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MANAGEMENT OF WEEDS ON PINEAPPLE FARM USING SELECTIVE HERBICIDE ON PEAT SOIL

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ABSTRACT

Weeds pose problem to the production of pineapple by competing for nutrients, space, light and water. Pineapple production without good weed management could reduce yield and could cause insects infestation such as mealybugs that could spread serious disease for instance pineapple mealybug wilt-associated virus. Weed management using selective herbicide kills the weed without affecting pineapple plant growth and fruit quality. Four different selective herbicides were chosen with active ingredients of Atrazine, Ametryn, Bromacil and Diuron. Three frequencies of application were chosen which are 8, 10 or 12 weeks. The results of plant growth rate showed no significant different between treatment except on unweeded plot. Bromacil showed the best control on weed followed by Ametryn, Diuron and Atrazine over period of time. Eight weeks frequency of application did not differ to 10 weeks but both frequencies provide better weeds management over 12 weeks frequency of application. Major weeds species recorded were *Melastoma malabathricum*, *Asystasia gangetica* and *Fimbristylis pauciflora*. The used of selective herbicide is suitable in controlling weeds on pineapple plantation on peat soil without affecting plant growth rate.

Keywords: Selective herbicide, Pineapple, Peat soil, MD2

1. INTRODUCTION

Pineapple is a slow growth plant with shallow root system that put it at risk of competition with weeds that could interrupt plant growth consequently affecting fruit quality and yield. It is recommended to keep pineapple field clear with excessive weeds during 5-6 months after planting [1]. Slow growth of pineapple plant causes the weed to overgrow the plant faster.

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Altogether, weed extracted water and nutrients which are essential for pineapple plant growth [2]. Weed control using herbicide is an effective, cheap and fast method to control weed density as compared to manual weeding especially in large pineapple plantation. Usage of suitable herbicide helps controlling weed population without affecting pineapple plant growth in which will affect fruit quality and yield. Selective herbicide is a form of herbicide that kills selective weeds without causing phytotoxicity to the plant if applied with care [1]. Selective herbicide used in pineapple farm controls on broad-leaf weeds.

Frequency of selective herbicide application as stated by different herbicide commercial brands indicate different period of weed control ranging from 5-14 weeks. Four active ingredients (a.i.) used are Ametryn, Bromacil, Atrazine and Diuron. All four types of selective herbicide are inhibitor of electron transfer in photosystem II [3][4]. Ametryn could control weed for 5-10 weeks, Bromacil for8-10 weeks, Atrazine for 10-14 weeks and Diuron for 6-12 weeks. It is significant to test these selective herbicides to control weed especially on peat soil that could retain large amount of water that could disrupt herbicide control on weed. After herbicide application, active ingredients are absorbed by plant roots into internal plant system and disrupt activity of plant photosynthesis. Thus, it is crucial the application of herbicide is done during wet season so active ingredient molecule can be transported into the plant by roots.

Thus, this study was conducted to investigate the relationship between different active ingredients of selective herbicide correlates with different frequency of herbicide application to control weed population in pineapple plantation cultivated on peat soil.

2. MATERIALS AND METHODS

2.1 Field Preparation

A field study was conducted at Malaysian Agricultural Research and Development Institute (MARDI) Pontian, Johor, Malaysia (1°30' N latitude, 103°27' E longitude) from November 2020 until September 2021. Mean monthly precipitation on this area ranging from 160 mm to 320 mm all year round. Previously, the area was planted with MD2 pineapple that has been cleared using rotor slasher leaving the slashed pineapple leaves and stem on the ground before planting. This study was conducted using a randomized complete block design (RCBD) with thirteen treatments that consist of four types of selective herbicide; Ametryn, Bromacil, Atrazine and Diuron with three frequencies of application; 8, 10 and 12 weeks. Unweeded plot was used as control. The plot is divided into four blocks indicating four replication per treatment. Each subplot with size 3.35 m X 7.0 m was planted with double row of 64 (8 X 8) plants per plot with planting distance of 30x60x90 cm. Each individual plot was separated with a spacing of 1.8 m between each subplot to prevent selective herbicide drift during application. Pineapple suckers of

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MD2 variety with average length of 30 cm were obtained from Kulim Pineapple Farm, Ulu Tiram Johor where the pineapple suckers were treated with fungicide, fosetyl-aluminium before shipment to planting site. NPK fertilizer 15:15:15 was used on 3 and 6 MAP while NPK fertilizer 12:12:17:2 on 9 MAP. All type of fertilizers were applied through basal application with rate of 20 gram per plant for each application. Application of foliar fertilizer was made on 1.5 MAP and 4.5 MAP for 100 mL per plant with mixture of 32 g/L of hydrated lime, 2.1 g/L of copper sulfate, 2.1 g/L zinc sulfate and 2.1 g/L of iron sulfate. Urea with rate of 32g/L was added into foliar fertilizer mixture on 4.5 MAP. The plot was not irrigated and water level was maintained approximately 1.0 m throughout the study.

2.2 Selective Herbicide Application

Systemic herbicide with active ingredient; glyphosate-isopropylammonium (41.0% w/w) Monsanto with application concentration of 0.45% w/w was applied using sprayer 2 weeks before pineapple suckers planting. Four different selective herbicides Amepax 500 45% (w/w) a.i. Ametryn, Rimix 80 WP 80% (w/w) a.i. Bromacil, Rezim 90 WG 90% (w/w) a.i. Atrazine and CH Diuron 80 80% (w/w) a.i. Diuron were used based on recommended concentration of 3.2 L/ha, 2.0 kg/ha, 1.7 kg/ha and 2.5 kg/ha respectively. Herbicide was applied using 20L Backpack Knapsack Sprayer with full cone nozzle with application volume of 450L/hectare for each subplot in which spraying were done thoroughly within the subplot. Each subplot was separated with 2 m buffer zone and every herbicide application was made on clear early morning made to prevent drift effect of herbicide application. Three different frequencies of application were chosen which are 8, 10 and 12 weeks. Herbicide application for all treatment (except control) regardless of type of herbicide or frequency of application was started on 12 weeks after planting indicating suitable weed control by application of systemic herbicide before planting. For treatment of 8 weeks frequency, three applications of herbicide were done while for treatments of 10- and 12-weeks frequency of application only 2 applications were made.

2.3 Vegetative Growth of Pineapple Plants and Weed Population

Twenty plants from each treatment; five plants per replication of treatment were chosen randomly for vegetative growth data collection. Data collection included plant height, D-leaf length and width and number of leaves on 12, 24 and 36 weeks after planting. D-leaf on pineapple plant is the longest leaf on the plant [5]. The plant height was measured using a meter ruler and D-leaf length and width were measured with a 30 cm ruler. For number of leaves, the count was made on functional leaves only through manual counting. The control of each weed species by selective herbicide was assessed by expressing the number of weeds of a particular species as a percentage of the total number of weeds recorded during assessment from all

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treatment plots on 24 and 36 weeks after planting. Weed species is identified using Hand Book on Weed Identification by [6] and [7].

2.4 Data Analysis

Data for vegetative growth and plant biomass were analysed by one-way analysis of variance (ANOVA). The differences between means were separated using Duncan's multiple range test (DMRT) at 5% significance level. Statistical analysis was completed using SAS software version 9.3.

3. RESULT AND DISCUSSION

3.1 Plant Growth Performance

Growth performance of MD2 pineapple on early stage of development recorded insignificant difference between all treatments. This was due to weed control during early growth stage by systemic herbicide glyphosate before planting. This also indicates application of systemic herbicide before planting did not affects plant growth within early stage of plant development. Twelve weeks after planting, the first application of selective herbicide was accomplished. Thus, on 24 weeks after planting, the difference was observed on plant growth indicators between treatments especially on plant height of Atrazine+8W to control treatment, D-leaf width of Atrazine+8W to Bromacil+10W, Bromacil+12W and control treatment and number of functional leaves where control treatment recorded the lowest number. On 36 weeks after planting, in term of plant height, Atrazine+8W was better compared to Bromacil+10W and control treatment. D-leaf width displayed wider pineapple leaf of Atrazine+8W compared to Atrazine+10W and control treatment while number of functional leaves displayed lower number of leaves on Diuron+8W, Bromacil+10W, and Diuron+12W.

Based on plant growth performance, the data show irregular pattern to show significant weed control from all four selective herbicide except on Atrazine+8W where both data on 24 and 36 weeks after planting showed good growth performance compared to control.

3.2 Selective Herbicide Control over Weed Population

Weed population as displayed on fig. 1 recorded 17 major weed species, which are *Ageratum conyzoides, Asystacia gangetica, Borreria latifolia, Cleome rutidosperma, Commelina nudiflora, Cyperus zollingeri, Digitaria longifora, Echinochloa colonum, Emilia sonchifolia, Fimbristylis pauciflora, Hedyotis corymbosa, Jussiaea linifolia, Lindernia crustacean, Melastoma malabathricum, Melicopeptelefolia, Nephrolepis biserrata and Stenochlaena palustris*. Among these entire weed species, only three (3) species of weed recorded in higher number, which were

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Melastoma malabathricum, Fimbristylis pauciflora followed by *Asystacia gangetica*. These three weed species showed ineffective control by all four selective herbicides. Therefore, manual hand weeding is necessary to control these weeds especially *Melastoma malabathricum* and *Asystacia gangetica* where these two weeds' species could overshadow pineapple plant with its height.

Based on fig. 2, weed control of Ametryn, Bromacil and Diuron were slightly better compared to Atrazine over span of time regardless of frequency of application. Although 8W frequency of control showed better weed control compared to 10W and 12W but the data showed insignificant different between those three frequencies of application. This indicates it is unnecessary to apply frequent herbicide spray under 8 weeks of planting. Over time, longer period of control for Atrazine did have negative impact on weed control where 12W of frequency application recorded higher percent of weed recorded on field. This could be the reason plant growth performance of treatment Atrazine+8W was better compared to Atrazine+10W and Atrazine+12W. Conducting this study on multi-site of pineapple plantation with different soil type should shows interesting result since the population of weed based on other soil type will be different compared to peat soil with low pH value.

Cumulative data of weed control as shown on fig. 3 showed insignificant difference between frequencies of herbicide application indicating spraying of 8W was showing the same weed control as 12W. While, Atrazine was showing the weakest weed control as compared to the other selective herbicides. Despite the fact that Atrazine displaying the weakest weed control, it is indeed did not affecting plant growth performance. The same result was recorded for unweeded control plot despite having higher weed species within the plot.

Table 1: Growth performance of MD2 pineapple with weed control using different type of selective herbicide.

Treatment	WAP	Plant height (cm)	D-leaf length (cm)	D-leaf width (cm)	Number of functional leaves
All treatments	**12**	n.s.	n.s.	n.s.	n.s.
Ametryn + 8W	**24**	71.7 ^{ab}	65.6 ^{a}	5.53 ^{abc}	30.1 ^{bc}
Bromacil + 8W		71.5 ^{ab}	66.2 ^{a}	5.63 ^{abc}	30.4 ^{abc}
Atrazine + 8W		75.0 ^{a}	67.9 ^{a}	6.00 ^{a}	32.7 ^{ab}
Diuron + 8W		69.0 ^{ab}	63.3 ^{a}	5.48 ^{abc}	30.7 ^{abc}
Ametryn + 10W		72.6 ^{ab}	67.0 ^{a}	5.78 ^{ab}	29.7 ^{bc}

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Bromacil + 10W		68.2 ^{ab}	63.5 ^{a}	4.85 ^{c}	29.4 ^{bc}
Atrazine + 10W		69.9 ^{ab}	63.4 ^{a}	5.60 ^{abc}	31.6 ^{abc}
Diuron + 10W		73.0 ^{ab}	66.8 ^{a}	5.80 ^{ab}	33.7 ^{a}
Ametryn + 12W		73.7 ^{ab}	68.6 ^{a}	5.68 ^{abc}	29.4 ^{bc}
Bromacil + 12W		68.4 ^{ab}	63.3 ^{a}	4.83 ^{c}	31.3 ^{abc}
Atrazine + 12W		70.2 ^{ab}	64.2 ^{a}	5.35 ^{abc}	30.5 ^{abc}
Diuron + 12W		69.2 ^{ab}	64.1 ^{a}	5.45 ^{abc}	30.0 ^{bc}
Control (unweeded)		66.7 ^{b}	63.0 ^{a}	5.10 ^{bc}	28.5 ^{c}
Ametryn + 8W	**36**	86.9 ^{ab}	73.0 ^{a}	6.18 ^{abc}	42.5 ^{abc}
Bromacil + 8W		87.8 ^{ab}	75.8 ^{a}	6.15 ^{abc}	43.5 ^{abc}
Atrazine + 8W		89.8 ^{a}	76.8 ^{a}	6.65 ^{a}	45.2 ^{a}
Diuron + 8W		84.9 ^{ab}	73.0 ^{a}	5.89 ^{bc}	39.0 ^{c}
Ametryn + 10W		86.0 ^{ab}	73.7 ^{a}	6.43 ^{abc}	44.8 ^{ab}
Bromacil + 10W		83.8 ^{b}	73.1 ^{a}	6.03 ^{abc}	39.2 ^{c}
Atrazine + 10W		86.0 ^{ab}	73.8 ^{a}	5.80 ^{c}	45.2 ^{a}
Diuron + 10W		87.8 ^{ab}	75.3 ^{a}	6.53 ^{abc}	46.3 ^{a}
Ametryn + 12W		88.1 ^{ab}	76.1 ^{a}	6.60 ^{ab}	43.8 ^{abc}
Bromacil + 12W		86.9 ^{ab}	75.9 ^{a}	6.10 ^{abc}	42.2 ^{abc}
Atrazine + 12W		86.3 ^{ab}	71.8 ^{a}	6.10 ^{abc}	39.6 ^{bc}
Diuron + 12W		86.0 ^{ab}	74.4 ^{a}	5.95 ^{abc}	39.4 ^{c}
Control (unweeded)		84.7 ^{b}	73.5 ^{a}	5.80 ^{c}	39.5 ^{bc}

Note: Mean was analyzed by ANOVA. The different letter within each row indicates significant difference at $p \leq 0.05$ based on Duncan's multiple range test (DMRT). WAP (weeks after planting), n.s. (not significant)

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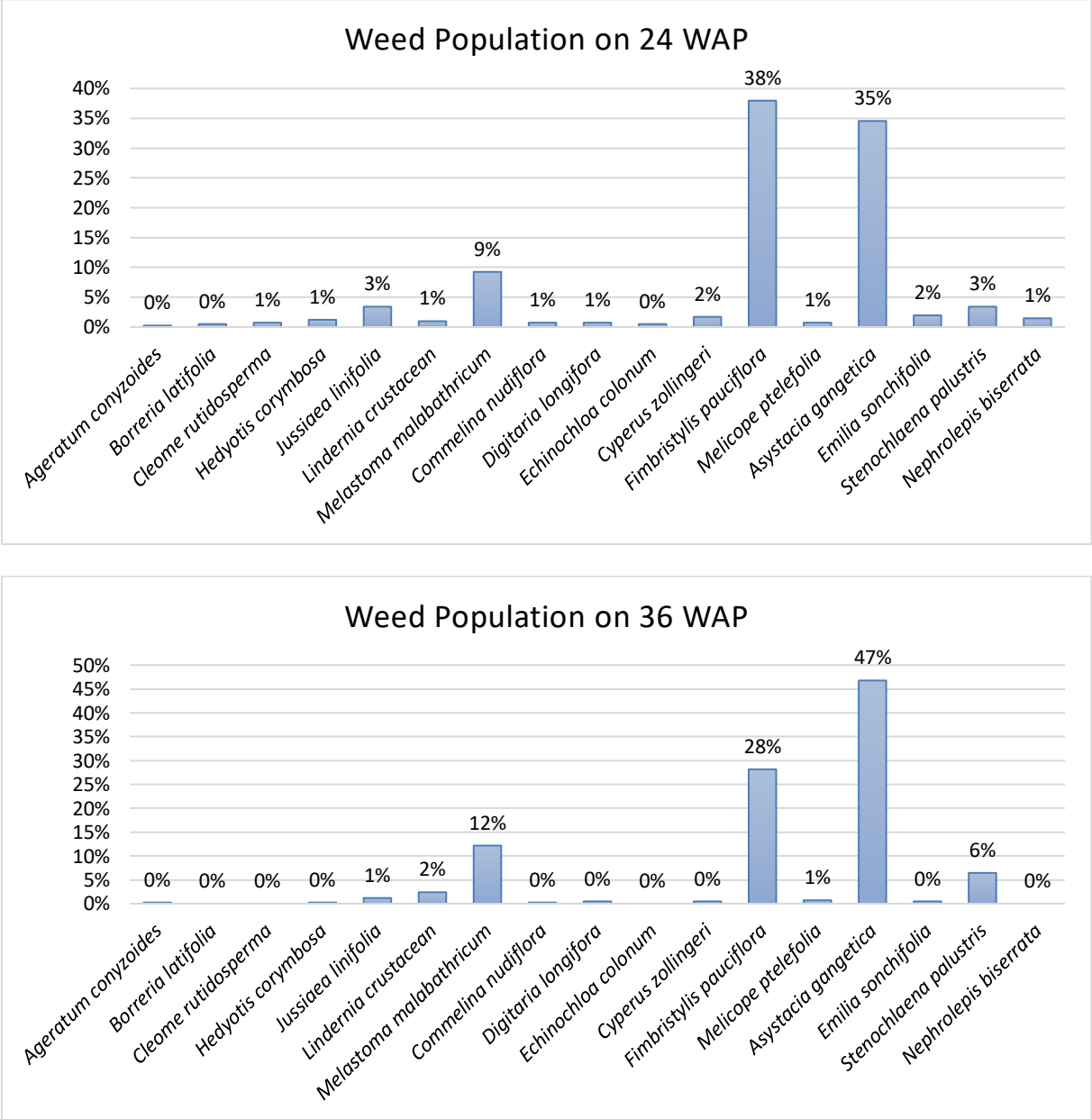

Figure 1: Weed population recorded on 24and 36weeks after planting.

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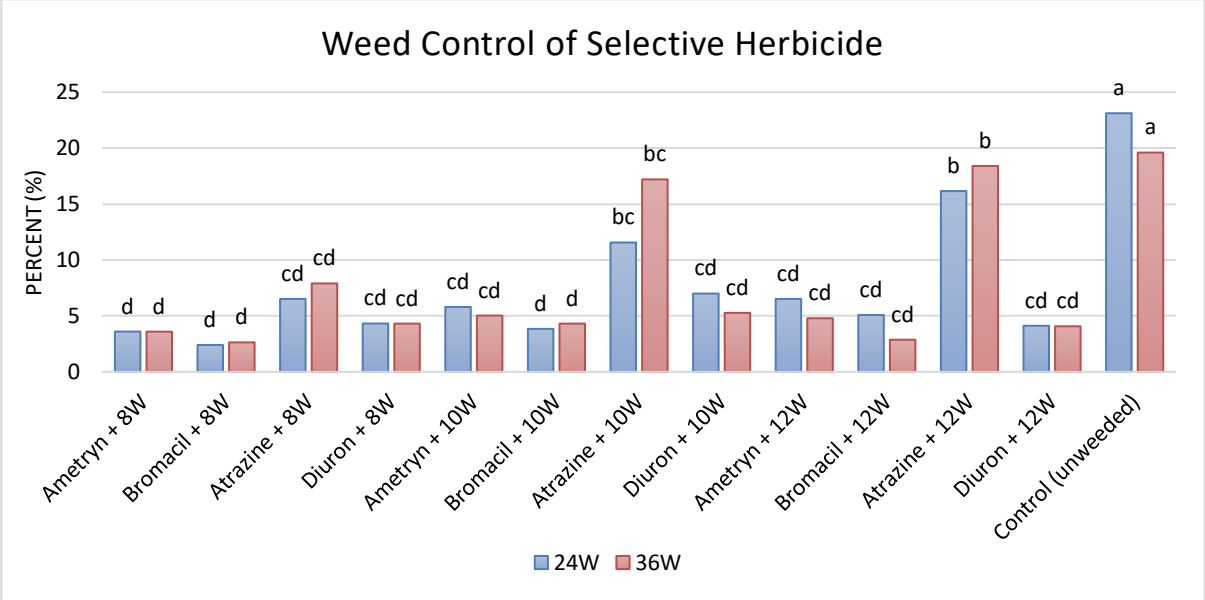

Figure 2: Weed control of different selective herbicide with different frequency of application on 24 and 36 weeks after planting. Mean was analyzed by ANOVA. Different letter between each bar with same colour indicates significant difference at $p \leq 0.05$ based on Duncan's multiple range test (DMRT).

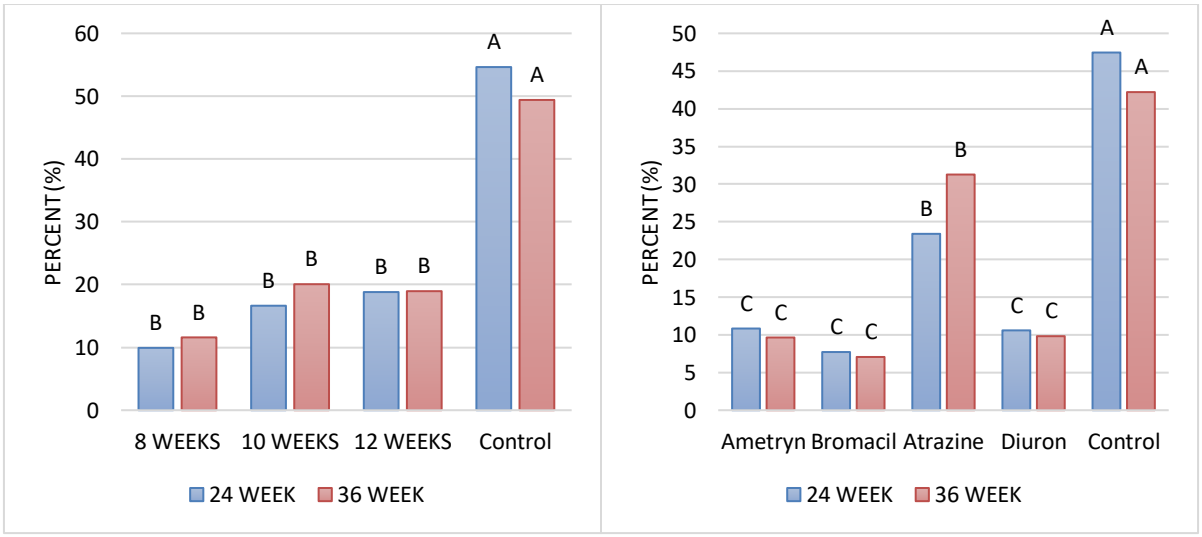

Figure 3: Weed control of different selective herbicide and different frequency of application on 24 and 36 weeks after planting. Mean is analysed by ANOVA. Different letter between each bar with same colour indicates significant difference at $p \leq 0.05$ based on Duncan's multiple range test (DMRT).

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4. CONCLUSION

Herbicide control of all selective herbicides showed good suppression of weed especially Bromacil followed by Ametryn, Diuron dan Atrazine. Frequency of 10 or 12 weeks application of herbicide suppress weed better than 8 weeks of application. Application of systemic herbicide during land preparation followed by weed control using selective herbicide with suitable frequency of application will control weed on pineapple plantation especially on peat soil pineapple plantation without affecting pineapple plant growth. Different soil type with different topography should result with different result due to different weed population inhabited within different soil type.

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