Effect of Herbicide Application on Asystasia Gangetica and Ottochloa Nodosa in Young Oil-palm Plantation

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Abstract: A field study was conducted to evaluate the effect of herbicide application on *Asystasiagangetica* and *Ottochloanodosa* in young oil-palm plantation. Experimental plots with the size of 3 x 3 m^2 each were laid in a randomized complete block design with 3 replications. The summed dominance ratio of *A. gangetica* and *Ottochloanodosa* were 32 and 37%, respectively. The treatments were Glyphosate-isopropyl ammonium 1.5 l/ha + Metsulfuron-methyl 150 g/ha; paraquat dichloride 2 l/ha and 2,4-D Dimethyl amine 2.5 l/ha and untreated control (water). The percentage of weed yellowing, weed killed, weed re-growth and wet weight and dry weight of weed was found to be significantly affected by herbicide application compared to untreated control. The result showed that Paraquat dichloride (2 l/ha) caused high weed yellowing on *A. gangetica* and *O. nodosa* (88.66 and 85%) at 4 Days After Treatment (DAT). Glyphosate-isopropyl ammonium 1.5 l/ha + Metsulfuron-methyl 150 g/ha caused low effect on *A. gangetica* and *O. nodosa* killed at initial (7 DAT) observation (21.66 and 13.33 %, respectively), but the percentage of weed killed increased consistently until 28 DAT (100 and 68.33%, respectively). Application of 2,4-D Dimethyl amine 2.5 l/ha caused weed re-growth to be low on *A. gangetica* (2.66%) whilst, Glyphosate-isopropyl ammonium 1.5 l/ha + Metsulfuron-methyl 150 g/ha and Paraquat Dichloride 2 l/ha was 17.66 and 38.33%, respectively. Paraquat dichloride 2 l/ha showed good effect at 7 DAT on *O. nodosa*, but there was high weed re-growth at 58 DAT (95%).

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1 INTRODUCTION

Weeds competed with cultivated crops for nutrients, such as water, light and space can result in significant crop losses. Weed infestation is severe especially during young stage of oil palm. Among different noxious weed species, *Asystasiagangetica* is frequently found in oil palm plantation (Samedani et al., 2013). *Asystasiaganetica* begins to be considered harmful because it can reduce yields on pineapple and palm oil. The weed spreads very quickly in most plantation (Wibawa et al., 2009) *Asystasiagangetica* is classified as noxious weed because of its ability to produce many seeds, and it is very difficult to be controlled. It suppresses oil palm yield by 13% (Rajanratmam et al., 1979). *Ottochloanodosa* is a tanned leafy annual grass that forms a "sheet". The flower is purple, shaped like a panicle with branches similar to the shape of barbed wire, growing in all directions. These weeds can produce many small seeds and are easily carried away by processing equipments and the population is easily dispersed. It is one of the dominant weeds in Bangun Bandar Palm Oil Plantation (Tantra and Santoso, 2016). *Ottochloanodosa* despite grows from the seeds, can also be reproduced by stems, especially at the bottom of soil, forming new roots and shoots (Nasution, 1986[b]). Therefore, it is difficult to eradicate mechanically.

Weed control by using herbicides is recognized to be an economical practice in oil palm plantations. It can reduce reliance on manpower for hand weeding which can delay operations in time of scarcity. Glyphosate and paraquat is a broadspectrum herbicide that is often used to control weeds in oil palm plantation (Tjitrosoedirdjo et al., 1984; Wibawa et al., 2009). Glyphosate is a systemic herbicide and acts as cell division and photosynthetic inhibitor.

The purpose of this study is to determine the effectiveness of some herbicides for weed control of *A. gangetica*and *O. nodosa.*

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2 MATERIALS AND METHODS

A field trial was set up in the Immature Plants Palm Oil Plantation, PT. FajarAgung Lestari North Sumatera, PerbaunganSerdangBedagai. The study was conducted on 6 April to 10 June 2017. Experimental plots with each size of 3 x 3 m^2 were laid in a randomized complete block design with 3 replications. The summed dominance ratio of*A. gangetica* and *Ottochloanodosa* were 32 and 37%, respectively. The other weeds were *Puerariajavanica*(15%) and mixed of *Cynodon*sp, *Colocasia*sp, *Centrocema*sp (14%).

The treatments were Glyphosate-isopropyl ammonium 1.5 l/ha + Metsulfuron-methyl 150 g/ha; Paraquat dichloride 2 l/ha; 2,4-D Dimethyl amine 2.5l/ha and untreated control (water). Spray volume was 450 l/ha using conventional Solo Knapsack Sprayer with red flat-fan nozzle of 5/64 inch orifice diameter, 1-1.5 bars pressure. Assessments were done on percent yellowing of treated weeds at 3 days after treatment (DAT) and percentage of weeds killed was carried out at 7, 14, 21, 28 DAT. Re-growth of weed was evaluated at 30, 44 and 58 DAT. Wet and dry weight of weed were also evaluated at 58 DAT (from square quadrate of 0.5 x0.5m).

One-way ANOVA was done to determine the effect of treatments on the weed. If ANOVA results were significant, LSD Test (P = 0.05) were used to separate the means. Data of weed yellowing, weed control and re-growth was normalized $\sqrt{x+0.5}$ (Gomez & Gomez, 1984) before analysis. All statistical analyses were run on the MINITAB Statistical Package (Minitab vol.16, 2010).

3 RESULTS AND DISCUSSIONS

Herbicides affected weed yellowing. Both *A. gangetica* and *O. nodosa* showed high weed yellowing (up to ±80%) caused by Paraquat dichloride 2 l/ha, whilst 2,4-D Dimethyl amine 2.5l/ha caused of 57.33 and 76.66%, respectively. Application of Glyphosate-isopropyl ammonium 1.5 l/ha + Metsulfuron-methyl 150 g/ha caused lowest *A. gangetica* and *O. nodosa* yellowing (23.33 and 43.33%) (Table 1).

The high effect of Paraquat dichloride 2 l / ha on *A. gangetica* and *O. nodosa* showed yellowing of leaves, and some of them were brown, even black , especially leaves at weed canopy. However, the leaves, stems and branches on the bottom position were still alive. Paraquat dichloride is a contact herbicide acting by inhibition of respiration and photosynthesis, destroying the plants foliar system (Sebayang, 2005).

Application of 2,4-D Dimethyl amine 2.5 l / ha caused 100% of *A. gangetica*killed at 21 DAT. It might causea selective herbicides, poisonous especially to broadleaf weeds, mainly absorbed by leaf and also through the soil. Whilst, Glyphosate-isopropyl ammonium 1.5 l/ha + metsulfuron-methyl 150 g/ha caused lowest *A. gangetica*killed at 7 DAT, and it increased consistently up to 100% at 28 DAT. Glyphosate is a systemic herbicide and it is much more effective against weed with translocated readily through the plant. Paraquat dichloride generally seems to be similar effective with 2,4-D Dimethyl amine 2.5 l/ha in controlling *A. gangetica*.

Paraquat dichloride 2l/ha caused high effect on*O. nodosa*killed (up to 80%) at 7 DAT, whilst Glyphosate-isopropyl ammonium 1.5 l/ha + metsulfuron-methyl 150 g/ha and 2,4-D Dimethyl amine 2.5 l/ha only caused weed killed 13.33 and 33.33%, respectively. Application of 2,4-D Dimethyl amine showed weed killed ranging 30 to 40% until 28 DAT, but Glyphosate-isopropyl ammonium 1.5 l/ha + metsulfuron-methyl 150 g/ha showed weed killed until 28 DAT and it caused 68.33% of weed killed. Generally, herbicides of 2,4-D Dimethyl amine 2 l/ha showed less effective in controlling *O. nodosa* (Table 1). According to Nasution (1986[a]) 2.4-D compounds included in selective herbicides, are toxic especially to broadleaf plants. The selectivity properties of 2,4-D herbicides occur on the basis of recovery in broad-leaved plants greater than that in tanning plants due to interception and higher spray solution retention.

Paraquatdichloride 2 l/ha showed high effect at early evaluation, but it decreased the effect at 14, 21, and 28 DAT. Control of *O. nodosa* with a paraquat herbicide did not show effective results because the stolen part of weeds was not exposed to herbicides. Consequently, new leaves continued to grow in the next period. According to Wibawa et al. (2009), some annual grasses may only be temporarily suppressed by paraquaat, because the low and enclosed growing points are not contacted by the spray.

A 38.33% *A. gangetica* re-growth was observed in the Paraquat dichloride 2 l/ha application. Observation at 58 DAT also indicated the faster re-growth duration than other application due to their relatively higher dry weights at 58 DAT (Table 2).

Application 2,4-D Dimethyl amine on *A. gangetica*(Table 2) showed the lowest weed re-

growth (2.66%). The herbicide was a selectiveherbicides, poisonous especially to broadleaf weeds, mainly absorbed by leaf and also through the soil.

The higher *O. nodosa* re-growth showed when it was applied with 2,4-D Dimethyl amine 2.5 l/ha (95%). According to Nasution's (1986[a]), the 2,4-D herbicide belongs to a selective herbicide, poisonous especially to broadleaf plants. Therefore, *O. nodosa* could dominate the area which was *A. gangetica* controlled. Wet and dry weight of *O. nodosa* were associated with the re-growth of *O. nodosa* at 58 DAT (Table 2). The heaviest wet weight of all herbicides treatments was found in treatment 2,4-D Dimethyl amine 2.5 l / ha (392 g), and it caused the observation of 58 DAT that*O. nodosa* re-growth reached 95%.

The lowest *O. nodosa* re-growth was shown at application of Glyphosate-isopropyl ammonium 1.5 l/ha + Metsulfuron-methyl 150 g/ha (50%), but the lowest wet and drry weight result was Paraquat dichloride 2 l/ha; this is caused at the time of re-growth observation, *O. nodosa* coverage was less, but the composition of leaves and stems in the lower layer was higher than that of paraquat dichloride 2 l / ha. Thus the wet and dry weight of *O. nodosa*caused by Glyphosate-isopropyl ammonium 1.5 l/ha + Metsulfuron-methyl 150 g/ application is more severe.

Tabel 1: Herbicides application effect on *A. gangetica* and*O. nodosa* (% yellowing and killed).

Herbicides	Weed Yellowing (%)		Weed Killed (%)							
			A.g.				O.n.			
	A.g.	O.n.	7 DAT	14 DAT	21 DAT	28 DAT	7 DAT	14 DAT	21 DAT	28 DAT
Control	0 c	0 c	0 c	0 b	0 c	0 b	0 c	0 b	0 b	0 c
Glyphosate-isopropyl ammonium 1.5 l/ha + Metsulfuron-methyl 150 g/ha	23.33 b	43.33 b	21.66 b	75 a	91 ab	100 a	13.33 bc	53.33 a	61.66 a	68.33 a
Paraquat dichloride 2 l/ha	81.66 a	85.00 a	78.33 a	80.33 a	83.33 b	93.33 a	80.66 a	68.33 a	55 a	25 b
2,4-D dimethyl amine 2.5l/ha	57.33 a	76.66 a	76.66 a	85 a	100 a	100 a	33.33 ab	38.33 a	40 a	30 b

Means in a column followed by different letters are significantly different (P = 0.05) by LSD Test.
A.g. (*Asystasiagangetica);* O.n. (*Ottochloanodosa)*

Tabel 2: Herbicides application effect on *A. gangetica* and*O. nodosa* (% regrowth and wet, dry weight).

Herbicides	Re-growth (%)						Weight (58 DAT)			
	A.g.			O.n.			A.g.		O.n.	
	30 DAT	44 DAT	58 DAT	30 DAT	44 DAT	58 DAT	Wet (g)	Dry (g)	Wet (g)	Dry (g)
Control	0	0 b	0 b	0 c	0 c	0 c	110.66 a	15.13 a	131.33 b	32.84 b
Glyphosate-isopropyl ammonium 1.5 l/ha + Metsulfuron-methyl 150 g/ha	0	8.33ab	17.66ab	31.66 b	38.33 b	50 b	29.33ab	2.49 b	280.33 a	76.67ab
Paraquat dichloride 2 l/ha	18.33	28.33 a	38.33 a	55ab	61.66ab	70ab	58ab	6.99ab	276.33 a	76.63ab
2,4-D dimethyl amine 2.5l/ha	0	1.66 b	2.66 b	71.66 a	86.66 a	95 a	0 b	0 b	392 a	111.28 a

Means in a column followed by different letters are significantly different (P = 0.05) by LSD Test.
A.g. (*Asystasiagangetica);* O.n. (*Ottochloanodosa)*

4 CONCLUSIONS

All of the treatedherbicides showed similar control of *A. gangetica* with a 90-100% weed killed, but 2,4-D dimethyl amine showed better results because it showed that the re-growth was less (2.66%). Herbicide ofGlyphosate-isopropyl ammonium 1.5 l/ha + Metsulfuron-methyl 150 g/ha showed good control on *A. gangetica* and *O. nodosa*, but this weed showed a high land dominate after *A. gangetica* was controlled.Paraquat dichloride 2 l/ha showed immediate effect both on *A. gangetica* and *O. nodosa*, but it also caused high *O. nodosa* re-growth.

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