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Effect of the mixture herbicides bispyribac sodium 150 g/l and cyhalofop-butyl 50 g/l on growth and the yield of paddy rice (*Oryza Sativa* L.) cultivar SR-P08

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Abstract
Weeds are one of the organisms that interfere with plants and can reduce rice productivity because they compete directly for nutrients, light, water, and growing space. Controlling weeds using systemic and selective herbicides is considered more effective in controlling weeds in rice cultivation than other methods. This study aims to determine the effective mixture dosage of the herbicides Bispyribac Sodium 150 g/L and Cyhalofop-Butyl 50 g/L at a rate of 50–150 ml/ha to suppress weed growth and enhance the productivity of irrigated rice crops of the SR-P 08 variety. The study was conducted from August to December 2024 at the SPLPP Faculty of Agriculture, Padjadjaran University. The study was conducted using a Randomized Block Design with 7 treatments and 4 replications. The treatments consisted of the following herbicide mixture doses: Bispyribac Sodium 150 g/L and Cyhalofop-Butyl 50 g/L at rates of (A=50 ml/ha), (B=75 ml/ha), (C=100 ml/ha), (D=125 ml/ha), (E=150 ml/ha), (F=Manual weed control), and (G=Without weed control). The results showed that the herbicide mixture of Bispyribac Sodium 150 g/L and Cyhalofop-Butyl 50 g/L at doses of 50–150 ml/ha effectively suppressed the weight of broadleaf (*Monochoria Vaginalis, Ludwigia Octovalvis*) sedge (*Cyperus iria*), grasses (*Echinochloa crussgalli*) and total weeds up to 6 weeks after sowing and had a positive effect on the growth and yield of the rice variety SR P-08.

Keywords: Herbicide, bispyribac sodium 150 g/L + cyhalofop butyl 50 g/L, weeds, variety SR-P08, paddy rice

Introduction

Rice is one of the main food crops for the majority of the world's population, especially in Indonesia, with rice consumption reaching 111.58 kg per capita per year (Kementerian Pertanian, 2019) [11]. According to Badan Pusat Statistik (2019) [2], total rice production in Indonesia in 2019 reached approximately 54.60 million tons of milled rice, a decrease of 4.60 million tons (7.76%) compared to 2018 production, which reached 59.20 million tons (Herdiyanti *et al*., 2021) [8], Therefore, solutions are needed to maintain food stability through the use of high-yielding varieties such as SR P-08, which can be harvested in 70 days, has the potential to yield 10-12 tons per hectare, and is adaptable to various types of land (Tani Makmur Nusantara, 2023) [19].

One of the causes of declining rice production is weeds, in addition to shrinking land area. Weeds are plants that grow in undesirable places because they can affect and reduce crop production (Syarifah *et al*., 2018) [18]. The presence of weeds in rice crops can lead to reduced production if weeds are not controlled during this critical period, resulting in significant yield losses, ranging from 44% to 96% depending on the type of weed and its density (Kusumaningtyas and Suryanto, 2022) [13].

According (Kementerian Pertanian, 2011) [10], weeds can be controlled through four methods, namely mechanical weed control, technical culture, biological control, and chemical control using herbicides. Chemical control is considered the most effective and efficient method for addressing weed problems, as it can handle weeds on a large scale with less time and effort, and can specifically target certain types of weeds without damaging the main crop.

Weed control with herbicides generally uses a single active ingredient or single herbicide, the repeated and long-term use of which can cause problems, such as the emergence of herbicide-tolerant weeds, requiring increased doses for effective control. The use of high herbicide doses poses a risk of environmental damage, including ecosystem damage due to the large amount of herbicide residues in the environment (Hager and Sprague, 2000) [6]. However, there is an alternative to reduce the dose and minimize the negative impact on the environment, which is to mix several herbicide active ingredients (Rao, 2000) [16].

Advances in technology in mixing herbicides with different active ingredients have been made to broaden the spectrum of weed control, reduce the risk of resistance to a single type of herbicide, and prevent the dominance of homogeneous weed vegetation (Widayat, *et al*. 2018) [23]. This mixture also increases the effectiveness of herbicides through the combination of two or more active ingredients in lower doses. The accumulation of active ingredients within the weed's body causes them to interact with one another, resulting in a different response from the weed compared to the application of a single herbicide. This enables more optimal weed control and covers a wider range of weed types with a broader control spectrum (Zimdhal, 2007) [24].

Herbicides with the active ingredient bispyribac sodium belong to the *pyrimidunyloxybenzonic* group. These herbicides are systemic and effective in controlling weeds in rice fields, specifically weeds such as *Echinochloa* sp. (Hardini *et al*., 2020) [7], while cyhalofop butyl is a post-emergence herbicide belonging to the aryloxyphenoxypropionate class, which works by inhibiting the activity of the enzyme *acetyl-CoA carboxylase* (ACCase) (Santaella *et al*., 2006) [17]. This cyhalofop butyl-based herbicide is effective in controlling *Echinochloa crus-galli*, *Leptochloa chinensis*, and other grass weeds, but it is less effective in controlling broadleaf weeds.

Research conducted by (Inayati, 2013) [9]. states that bispyribac sodium herbicide at a dose of 50 g ha^{-1} is capable of suppressing weed growth without causing symptoms of toxicity to rice plants in paddy fields. In line with these

results, (Kurniati, 2018) [12]. revealed that bispyribac sodium herbicide at 400 g/L and a dose of 30–60 g/ha is effective in controlling broadleaf weeds such as *Ludwigia hyssopifolia*, *Monochoria vaginalis*, and *Spenochlea zeylanica*, as well as sedge weeds such as *Fimbrisylis miliacea*, *Cyperus difformis*, and *Cyperus iria*.

According to Chauhan *et al*. (2017) [3], the herbicide with the active ingredient cyhalofop butyl at a concentration of 100 g/L is effective in controlling grass weeds by 95.13%, including *Leptochloa cinensis*, *Cyperus iria*, and *Echinochloa crus-galli*. Meanwhile, the results of a study by Umiyati *et al*. (2021) [22]. indicate that the herbicide cyhalofop butyl at 100 g/L, applied at a rate of 50–175 L/ha, does not cause symptoms of toxicity or phytotoxicity in rice plants.

Based on this background, this study aims to determine the effectiveness of a herbicide mixture containing 150 g/L of sodium bispiribac and 50 g/L of butyl sihalofop in suppressing weed growth in SR-P08 rice fields. With proper and effective weed control, it is hoped that rice production can be optimized or even increased.

Materials and Methods

The experiment was conducted at SPLPP Faculty of Agriculture, Padjadjaran University, Ciparay, Baleendah District, Bandung Regency, West Java. The research was conducted from August to December 2024. The dry weight of weeds was calculated at Weed Laboratory, Faculty of Agriculture, Padjadjaran University, Jatinangor.

The materials used in this experiment were herbicide with active ingridients of bispyribac sodium 150 g/L and cyhalofop butyl 50 g/L, SR-P08 variety rice plant seeds, urea fertilizer (195,6 kg/ha), SP-36 (125 kg/ha) and KCL (75 kg/ha). The tools used in this experiment were a semi-automatic knapsack sprayer and T-jet nozzles, measuring cups, pipettes, digital scales, ovens, ruler, sickle, scissors hoes, bucket, plastic, labels, envelopes, writing tools, a quadrant and a camera for documentation.

This experiment used the Group Randomized Design method consisting of 7 treatments and each treatment was repeated 4 times, resulting in 28 experimental plots. The experimental plot unit consist of plots measuring 3m x 3,5m, with a planting distance of 25 cm x 25 cm. The treatments observed were the application of bispyribac sodium 150 g/L and cyhalofop butyl 50 g/L at doses of 50 ml/ha (A), 75 ml/ha (B), 100 ml/ha (C), 125 ml/ha (D), 150 ml/ha (E), manual weed control (F), and without weed control (G).

Data analysis was performed using SPSS software, a commonly used statistical software for quantitative data analysis. If the treatments showed a significant effect, a Duncan's multiple range test was conducted to compare the differences in effcets between treatments at a 95% confidence level.

Result and Discussion

Dry Weight Observation

1. Dry Weight of *Monochoria vaginalis*

The result of observations in Table 1 herbicide application with active ingridients of bispyribac sodium 150 g/l and cyhalofop butyl 50 g/L at a doses of 50-150 ml/ha it has a significantly different effect compared to manual weed control and without weed control up to 6 weeks, which is in line with the statement (Badan Penyuluhan dan Pengembangan SDM Pertanian, 2015) [1]. that *Monochoria vaginalis* weeds belong to the broadleaf weed group, making them more sensitive and easier to control chemically using herbicides. Its broad leaf shape allows its canopy surface to capture more herbicide spray, making its absorption more effective and causing the weed to die more quickly due to herbicide exposure. This shows that the application of herbicide with active ingridients of bispyribac sodium 150 g/L and cyhalofop butyl 50 g/L at a doses of 50-150 ml/ha is able to control *Monochoria vaginalis* weeds in rice field cultivation.

Table 1: Result of statistical analysis of dry weight of *Monochoria vaginalis*

Perlakuan	Dosis g/L	Berat Kering (gr)	
		3 MSA	6 MSA
A (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	50	1,22a	1,51a
B (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	75	1,46a	1,29a
C (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	100	1,02a	1,26a
D (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	125	0,42a	1,23a
E (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	150	1,19a	1,18a
F (Penyiangan Manual)	-	3,40b	3,49b
G (Kontrol)	-	3,84b	3,88b

Remarks : Average values marked with the same letter in the same column show no real difference at the level of 5% according to the Duncan Test.

2. Dry Weight of *Ludwigia octovalvis*

The results of observations of the dry weight of Ludwigia octovalvis weeds at 3 weeks showed that the herbicide with active ingridients of bispyribac sodium 150 g/l and cyhalofop butyl 50 g/L at a doses of 50-150 ml/ha (Table 2) The dry weight of *Ludwigia octovalvis* weeds differed significantly between manual weed control and without weed control, while at 6 weeks, the application of the herbicide mixture at a dose of 50-75 ml/ha showed a significant difference from the control treatment and no significant difference from manual weeding, indicating that the herbicide's control efficacy at that dose was comparable to manual weeding. This is likely because manual weeding can cause weeds to be cut, thereby inhibiting weed growth (Paiman, 2020) [14], while herbicide use offers higher benefits than manual weeding, including time savings and reduced labor costs on large plots of land (Rahman, 2016) [15]. This shows that the application of herbicide with active ingridients of bispyribac sodium 150 g/L and cyhalofop butyl 50 g/L at a doses of 50-150 ml/ha is able to control *Ludwigia octovalvis* weeds in rice field cultivation.

Table 2: Result of statistical analysis of dry weight of *Ludwigia octovalvis*

Perlakuan	Dosis g/L	Berat Kering (gr)	
		3 MSA	6 MSA
A (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	50	0,45a	2,16ab
B (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	75	0,47a	1,82ab
C (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	100	0,69a	1,34a
D (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	125	0,56a	1,13a
E (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	150	0,53a	1,12a
F (Penyiangan Manual)	-	2,58b	3,84bc
G (Kontrol)	-	3,28b	5,12c

Remarks : Average values marked with the same letter in the same column show no real difference at the level of 5% according to the Duncan Test.

3. Dry Weight of *Echinochloa crussgalli*

The results of observations of the dry weight of *Echinochloa crussgalli* weeds at 3 and 6 weeks (Table 3) show that the herbicide with active ingridients of bispyribac sodium 150 g/L and cyhalofop butyl 50 g/L at a doses of 50-150 ml/ha had a significant effect compared to manual weed control and without weed control. These differences in dry weight indicate that the application of these herbicides can effectively control *Echinochloa crussgalli* weeds. The difference in dry weight of weeds indicates that the application of herbicides can control *Echinochloa crussgalli* weeds. The highest biomass in the control treatment was due to no treatment being applied,allowing weed growth to proceed unhindered. In the manual weeding treatment, the high biomass accumulation may have been caused by weeding during the generative phase, which could accelerate seed dispersal, or by incomplete removal of the weeds, leaving roots intact, which allowed weed growth to continue. According to research by Dwi Purnamasari *et al*., 2017 [4], *Echinochloa crussgalli* weeds belong to the C4 plant group, which has high tolerance to hot conditions, high light intensity, and high water and nitrogen requirements. Therefore, if the control strategy is not implemented properly, the *Echinochloa crussgalli* weed remains capable of competing effectively with the main crop. This shows that the application of herbicide with active ingridients of bispyribac sodium 150 g/L and cyhalofop butyl 50 g/L at a doses of 50-150 ml/ha is able to control *Echinochloa crussgalli* weeds in rice field cultivation.

Table 3: Result of statistical analysis of dry weight of *Echinochloa crussgalli*

Perlakuan	Dosis g/L	Berat Kering (gr)	
		3 MSA	6 MSA
A (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	50	0,54a	1,15a
B (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	75	0,43a	0,77a
C (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	100	0,37a	0,70a
D (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	125	0,30a	0,25a
E (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	150	0,17a	0,25a
F (Penyiangan Manual)	-	1,59b	2,45b
G (Kontrol)	-	2,64c	3,22b

Remarks : Average values marked with the same letter in the same column show no real difference at the level of 5% according to the Duncan Test.

4. Dry Weight of *Cyperus iria*

The results of observations of the dry weight of *Cyperus iria* weeds at 3 and 6 weeks (Table 4) show that the herbicide with active ingridients of bispyribac sodium 150 g/L and cyhalofop butyl 50 g/L at a doses of 50-150 ml/ha had a significantly different effect from the control treatment and no significant difference from the manual weeding treatment, which aligns with the statement by Gafur *et al*. (2013) [5]. that manual weeding can disrupt weed growth by damaging all parts of the weed, but the use of herbicides can reduce labor costs that are continuously increasing, and serve as a highly efficient alternative when mechanical weed control is not feasible due to certain conditions (Travlos *et al*., 2020) [21]. This shows that the application of herbicide with active ingridients of bispyribac sodium 150 g/l and cyhalofop butyl 50 g/L at a doses of 50-150 ml/ha is able to control *Cyperus iria* weeds in rice field cultivation.

Table 4: Result of statistical analysis of dry weight of *Cyperus iria*

Perlakuan	Dosis g/L	Berat Kering (gr)	
		3 MSA	6 MSA
A (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	50	1,21ab	1,83a
B (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	75	1,20ab	1,57a
C (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	100	0,92a	1,43a
D (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	125	0,70a	1,27a
E (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	150	0,54a	0,95a
F (Penyiangan Manual)	-	3,13bc	5,25ab
G (Kontrol)	-	3,70c	6,56b

Remarks : Average values marked with the same letter in the same column show no real difference at the level of 5% according to the Duncan Test.

Rice Plant Observation

1. Rice Crop Yield

The result of statistical analysis of the effect of various doses of herbicides on rice yields can be seen in Table 5.

Table 5: Observation of dry milled rice

Treatment	Doses	Milled dry grain (g/3m x 3,5m)	Milled dry grain per hectare (Ton/ha)
A (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L	50	435,50c	0,414
B (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	75	382,75bc	0,364
C (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	100	342,50bc	0,326
D (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	125	379,25bc	0,361
E (Natrium Bispiribak 150 g/L dan Butil Sihalofop 50 g/L)	150	362,75bc	0,345
F (Penyiangan Manual)	-	305,75ab	0,291
G (Kontrol)	-	210,75a	0,200

Remarks : Average values marked with the same letter in the same column show no real difference at the level of 5% according to the Duncan Test.

Based on the statistical analysis results as shown in Table 5, there is a significant difference between the treatment and the control in terms of crop yield, specifically the weight of milled dry grain (g/3m x 3,5m). Treatment A (50 ml/ha) yielded the highest average milled rice weight of 0.414 tons/ha, while Treatment G (Without weed control) had the lowest weight of 0.200 tons/ha. The use of herbicide with active ingridients of bispyribac sodium 150 g/L and cyhalofop butyl 50 g/L herbicides showed that it did not inhibit rice plant growth, allowing rice plants to optimally absorb nutrients from the environment to support photosynthesis and grain filling processes, which ultimately increase the weight of milled dry grain per hectare. This difference in results is influenced by the level of competition between weeds and rice plants, where the application of the herbicide mixture was able to suppress weed populations, allowing rice plants to access resources such as water, light, and nutrients more effectively and under more optimal growth conditions, thereby increasing grain production. These results align with Tarigan (2009) [20]. assertion that plants will grow and develop optimally when they are in an environment that meets their growth requirements.

Conclusion

A mixture of herbicides containing 150 g/L of Bispyribac Sodium and 50 g/L of Cyhalofop-Butyl at a doses of 50-150 ml/ha is effective in suppressing the growth of broadleaf weeds (*Monochoria vaginalis*, *Ludwigia octovalvis*) sedge weeds (Cyperus iria), grass weeds (*Echinochloa crussgalli*), and total weeds in rice paddy cultivation up to 6 weeks observations.

The application of a mixed herbicide containing 150 g/L of Bispyribac Sodium and 50 g/L of Cyhalofop-Butyl at a dose of 50-150 ml/ha had a positive effect on the growth and yield of SR P-08 cultivar paddy rice.

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