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Effication of Herbicide 2,4-D dimethylamine 870 g/l against weeds in paddy rice crops (*Oryza sativa)*

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Abstract
This experiment aims to determine the efficacy of an herbicide with active ingridient 2.4 D dimethylamine 870 g / l to control common weeds in the cultivation of lowland rice plants. The experiment was conducted in Tomo, Kabupaten Sumedang, West Java on June until October 2019. The experimental design used was a randomized block design with 4 replications and 7 treatments. The treatment consisted of a dose of herbicide with an active ingridient 2.4 D dimethylamine 870 g / l which was a dose of 1.5; 2; 2.5; 3; 3,5 l/ha, manual weeding and control treatment (without weed control). The results showed that herbicide with active ingridient 2,4 D dimethylamine 870 g / l starting at a dose of 1.5 to 3.5 l / ha can control weeds Ludiwigia octovalvis, Sphenochloa zeylainica, Fimbristylis miliacea, Cyperus iria and overall weeds up to 6 MSA without causing any effects poisoning in lowland rice cultivation.

Keywords: herbicide, 2,4-D dimethylamine 870 g/l, weeds, lowland rice

Introduction
Rice (*Oryza sativa*) is now the staple food of Indonesia citizens. According to BPS data (2018) in 2030 Indonesia needs to produce about 59 million tons rice to fullfill the rice consumption. Therefore, to increase the yield production we need to trying improve for fullfill the rice consumption on the next 10 years. Weeds is one of the factors causing the low quality of rice production in quality and quantity. Weed is a plant that has a negative impact on plant growth because it can become a competitor in utilizing nutrients, water, light, CO2 and growing space, so humans try to control it (Kilkoda *et al*., 2015) [4]. Weeds can decrease rice yield by 10-25% in transplanting systems and more than 50% in direct seed planting systems.
Farmers commonly use chemical control by applying herbicide. The use of herbicides has a positive impact because it can control weeds in a relatively short time and can control weeds over a large area (Umiyati, 2005) [9]. 2,4-D is an active ingridient of herbicide which effective for control weeds such as *Limnocharis flava, Monochoria vaginalis, Salvinia natans, Cyperus iria, Fimbristylis milliaceae*, and *Scirpus juncoides* on rice (Sofnie *et al*., 2000) [7]. Herbicide efficacy influence by several factor the major factor is a dose, moreover the dose can also affect the efficiency of the cost (Girsang, 2005) [3]. This research was done to determine the best dose rate to control the weeds target.

Materials and Methods
This experiment was conducted in June 2019 until October 2019 in Tomo Village, Sumedang District. Dry weeds analysis was done at the Weed Science Laboratory, Faculty of Agriculture, Padjadjaran University. Materials used in this experiment include: Ciherang variety rice seeds, herbicide with active ingridient 2,4-D dimethylamine 870 g / l, fertilizers (NPK and urea), insecticides with active ingridient friponil 50 g / l. Tools used in this experiment include: hoes, ropes, treatment stakes, measuring cups, pipettes, analytical scales, semi-automatic back sprays and T-jet nozzles, ovens, and rulers. The experimental method is an experimental randomized block design (RBD) with one single factor is the dose of the herbicide 2,4-D dimethylamine 870 g / l. This experiment consisted of seven treatments.

Results and Discussion
Early Vegetation Analysis. Table 1 shows the data from the early vegetation analysis on the experimental land. Based on the results of the early vegetation analysis, the dominant weed species on the experimental field was Spenochlea zeylanica.

Table 1: Early Vegetation Analysis on Experimental Land

Name	Group	SDR
Spenochlea zeylanica	Daun lebar	31,21
Ludwigia octovalvis	Daun lebar	16,99
Fimbristylis miliacea	Teki	16,66
Cyperus iria	Teki	13,79
Echinochloa crussgalli	Rumput	7,09
Alternanthera philoxeroides	Daun lebar	5,74
Leptochloa chinensis	Rumput	4,60
Cyperus difformis	Teki	3,91
Total		100,0

Table 2: Phytotoxicity of Herbicide With Active Ingridient 2,4-D dimethylamine 870 g/l on Experimental

Treatments		Dose (l/ha)	Poisoning Rate		
			1 MSA	2 MSA	3 MSA
A	2,4-D dimethylamine	1.5	0	0	0
B	2,4-D dimethylamine	2	0	0	0
C	2,4-D dimethylamine	2.5	0	0	0
D	2,4-D dimethylamine	3	0	0	0
E	2,4-D dimethylamine	3.5	0	0	0

Information: 0 is for poisoning rate 0-5% on experimental land, MSA = Week After Aplication

Phytotoxicity

The results of observations of phytoxicity in lowland rice plants can be seen in Table 2. The observations show that the treatment of herbicides at a dose of 1.5 l / ha to 3.5 l / ha does not cause symptoms of poisoning in rice plants up to 3 MSA.

Weed dry weights

After applying the herbicide, weeds *S. zeylainica, L.octovalvis, F. mililiacea and C.iria* showed symptoms of damage such as the shape of the leaves becoming abnormal, followed by necrosis at the growing point and withered. The results of observations and analyzes of weed dry weights are presented in Table 3.

Table 3: Effect of Application Herbicide with active ingredient 2.4-D dimethyl amine 870 g/l Against Dried Weed Weights (g/0.25 m^2)

Treatments		Dose (l/ha)	Dried Weed Weights *S. zeylanica*		Dried Weed Weights *L. octovalvis*		Dried Weed Weights *F. miliacea*		Dried Weed Weights *C. iria*		Dried Weed Weights total	
			3 MSA	6 MSA	3 MSA	6 MSA	3 MSA	6 MSA	3 MSA	6 MSA	3 MSA	6 MSA
A	2,4-D dimethylamine	1.5	1,3b	1,91 b	1,58c	1,73b	1,43 c	1,66c	1,67b	1,71b	4.27b	3.72 c
B	2,4-D dimethylamine	2	0,2c	2,30 a	0,22d	1,43c	1,72b	1,51c	1,64b	1,69b	4.33b	3.35 c
C	2,4-D dimethylamine	2.5	0,2c	1,56 d	0,22d	0,22d	0,22d	1,44c	1,58b	1,47d	3.15 c	2.83 d
D	2,4-D dimethylamine	3	0,2c	1,71 c	0,22d	0,22d	0,22d	1,18d	0,22d	1,20e	1.71d	2.58 d
E	2,4-D dimethylamine	3.5	0,2c	1,54 d	0,22d	0,22d	0,22d	0,22e	0,22d	1,19e	1.54d	1.98 c
F	Manual Weeding	-	1,6a	1,74bc	2,24b	1,89b	1,58bc	2,82b	1,28c	1,60c	6.35 a	5.73 b
G	Without Weed Control	-	1,6a	2,39 a	2,49a	3,13a	3,41 a	4,55a	2,34a	3,31a	6.74 a	7.55 a

Information: MSA = Week After Aplication

The observations showed that the application of herbicide with active ingredients 2,4-D dimethylamine 870 g / l starting at a dose of 1.5 L / ha could minimize the weed dry weight which was significantly lower and significantly different from manual weed control and control until 6 MSA observation. Although for dry weeds C.iria at a dose of 1.5 - 2.5 l / ha has a higher weed dry weight when compared to manual weeding treatment, because C. iria is a weed that has a seed dormancy period, where the dormancy period of these weed seeds to germinate can reach 75 days (Caton *et al*., 2011) [2].

Application of active herbicide with active ingredients 2,4-D dimethylamine 870 g / l from each treatment showed that the higher the dose of herbicide used got the lower weed's dry weight. This is consistent with the statement of Moenandir (1990) [5] that higher concentration of the applied herbicide, may be increasing the ability of the herbicide to minimize the growth of weeds.

Components of rice plant growth

Based on Table 4 shows that the growth parameters in the form of height are not influenced by weed control treatment either applied by herbicide or by manual weeding. According to Sujitno., *et al* (2011) concluded that plant height is influenced by genetic traits and plant growing conditions. Based on this, the plant height in this experiment is relatively same and close to the plant height in the variety description due to genetic factors of the rice plant itself.

While the vegetative tillers parameters showed quite varied values. The variation of the number of rice tillers in the vegetative phase is likely due to the applied herbicide emphasizing the growth of weeds, there by expanding the plant's growing space. Such as the statement of Widayat (2015) [4], that the number of tillers is highly determined by competition in terms of growing space with weeds and the height of standing water in the active vegetative phase.

Table 4: Effect of Application Herbicide with active ingredient 2.4-D dimethyl amine 870 g/l Against Components of Plant Growth

No	Treatments	Dose (l/ha)	Plant Height (cm)		Vegetative Tillers	
			3 MSA	6 MSA	3 MSA	6 MSA
A	2,4-D dimethylamine	1.5	81.25a	100.5a	22.65b	29.6b
B	2,4-D dimethylamine	2	81.31a	101.2a	23.10b	30.7ab
C	2,4-D dimethylamine	2.5	81.41a	100.4a	25.43a	27.54 b
D	2,4-D dimethylamine	3	82.77a	102.1a	27.83a	33.18ab
E	2,4-D dimethylamine	3.5	81.47a	101.3a	26.55a	37.15 a
F	Manual Weeding	-	82.52a	102.7a	25.85a	27.37 b
G	Without Weed Control	-	82.68a	104.9a	22.35b	27.03 b

Information: MSA = Week After Aplication

Components of rice yield

The application of herbicide with active ingredients 2,4-D dimethylamine 870 g / l gave significant effect on the number of productive tillers, while the observational data showed that the weight value of 1000 grains with herbicide dosage treatment was significantly different when compared to control treatment, and not significantly different from manual weeding treatment. The same result is shown by the other yield component parameters, the number of heads.

The results of observational data show that the application of herbicide was significantly different compared to control, but not significantly different when compared to manual weeding. The decrease in the number of low-scale heads in the control treatment was caused by weeds that were not controlled at the critical period. Critical period is the period where the main crop is very sensitive or sensitive to weed

competition, so it needs to be controlled (Sukman and Jacob, 2002). As for the GKP yield, it can be seen that the application of herbicide gives positive results to the weight of the GKP obtained. According to Guntoro (2013) the magnitude of yield decrease caused by weeds is low and some are high, this is influenced by population density and weed composition.

Table 5: Effect of Application Herbicide with active ingredient 2.4-D dimethyl amine 870 g/l Against Components of Rice Yield

No	Treatments	Dose (l/ha)	Productive Tillers	1000 grains Weight (gram)	Jumlah bulir permalai	Hasil GKP	
						g/6,25 m^2	Ton/ha
A	2,4-D dimethylamine	1.5	24 ab	20.00 a	103.5 b	2120,8b	3,45
B	2,4-D dimethylamine	2	19.5 b	19.59 a	108 b	2072,3b	3,35
C	2,4-D dimethylamine	2.5	24.75 ab	20.60 a	117 b	2304,3b	3,68
D	2,4-D dimethylamine	3	29.25 ab	21.89 a	125.25 b	4393,8a	7,02
E	2,4-D dimethylamine	3.5	30 a	20.94 a	247.75 a	3784,0a	6,05
F	Manual Weeding	-	21 ab	20.26 a	114.5 b	2072,3b	3,31
G	Without Weed Control	-	12.25 c	16.84 b	79.75 c	870,14c	1,39

Information: MSA = Week After Aplication

Conclusions

1. Application of herbicides with active ingredients 2,4 D dimethylamine 870 g / l starting at a dose of 1.5 - 3.5 l / ha affects to minimize weeds in lowland rice cultivation and positively influences the yield of rice.
2. Herbicide with active ingredient 2,4 D dimethylamine 870 g / l starting with a dose of 1.5 l / ha is effective in controlling weed *Ludiwigia octovalvis, Sphenochloa zeylainica, Fimbristylis miliacea. Cyperus iria* and weeds total of up to 6 MSA.

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