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# Effect of herbicide ethyl pyrazosulfuron 10% on weeds, growth and yield of ciherang cultivar lowland rice (*Oryza sativa* L.)

**Yayan Sumekar*, Uum Umiyati, Raden Alya Rifani Rahmanisa**
Faculty of Agriculture, Universitas Padjadjan, Jl. R. Bandung-Sumedang, Jatinangor, Indonesia

**Abstract**
Weeds are plants whose existence is undesirable because they can harm productive plants grown by humans such as rice by competing directly for nutrients, light, water and space to grow. Weed control can be done chemically using herbicides which are considered more effective. One type of herbicide that can be used to control weeds in lowland rice cultivation is a herbicide with the active ingredient ethyl pyrazosulfuron. This study aims to determine the effectiveness of herbicides with the active ingredient 10% ethyl pyrazosulfuron in controlling weeds, and their effect on the growth and yield components of lowland rice. This research was conducted at the SPLPP Faculty of Agriculture, Padjadjaran University, Ciparay, Baleendah District, Bandung Regency, West Java from June to September 2022. The study was arranged in a randomized block design with 7 treatments and 4 replications. The treatment consisted of a dose of 10% ethyl pyrazosulfuron herbicide with a level of 150; 225; 300; 375; 450 g/ha, manual and control weeding. The results showed that 10% ethyl pyrazosulfuron herbicide at a dose of 150 – 300 g/ha was effective in controlling weeds in lowland rice cultivation, namely weeds *Sphenoclea zeylanica*, *Ludwigia octovalvis*, *Cyperus difformis*, *Leptochloa chinensis*, and total weeds up to 6 weeks without causing phytotoxicity in rice plants. The herbicide ethyl pyrazosulfuron 10% had a good effect on the yield of rice plants.

**Keywords:** Lowland rice, herbicide, ethyl pirazosulfuron, weeds

## Introduction

Asian rice consumption is the highest in the world, at 77.2 kg per person per year during 2018-2020 (OECD, 2020). In 2018 [18], the average rice consumption of Indonesian people is 114.8 kilograms per capita per year (Logistics Affairs Agency, 2018) [2]. According to the Central Statistics Agency, Indonesia's rice productivity throughout 2021 reached 52.26 quintals of dry milled grain per hectare, however, national rice production decreased by 0.43% from 54.6 million tons of Dry Milled Grain in 2020 to 54.42 million tons of dry milled grain in 2021. This shows the need to increase rice production for Indonesia's future.

According to Masganti *et al*., (2020) [15], efforts to increase rice production are constrained by several problems, including land fertility degradation, conversion of agricultural land to non-agricultural functions, and attacks by plant disturbing organisms, one of which is weeds. Weeds are plants whose existence is undesirable because they can disturb or harm productive plants planted by humans (Suryatini, 2018) [26]. The presence of weeds in rice crops can affect the components of rice yield (Syarifah *et al*., 2018) [27]. The decline in national rice production caused by weeds is estimated to reach 15–42% (Pitoyo, 2006). Common weeds found in rice fields include *Sphenochlea zeylanica, Monochoria vaginalis, Ludwigia octovalvis*, *Fimbristylis miliacea*, and *Cyperus iria* (Umiyati *et al*., 2018) [29].

Weed control is classified into four categories, namely: physical or mechanical weed control, technical culture weed control, biological weed control, and chemical weed control (Widiyati *et al*. 2001 in Fadhly &; Thabri, 2009) [6]. Chemical control using herbicides is the most widely done method because it is considered more effective and efficient to reduce weed populations compared to other controls because it can reduce production costs by reducing the labor required and the time needed is relatively short and covers a large area (Guntoro and Fitri, 2013) [8].

Factors that need to be considered in herbicide administration are the dose, time, and selection of herbicide active ingredients for the type of weed to be controlled (Djojosumarto, 2008) [5]. Herbicides that are applied incorrectly will cause weeds to not be controlled effectively and herbicides will be harmful to staple crops. In addition, applying the same herbicide repeatedly continuously and not using the required amount can result in environmental pollution and faster weed resistance to herbicides (Darmawan *et al*., 2020) [4].

The response or response of several types of weeds to herbicides depends on the type of herbicide used, which is classified into selective or non-selective herbicides (Jamilah, 2013). The selection of herbicide selectivity needs to be considered so that the applied herbicide can inhibit and kill weeds without poisoning the staple crops (Fuadi &; Wicaksono, 2018) [7]. One of the selective herbicides that can be used for rice cultivation is a herbicide with the active ingredient Ethyl pirazosulfuron 10%.

Herbicide Ethyl pirazosulfuron 10% is a herbicide that is easily soluble in water and in the form of white flour which is systemic and selective for rice plants (Saini *et al*., 2008) [21]. Systemic herbicides themselves are herbicides that kill weeds by translocating their active ingredients throughout the body or parts of weed tissue (Sembiring &; Sebayang, 2019) [23]. Herbicides with the active ingredient Ethyl pirazosulfuron 10% can be used to control pre-grow and early after-sprout weeds applied through the crown or soil. This herbicide works by being absorbed by roots or leaves and then translocated throughout the plant to inhibit the activity of *the enzyme Acetolactate synthase* (ALS) which results in weed death (IUPAC, 2014) [11].

Herbicides with active ingredients Ethyl pirazosulfuron 10% effectively control dominant weeds in rice crops such as *Echinochloa colona*, *Cyperus difformis*, *Ludwigia octovalis*, and *Monochoria vaginalis* without causing poisoning effects (Pal *et al*., 2012) [19]. This herbicide is able to reduce the density of three categories of weeds in rice field plantings, namely broadleaf weeds such as *Ludwigia parviflora*, *Monochoria vaginalis*, *Eclipta alba*, grass weeds such as *Echinochloa colona*, *Echinochloa cruss galli*, *Paspalum scorbiculatum*, sedges weeds such as *Fimbristylis miliacea*, *Cyperus iria*, *Cyperus difformis* and reduce the total dry weight of the weed (Malemnganbi &; Lhungdim, 2019) [14]. Based on this background, this study aims to determine the effectiveness of the 10% Ethyl pirazosulfuron herbicide on weed suppression and the growth and yield of Ciherang cultivar rice plants.

## Materials and Methods

The trial analysis of the effect of 10% Ethyl pirazosulfuron herbicide dose on weeds, growth, and yield of rice cultivation (*Oryza sativa* L.) will be carried out from June 2022 to September 2022 at SPLPP Faculty of Agriculture, Padjadjaran University Ciparay, Jelengkong Village, Baleendah District, Bandung Regency, West Java Province. The location of the experimental land was at an altitude of ±600 meters above sea level with inseptisol soil type and rainfall type D3 according to Oldeman (1975). The laboratory analysis was carried out at the Weed Science Laboratory of the Faculty of Agriculture, Padjadjaran University, Jatinangor District, Sumedang Regency, West Java Province. The materials used in this experiment were Ciherang variety rice plant seeds, herbicides with the trademark K-KINGGOLD 10 WP (b.a, = Ethyl pirazosulfuron 10%), Urea fertilizer (45% N), SP-36 (36% P2O5), and KCL (53% K2O). The tools used in this experiment were a semi-automatic knapsack sprayer and T-jet nozzles, measuring cups, digital scales, ovens, ajir, tape measure, scissors, hoes, plastics, labels, envelopes, stationery, and cameras as documentation tools.

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 consists of plots measuring 3 m2 x 5 m2 with a planting distance of 25 cm2 x 25 cm2. The distance between the treatment plot units is in the form of cans with a width of 20-30 cm2. The treatment observed was the administration of herbicides with active ingredients Ethyl pirazosulfuron 10% at doses of 150g/ha (A), 225 g/ha (B), 300 g/ha (C), 375 g/ha (D), 450 g/ha (E), manual weed control (F), and without weed control (G). Data processing is carried out by variety analysis methods. If the treatment showed a real effect, Duncan's follow-up test was carried out on the difference in influence between treatments at a 95% confidence level. Weed sampling was carried out on each unit of treatment plot, observed as many as two sample plots measuring 0.5 m x 0.5 m. The location of the tiles is systematically established. Weed observations were conducted to obtain data on biomass and total weeds. Sampling of weed dry weight is carried out by cutting fresh weeds at ground level, then collected by species. Then dried in the oven at $80^0$C for 48 hours or until it reaches a constant dry weight, then weighed. Observations were made at times 3 and 6 WEEKS. Observations for rice plants were made on plant height and number of saplings. The samples taken were as many as 12 clumps per plot. Measurements were made twice, namely when rice plants were 3 and 6 weeks old. Observations for Dry Rice Milled Grain Yields. Observation of dry rice milled rice yield (moisture content 14%) was carried out on sweet potato plots measuring 2.5 m x 2.5 m.

## Results and Discussion

### Dry Weight Observation

#### 1. Dry Weight of *Sphenoclea zeylanica*

The results of observations in Table 1 herbicide application with active ingredients Ethyl pirazosulfuron 10% at a dose of 150 g / ha – 450 g / ha can control *Sphenoclea zeylanica* weeds in rice cultivation in experimental fields up to 6 weeks which can be seen from the dry weight of different weeds is significantly lower than the manual and control weed control treatment. At 6 weeks after plants, there was a noticeable difference between the treatment given the 10% ethyl pirazosulfuron herbicide and the control treatment. The highest weed biomass was 11.69 grams in the control treatment and the lowest weed biomass was in D and E treatments with values of 1.06 and 0.54. In line with the statement of Moenandir (2010) [16], which states that the presence of herbicides in plant tissues can cause inhibition of weed growth itself. Supported by Chopra's research (2003) [3], which states that ethyl pirazosulfuron herbicide at a dose of 25 g / ha can reduce the dry weight of *Sphenoclea zeylanica weeds.* This shows that the application of herbicides with active ingredients of ethyl pirazosulfuron 10% is able to control *Sphenoclea zeylanica* weeds in rice field cultivation.

**Table 1:** Results of statistical analysis of dry weight of *S. Zeylanica*

| Treatment | Dosage g/ha | Dry Weight (gr) | |
|---|---|---|---|
| | | 3 weeks | 6 weeks |
| A (Ethyl pyrazosulfuron 10%) | 150 | 0,68 a | 2,65 ab |
| B (Ethyl pirazosulfuron 10%) | 225 | 0,37 a | 1,77 a |
| C (Ethyl pirazosulfuron 10%) | 300 | 0,28 a | 1,66 a |
| D (Ethyl pyrazosulfuron 10%) | 375 | 0,25 a | 1,06 a |
| E (Ethyl pyrazosulfuron 10%) | 450 | 0,08 a | 0,54 a |
| F (Manual) | - | 1,56 a | 4,29 b |
| G (Control) | - | 5,99 b | 11,69 c |

**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 the observation of dry weight *of L. Octovalvis* weeds at 3 and 6 weeks (Table 2) showed that the application of 10% ethyl pirazosulfuron herbicide at a dose of 150 g / ha – 450 g / ha had a significantly different effect with manual weeding treatment and control treatment. The difference in dry weight of weeds is caused because ethyl pirazosulfuron herbicide is a type of herbicide that is selective for rice cultivation so that it can control broadleaf weeds such as *Ludwigia octovalvis*. This active ingredient is absorbed by germinated shoots or leaves and together with metabolic processes is translocated to all plant tissues and administration with higher concentrations can suppress vegetative parts (Monaco *et al*., 2002) [17]. This showed that 10% ethyl pirazosulfuron herbicide treatment from doses of 150 g/ha to 450 g/ha was effective in controlling *Ludwigia octovalvis* weed up to 6 weeks age.

**Table 2:** Results of statistical analysis of dry weight of *L. Octovalvis*

| Treatment | Dosage g/ha | Dry Weight (gr) | |
|---|---|---|---|
| | | 3 weeks | 6 weeks |
| A (Ethyl pyrazosulfuron 10%) | 150 | 0,77 a | 3,29 a |
| B (Ethyl pirazosulfuron 10%) | 225 | 0,31 a | 3,05 a |
| C (Ethyl pirazosulfuron 10%) | 300 | 0,23 a | 2,66 a |
| D (Ethyl pyrazosulfuron 10%) | 375 | 0,15 a | 2,16 a |
| E (Ethyl pyrazosulfuron 10%) | 450 | 0,04 a | 1,89 a |
| F (Manual) | - | 2,14 b | 7,32 b |
| G (Control) | - | 5,08 c | 13,19 c |

**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 *Leptochloa chinensis*

In 3 and 6 weeks after apllication based on observations and analysis results (Table 3) showed that 10% ethyl pirazosulfuron herbicide treatment at a dose of 150 g / ha – 450 g / ha resulted in a dry weight of *Leptochloa chinensis* weed that was significantly different compared to manual weeding and control treatment. The dry weight of weeds produced in the herbicide treatment with the active ingredient ethyl pirazosulfuron 10% starting at a dose of 150 g / ha – 450 g / ha has a smaller amount compared to the control treatment and manual weeding. Herbicides made from ethyl pirazosulfuron 10% are a type of pregrowth herbicide that is selective and systemic to control weeds in rice plantations (Harahap *et al*., 2022) [9]. This can be interpreted that herbicide treatment with 10% ethyl pirazosulfuron active ingredients ranging from doses of 150 g / ha to 450 g / ha is effective to control *Leptochloa chinensis* weeds.

**Table 3:** Results of statistical analysis of dry weight of *L. Chinensis*

| Treatment | Dosage g/ha | Dry Weight (gr) | |
|---|---|---|---|
| | | 3 weeks | 6 weeks |
| A (Ethyl pyrazosulfuron 10%) | 150 | 3,10 b | 3,89 b |
| B (Ethyl pirazosulfuron 10%) | 225 | 2,35 ab | 3,46 ab |
| C (Ethyl pirazosulfuron 10%) | 300 | 2,42 ab | 2,95 ab |
| D (Ethyl pyrazosulfuron 10%) | 375 | 1,88 ab | 2,43 a |
| E (Ethyl pyrazosulfuron 10%) | 450 | 1,22 a | 2,24 a |
| F (Manual) | - | 5,01 c | 6,29 c |
| G (Control) | - | 8.75 d | 10.32 d |

**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 difformis*

The results of observations on 3 weeks and 6 weeks after aplliaction (Table 4) showed that the application treatment of 10% ethyl pirazosulfuron herbicide at a dose of 150 g/ha – 450 g/ha resulted in dry weight of *C. difformis* weeds that differed markedly from the control treatment. The results of observations at 6 weeks showed that the dose treatment of the herbicide was not significantly different from manual weeding. In line with the statement (Kusmiadi *et al*., 2015), manual weeding can cause weed growth to be disrupted due to damage to all parts of the weed. However, the use of herbicides can reduce labor costs that are increasingly expensive and become very effective when mechanical or manual methods cannot be carried out due to certain conditions (Travlos *et al*., 2020) [28]. This can also mean that the herbicide ethyl pirazosulfuron 10% at a dose of 150 g / ha – 450 g / ha is effective for controlling *Cyperus difformis* weeds up to 6 weeks observations and can replace the manual weeding system in rice field cultivation.

**Table 4:** Results of statistical analysis of dry weight of *C. Difformis*

| Treatment | Dosage g/ha | Dry Weight (gr) | |
|---|---|---|---|
| | | 3 weeks | 6 weeks |
| A (Ethyl pyrazosulfuron 10%) | 150 | 0,89 ab | 1,40 a |
| B (Ethyl pirazosulfuron 10%) | 225 | 0,48 a | 1,36 a |
| C (Ethyl pirazosulfuron 10%) | 300 | 0,33 a | 1,12 a |
| D (Ethyl pyrazosulfuron 10%) | 375 | 0,08 a | 1,01 a |
| E (Ethyl pyrazosulfuron 10%) | 450 | 0,00 a | 0,61 a |
| F (Manual) | - | 1,64 b | 2,91 a |
| G (Control) | - | 3,24 c | 5,59 b |

**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 results 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 | Dosage g/ha | Milled dry grain per plot (Kg/6.25m2) | Milled dry grain per hectare (Ton/ha) |
|---|---|---|---|
| A (Ethyl pyrazosulfuron 10%) | 150 | 6,14 b | 7,85 |
| B (Ethyl pirazosulfuron 10%) | 225 | 7,28 b | 9,32 |
| C (Ethyl pirazosulfuron 10%) | 300 | 7,56 b | 9,68 |
| D (Ethyl pyrazosulfuron 10%) | 375 | 7,05 b | 9,03 |
| E (Ethyl pyrazosulfuron 10%) | 450 | 7,51 b | 9,61 |
| F (Manual Weeding) | - | 6,43 b | 8,24 |
| G (Control) | - | 4,02 a | 5,15 |

**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.

The highest dry milled grain yield was found in the application treatment of 10% ethyl pirazosulfuron herbicide with a dose of 300 g / ha, which is 9.68 tons / ha. While the lowest dry milled grain yield was found in the control treatment, which was 5.15 tons / ha. Duncan's Multiple Spacing Test results at the 5% level showed that all herbicide dose treatments did not differ markedly from manual weeding and differed markedly from control treatments. This is in line with Saini's research (2003) [22], that the application of 10% ethyl pirazosulfuron herbicide as much as 20g/ha can suppress weed growth and produce grain yields that are almost the same as manual weeding. Weed control with herbicides can provide higher yields due to the lower density of weeds that dominate in a field. then the rice yield obtained will be higher (Respati *et al*., 2015) [20]. These results showed that treatment with the herbicide

of the active ingredient ethyl pirazosulfuron 10% at a dose of 150-450 g / ha gave results equivalent to manual weeding treatment and could increase the yield of Ciherang cultivar rice plants.

## Conclusion

1. Herbicides with active ingredients ethyl pirazosulfuron 10% at doses of 150 g / ha up to 450 g / ha are effective in suppressing the growth of broadleaf weeds (*Sphenoclea zeylanica* and *Ludwigia octovalvis*), sedges weeds (*Cyperus difformis*), grass weeds (*Leptochloa chinensis L*.) and weeds totaling up to 6 weeks and are not phytotoxic to Ciherang cultivar rice plants.
2. Herbicides with active ingredients of ethyl pirazosulfuron 10% starting from doses of 150 to 450 g / ha are able to provide optimal results on yields of Ciherang cultivar rice fields.

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