Petridium (elephant fern), Stenochlaena (vegetable fern), Dicranopteris linearis (fern wire) is relatively few compared to sedge weeds and broadleaf weeds.

The results showed that the higher the concentration of Gempur herbicide used, the higher the percentage of weed mortality. The use of the herbicide Gempur at a higher concentration will increase the effectiveness of the herbicide (Soesanto, 2021), but the repeated use of the herbicide can result in the occurrence of resistance to various types of weeds that grow on the land.

The results also showed that there were several weeds that were resistant to the application of the herbicide Gempur. A weed population that is controlled using one type of herbicide with satisfactory results, there is a possibility that one individual out of millions of individuals given the herbicide has a gene that makes that individual immune to that herbicide. These resistant individuals grow normally and produce regeneration, a number of individuals that are also resistant to the same herbicide on subsequent herbicide applications. And so on repeatedly, each application of the same herbicide will kill sensitive individuals and leave resistant individuals. The number of resistant individuals at one point becomes significant and cause failure in control. On the other hand, because based on years of experience that with the same herbicide the results of controlling these species are always satisfactory, the herbicide will tend to continue to be used and increase the dose of the herbicide. Herbicide users do not realize that previously sensitive weed populations have now turned into resistant populations. If this happens and continues to be done, it will create weed control problems and higher control/herbicide costs.

Conclusion

Types of weeds on the land at PT. Toba Pulp Lestari Estate Tele such as tekian weeds such as Cyperus rotundus and broad leaf weeds such as Boreria latifolia, Climedia hirta and Melastoma malabathtricum, while narrow leaf weeds such as Petridium (elephant fern), Stenochlaena (vegetable fern), Dicranopteris linearis (wire fern) can be controlled by using Gempur 480 SL chemicals. The use of the concentration of the hebicide Gempur 480 SL of 1.25% can suppress weed growth where the percentage of dead weeds is higher. Gempur 480 SL chemicals are able to reduce the competition for absorption of staple crop nutrients with weeds due to their effectiveness in controlling/killing weed species.

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The authors declare no conflict of interest.

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