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Effectiveness of 150 g/l metamifop herbicide dosage on weeds, growth and yield of ciherang cultivar lowland rice (*Oryza sativa* L.)

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Abstract
Weeds are one of the plant-disturbing organisms that are an obstacle in lowland rice cultivation in Indonesia because they can cause competition for nutrients, light, water, and space to grow. Herbicides are considered more effective in controlling weed populations in a relatively short time and covering large areas. One herbicide that can be used to control weeds in rice is a herbicide with the active ingredient metamifop. This study aimed to determine the effectiveness of the herbicide with the active ingredient metamifop 150 g/l in controlling weeds and its effect on lowland rice's growth and yield components. This experiment was carried out at the SPLPP Faculty of Agriculture, Padjadjaran University, Ciparay, Baleendah District, Bandung Regency, West Java, from June to September 2022. The research used an experimental method with Randomized Block Design with 6 treatments and 4 replications. The treatment consisted of the herbicide metamifop dose of 150 g/l with a level of 1.125; 1.50; 1,875; 2.25 l/ha, manual weeding, and control. The results showed that the herbicide metamifop 150 g/l at a dose of 1.125-2.25 l/ha was effective in controlling total weed up to 6 weeks after application without causing phytotoxicity to paddy. The herbicide metamifop 150 g/l affected the growth and yield of paddy.

Keywords: herbicide, metamifop, paddy, weed, ciherang

Introduction

Weeds are one of the plant-disturbing organisms that are an obstacle in lowland rice cultivation in Indonesia because they can cause competition for nutrients, light, water, and space to grow. Antralina (2012) [1] states that weeds commonly grow in paddy fields, including *Leersia hexandra, Sphenoclea zeylanica, Fimbristylis miliacea, Monochoria vaginalis, Echinochloa crus galli, Limnocharis flava, Cyperus diffformis*. Presence of weeds in the planting area paddy could be causing competition in fighting over nutrients, light, water, and space grow (Sarifin, 2017) [9]. Data on the national decline in lowland rice production due to weed disturbance reached 15-42% (Pitoyo, 2006) [6].

Using herbicides to control weeds is rated more effective in controlling the weeds population in a relatively short period and covers a large area (Umiyati *et al*., 2019) [14]. One of the herbicides that can be used to control weeds in paddy rice cultivation is the herbicide made from active metamifop 150 g/l. Herbicide metamifop is post-emergence or herbicide post-growth (Xia *et al*., 2016) [16]. based on how it works, metamifop is included in the systemic herbicides absorbed through the leaves and roots to inhibit the activity of *Acetyl-CoA Carboxylase* (ACCase) in the mitochondria so that the lipid synthesis becomes obstructed (McCullough *et al*., 2016) [5].

According to Simatupang *et al*., (2020) [11], besides the time and way of applying herbicide, the herbicide's effectiveness also depends on the dosage of the herbicide. If the dosage is too much, it could damage the cultivated plant. However, by using the correct dose, it will succeed in turning off the weeds that are being targeted (Sembodo, 2010) [10]. Therefore it is necessary to test the range of herbicide doses with the active ingredient metamifop 150 g/l, which can control weed growth and determine its effect on the growth and yield of Ciherang cultivar lowland rice.

Materials and methods

The experiment was carried out from June – September 2022. The experiment was carried out in Baleendah, Bandung Regency, West Java rice fields. The land is at an altitude of 660m above sea level (masl). The laboratory analysis was carried out at the Laboratory of weed, Faculty of Agriculture, Padjadjaran University, Jatinangor, Sumedang Regency, West Java.

The herbicide tested in this experiment was the active ingredient metamifop. The plant seeds used are Ciherang rice cultivars. Fertilization was carried out using urea fertilizer (45% N), TSP (46% P2 O5), and KCL (50% K2O). The tools used in this research are semi-automatic back spray and T-jet nozzle, measuring cups, bamboo stakes, scissors, analytical scales, hoes, sickles, plastic bags, rulers, labels, ovens, envelopes, winnowing, writing instruments, and documentation tools (camera).

This experiment uses the randomized block design consisting of 6 treatments (Table 1), and each treatment was repeated 4 times, so there were 24 experimental plots in total. The experimental units were 3m2 x 5m2 with a spacing of 25 cm2 x 25 cm2. The distance between plot units is 20-30 cm2.

Observations included analysis of weed vegetation, dry weights of dominant weeds and total weeds, phytotoxicity, plant height, amount of vegetative tillers, amount of panicles per clump, number of grains per panicle, the weight of 1000 grains of rice, as well as grain weight per plot.

Table 1: Treatment Herbicide Metamifop 150 g/l.

Treatment	Dosage (l/ha)	
A. Herbicide Metamifop 150 g/l	1.125	
B. Herbicide Metamifop 150 g/l	1.50	
C. Herbicide Metamifop 150 g/l	1,875	
D. Herbicide Metamifop 150 g/l	2.25	
E. Manual Weeding	-	
F. Control	-	

Results and discussion

Weight Dry Total Weed. All doses of metamifop 150 g/l process total weed dry weights significantly differed from weeding and control. Metamifop 150 g/l effectively controls broadleaf weeds, nuts, and grass. Xia *et al*., (2016) [16] stated that metamifop herbicides could significantly change the structure of the chloroplast in the form of an almost complete loss of thylakoid, disrupting grana formation and causing the chloroplast to have an irregular shape.

Table 2: influence application herbicide metamifop 150 g/l against weight dry total weed

Treatment	Dosage l/ha	Weight dry (gr)	
		3 WAA	6 WAA
A (Metamifop 150 g/l)	1.125	8.78 c	20.00 b
B (Metamifop 150 g/l)	1.50	5.18 b	13.43 a
C (Metamifop 150 g/l)	1,875	3.45 ab	9.62 a
D (Metamifop 150 g/l)	2.25	2.48 a	8.03 a
E (Manual weeding)	-	12.60 d	39.20 c
F (Control)	-	29.68 e	86.08 d

According to Duncan's test, the mean value marked with the same letter in the same column is similar at the 5% level. WAA = Week After Application

Phytotoxicity

Metamifop 150 g/l dose of 1.125 l/ha – 2.25 l/ha did not cause phytotoxicity in paddy. This is because herbicides are selective, so they do not cause poisoning in paddy but can kill weed targets (Barik *et al*., 2018) [4]. Paddy can produce catalase enzymes that resist chemicals such as herbicides and protect plants from the toxic effects of herbicides (Apriadi *et al*., 2013) [2].

Table 3: observation of phytotoxicity of paddy

Treatment	Dosage (l/ha)	Observation to		
		1 week	2week	3wek
A Herbicide Metamifop150g/l)	1.125	0	0	0
B (Herbicide Metamifop 150 g/l)	1.50	0	0	0
C (Herbicide Metamifop 150g/l)	1,875	0	0	0
D (Herbicide Metamifop 150 g/l)	2.25	0	0	0
E (Manual Weeding)	-	0	0	0
F (Control)	-	0	0	0

0 = Not poisoned, 0-5% leaf shape or leaf color and or abnormal plant growth. WAA = Week After Application.

Based on the number of panicles per clump in Table 4, the results were not significantly different from weeding and significantly different from controls. These results indicated that all herbicide treatments positively affected the number of panicles. According to (Sumekar *et al*., 2021) [12] Application of herbicides can control the competition between paddy and weeds so that plant growth and the photosynthetic partition used to form panicles will increase.

Table 14 shows that metamifop 150 g/l dose of 1.125 l/ha and 1.50 l/ha gave total grains per panicle, which were not significantly different from manual weeding and significantly different from control. However, doses of 2.25 l/ha gave different results actual with manual weeding and control. This show that the whole metamifop gives equivalent results with treatment manual weeding and increases the average grain fruity per panicle and enhancement dose. In line with the study by Saha *et al*., (2018) [7], the sum of grains per panicle is the highest obtained from the treatment with the herbicide metamifop compared with the treatment oxyfluorfen herbicide.

The weight of 1000 grains of rice in table 4 shows that metamifop 150 g/l at s dose 1.125 l/ha – 2.25 l/ha gave results that were not significantly different from weeding and significantly different from control. All treatments of the metamifop herbicide 150 g/l produced a weight of 1000 grains corresponding to the description of the Ciherang variety rice, namely 27-28 grams (BBPP, 2011). According to Widayat *et al*., (2017), the decrease in the weight of 1000 rice grains in the control plot was due to competition between the paddy and several weed species growing in the control plot.

The grain yield per plot in Table 4 shows that metamifop 150 g/l with a dose of 1,125 l/ha gives no actual results with weeding and different real with control. The herbicide metamifop 150 g/l with a dose of 1.50 – 2,25 l/ha gave the highest yield of 9,68 – 9,94 ton/ha. This show that metamifop 150 g/l dose 1.125 l/ha – 2.25 l/ha gives equivalent results with weeding and can increase results harvest rice. In line with the study by Saha *et al*., (2018) [7], those using metamifop 150 g/ha – 200 g/ha were able to produce a high grain yield per plot.

Table 4: The Effect of Application Metamifop 150 g/l Herbicide on Yield Components of Paddy

Treatment	Dosage l/ha	Amount Panicles per clump	Amount of grains per panicle	1000 Grain Weight (g)	grain Dry Grind (ton/ha)
A (Herbicide Metamifop 150 g/l)	1.125	23.88 b	96 ab	27.47 b	8,04 b
B (Herbicide Metamifop 150 g/l)	1.50	25.45 b	102 bc	28.72 c	9,58 c
C (Herbicide Metamifop 150 g/l)	1,875	25.93 b	105 bc	28.26 bc	9,85 c
D (Herbicide Metamifop 150 g/l)	2.25	24.43 b	113 c	28.13 bc	9,94 c
E (Manual Weeding)	-	24.15 b	91 ab	27.54 b	7,83 b
F (Control)	-	19.45 a	81 a	25.28 a	5,20 a

According to Duncan's test, the mean value marked with the same letter in the same column is similar at the 5% level. WAA Week After Application

Conclusion

1. Herbicide with the active ingredient metamifop 150 g/l at a dose of 1.125 l/ha – 2.25 l/ha is effective in suppressing the growth of total weeds up to 6 WAA and non-phytotoxic to Ciherang cultivar paddy rice.
2. Herbicide with the active ingredient metamifop 150 g/l at a dose of 1.125 l/ha – 2.25 l/ha gave optimal results for plant height, number of vegetative tillers, number of panicles per clump, number of rice grains per panicle, the weight of 1000 grains of rice and yield dry milled grain (GKG). The herbicide metamifop 150 g/l with a dose of 1.50 – 2,25 l/ha gave the highest yield of 9,68 – 9,94 ton/ha.

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