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The application of Florpyrauxifen-benzyl 25 g/L, a new auxin synthetic herbicide, to control and inhibit the growth of water hyacinth weed (*Eichhornia crassipes* (Mart). Solms)

Abstract. Water hyacinth is an invasive species that spreads rapidly and causes several issues in aquatic habitats; therefore, efforts are required to eradicate weeds in aquatic ecosystems. Aquatic weed control in Indonesia using herbicide is very limited, so it can be an alternative for aquatic weed control management. This research goal was to examine the effectiveness of the herbicide with active agent Florpyrauxifen-benzyl 25 g/L in controlling and inhibiting the rapid growth of (*E. crassipes*). This research was carried out at the Ciparanje Greenhouse and Weed Science Laboratory, Faculty of Agriculture Universitas Padjadjaran, West Java, Indonesia, from August to October 2022. The experiment utilized a randomized block design (RBD) with eight treatments and four replications. The treatments consisted of herbicides with active ingredients Florpyrauxifen-benzyl 25 g/L doses of 5, 15, 25, 35, 45, herbicide 2,4-D DMA 825 g/L (1200), Penoxsulam 25 g/L (12.5) (g a.i/ha), and Control (Without Herbicide). According to the experiments, *E. crassipes* was effectively inhibited and controlled by the herbicide Florpyrauxifen-benzyl 25 g/L at a dose of 5 g a.i./ha. Florpyrauxifen-benzyl 25 g/L herbicide can inhibit relative growth rate, doubling time, number of leaves and clumps of *E. crassipes* up to 6 WAA.

Keywords: *Eichhornia crassipes* (Mart). Solms • Florpyrauxifen-benzyl 25g/L • Herbicide •Weeds

Aplikasi herbisida sintetik auksin baru, Florpyrauxifen-benzyl 25 g/L untuk mengendalikan dan menghambat pertumbuhan gulma air eceng gondok (*Eichhornia crassipes* (Mart). Solms)

Sari. Eceng gondok merupakan spesies invasif yang penyebarannya sangat cepat dan menimbulkan berbagai masalah di badan air, sehingga diperlukan usaha untuk mengendalikan gulma di ekosistem perairan. Pengendalian gulma air di Indonesia menggunakan herbisida sangat terbatas sehingga dapat menjadi alternatif untuk manajemen pengendalian gulma air. Penelitian ini memiliki tujuan untuk mengetahui efektivitas herbisida Florpyrauxifen-benzyl 25 g/L dalam mengendalikan dan menghambat pertumbuhan gulma air eceng gondok (*E. crassipes*). Percobaan ini dilakukan pada bulan Agustus 2022 hingga Oktober 2022 di Rumah Kaca Ciparanje dan Laboratorium Ilmu Gulma Fakultas Pertanian, Jawa Barat, Indonesia. Percobaan terdiri dari 8 perlakuan dan 4 ulangan menggunakan rancangan acak kelompok (RAK). Perlakuan terdiri dari herbisida berbahan aktif Florpyrauxifen-benzyl 25 g/L dosis 5, 15, 25, 35, 45, herbisida 2,4-D Dimetil Amina 825 g/L (dosis 1200), Penoxsulam 25 g/L (dosis 12,5) (g b.a/ha), dan Kontrol (Tanpa Herbisida). Hasil penelitian memperlihatkan bahwa herbisida sintetik auksin baru Florpyrauxifen-benzyl 25 g/L diawali dari dosis 5 g b.a/ha efektif mengendalikan gulma *Eichhornia crassipes* (Mart). Solm hingga 6 MSA. Herbisida Florpyrauxifen-benzyl 25 g/L dapat menghambat laju pertumbuhan relatif, doubling time, jumlah daun, dan jumlah rumpun gulma hingga 6 MSA.

Kata Kunci: *Eichhornia crassipes* (Mart). Solms) • Florpyrauxifen-benzyl 25 g/L • Gulma air • Herbisida

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Introduction

Water hyacinth (*Eichhornia crassipes* (Mart). Solms), is one species of aquatic weed which spreads widely, grows quickly, and is considered as an invasive species worldwide (Kurniadie et al., 2023). The rapid spread and ecological adaptability of the water hyacinth have detrimental effects on the environment, economy, and society (Sharma et al., 2016). Invasions of water hyacinth can result in water loss that is three times greater than in areas where water hyacinth is not covered (Osmond & Petroeschhevsky, 2013).

An overpopulation of water hyacinth in aquatic environments causes a variety of issues. Water hyacinth increases water loss in lakes and rivers, obstructs water transportation facilities, diminishes aesthetic value, causes blockage of waterways, prevents sunlight from reaching the water's body (Sasaqi et al., 2019; Ayanda et al., 2020).Water hyacinth can grow and develop in waters depending on environmental conditions such temperature, nutrients, light, pH, water salinity, waves, turbidity, and seasons (Wilson et al., 2005; Zarkami et al., 2021). In India, a single water hyacinth plant can double in size in just 14 days and cover a square meter in just 52 days (Gutiérrez et al., 2001). According to Sasaqi et al. (2019), In Rawapening Lake Indonesia, the water hyacinth's relative growth rate varied from 6.40 to 7.26% per day, and its doubling time (DT) ranged from 9.6 to 10.8 days.

Due to their negative effects on the ecosystem, invasive species water hyacinth must be controlled. There have been numerous attempts to control water hyacinth weeds, including mechanical control through manual weeding, biological control, and chemical control (Gettys et al., 2014). Chemical control using herbicide can be less affordable than mechanical control, but it must be suitable for humans and the environment (Mirzajani et al., 2022).

Aquatic weed control using herbicides has been widely used in numerous continents such as America and Australia. Glyphosate, 2,4-D, Diquat, Endothal, Fluridone, Penoxsulam, Imazamox, and Imazapyr are the most often used herbicides to control aquatic weeds (Villamagna and Murphy, 2010; Madsen and Kyser, 2020). Florpyrauxifen-benzyl is a new synthetic auxin herbicide that belongs to the arylicolinate family and works as a systemic post-emergence herbicide. This herbicide, which has a wide spectrum and quick absorption, is used to manage weeds in rice cultivation and aquatic ecosystems (Maienfisch and Mangelinckx, 2021).

Synthetic auxin herbicides imitate the natural plant hormone auxin, causing stems and petioles to curl and inhibiting plants growth (Grossmann, 2007). Synthetic auxin herbicides deregulate plant growth processes. Herbicide Flopyrauxifen-benzyl stimulated the abscisic acid (ABA) and ethylene precursor (ACC) (Gao et al., 2022). An increase in ABA concentration induces the stomata to close, which speeds up the death of cells by limiting the absorption of CO_2 and releasing reactive oxygen species (Grossmann, 2010).

Auxin synthetic herbicides attach to specific plant receptors, activating multiple deadly processes. Many auxin receptors in plants are referred to be the TIR1 and AFB protein (Lee et al., 2014). Florpyrauxifen-benzyl (FPB) binds to the nucleus of the cell with weak affinity to the TIR1 receptor and greater affinity to the AFB5 receptor, which makes it different from another auxin synthetic (2,4-D) (Maienfisch and Mangelinckx, 2021). The former auxin synthetic herbicide 2,4-D is selective against broadleaf weeds, and Florpyrauxifen-benzyl as a broad-spectrum herbicide can control weeds (grasses, broadleaves, and sedges) (Costa and Aschner, 2014; Maienfisch and Mangelinckx, 2021). Although many different molecules are classified as auxin herbicides, each molecule has unique herbicidal properties that are determined by many factors such as group family herbicide, efficacy, crop tolerance, dosage, persistence, and herbicide selectivity (Herrera et al., 2021).

Research on aquatic weed management in Indonesia is very limited. This research is needed to determine the optimum dosage of Florpyrauxifen-benzyl 25 g/L herbicide for controlling and decreasing the rapid growth of the invasive species *Eichhornia crassipes*.

Materials and Methods

Location, Materials, and Tools. The study was carried out at the Ciparanje Greenhouse and Weed Science Lab, Faculty of Agriculture, Universitas Padjadjaran. The research was conducted between August to October of 2022. The temperature and humidity ranged from 25.4 to 29^{0}C and 71 to 86% during the experiment.

The tools used in this experiment were a knapsack boom sprayer, flat fan nozzle, a bucket with a diameter of 72 cm x 24 cm high, an analytical balance, a measuring cup, thermometer and hygrometer, gauges, stationery, filters, plastic trays, and oven. The materials used in this study were water hyacinth propagules, water, herbicide Florpyrauxifen-benzyl 25 g/L, 2,4-D Dimethyl Amine 825 g/L, Penoxsulam 25 g/L, and foliar fertilizer (7.5% N, 2% P_2O_5, and 3% K_2O).

This study used a randomized block design (RBD) consisting of one factor, herbicide dosages with eight treatments and four replications. The treatments consisted of herbicides: Florpyrauxifen-benzyl (FPB) 25 g/L doses of 5, 15, 25, 35, 45 g.a.i/ha, herbicide 2.4-D DMA 825 g/L dose of 1200 g a.i/ha, Penoxsulam 25 g/L dose of 12.5 g a.i/ha, and control (without herbicide).

The weed propagules used originated from a holding pond located in Sukarapih Village, Sumedang District, West Java. Water hyacinth that used in this research has eight to ten leaves that each weighed between 25 and 35 grams. Weeds were transplanted into a plastic bucket with a diameter (72 cm) and height (24 cm) and filled with 55 liters of water. Before herbicide application, weeds were planted in plastic bucket tubs for three weeks as part of the adaptation process. Foliar fertilizer was equally distributed throughout the whole surface of the weed leaves before herbicide application.

Each plastic bucket contains 15 samples of the weed *E. crassipes*. Weeds were stored in a bucket of water for a total of eight treatments, which were repeated four times. Therefore, 480 weed propagules were utilized in the greenhouse experiment. A knapsack sprayer equipped with flat fan nozzles was used to apply herbicide three weeks after planting. The volume of water used is 400 liters per hectare at a pressure of 1 kilogram per square centimeter (15-20 p.s.i).

Weed observations included fresh weight, relative growth rate, doubling time, number of leaves, number of clumps, dried weight, and growth reduction of weed. According to Mitchell and Tur. (1975), the relative growth rate (RGR) is determined using the fresh weight value using the following formula:

$$RGR = \frac{(\ln MT_2 - \ln MT_1)}{T_2 - T_1}$$

Information:
RGR = Relative growth rate
MT_1= Biomass of weed at the first observation
MT_2= Biomass of weed at the end observation
T= Time observation (days)

When the fresh weight value of weeds doubles in comparison to the initial observation, it is known as the doubling time (DT). According to Mitchell and Tur. (1975), the formula for calculating doubling time using the formula below:

$$DT = \ln_2/RGR$$

Information:
$\ln_2$ = Natural logarithm
DT = Doubling time
RGR=Relative growth rate

The quantity of water hyacinth clumps is measured by counting the number of vegetative buds that sprout into new plants. The number of leaves on a weed hyacinth is measured by counting all the leaves that are still upright and above the water. Weed dry weight is achieved by destroying it and then drying it for 48 hours at 80°C to a constant dry weight. By comparing the dry weight value of the herbicide treatment with the control, it is possible to convert the dry weight value of weeds into the growth reduction percentage. Hilton (1957) calculated the growth reduction % using the formula below:

$$\%GR=1-(T/C) \times 100\%$$

Information:
%GR = Proportion of treatment inhibition.
T = Dry weight value of the weeds in herbicide treatments.
C = Dry weight of the weeds in control treatments.

This study's data processing was conducted using the ANOVA test and SASM Agri 8.1 software. If the treatment has a significant effect, the Scottt-Knott Advanced test at a significance level of α= 5% is used to examine the difference in mean values between treatments.

Results and Disccusion

Fresh Weight of *Eichhornia crassipes.* Weed fresh weight significantly decreased during the observation period from 0 WAA to 6 week after application (WAA). In contrast to the control treatment, there was an increase in weed biomass during the period of observation (Table 1). According to the results from statistical analysis, observations of the fresh weight of water hyacinth weeds at 6 WAA indicated that the application of the herbicide Florpyrauxifen-benzyl 25 g/L dose of 5 to 45 g a.i/ha, herbicide 2,4-D DMA 825 g/L, and penoxsulam 25 g/L gave significantly different values from the control treatment.

Table 1. Fresh weight of the weed *E. crassipes.*

Treatment (Herbicide)	Rate (g a.i/ha)	Fresh Weight (g)		
		0 WAA	4 WAA	6 WAA
FPB 25 g/L	5	33.31 a	7.13 c	0.00 d
FPB 25 g/L	15	32.90 b	5.53 d	0.00 d
FPB 25 g/L	25	33.66 a	57.00 e	0.00 d
FPB 25 g/L	35	33.98 a	4.13 f	0.00 d
FPB 25 g/L	45	33.75 a	4.09 f	0.00 d
2,4-D DMA 825 g/L	1200	33.59 a	5.44 d	6.74 c
Penoxsulam 25 g/L	12.5	32.24 b	23.72 b	15.88 b
Control	-	34.29 a	84.60 a	111.94a

Note: The average value following the identical letter is not significantly different, according to the Scott-Knott test, at the 5% significance level. FPB= Florpyrauxifen-benzyl

Herbicide Florpyrauxifen-benzyl 25 g/L dose of 5 – 45 g a.i./ha is effective in controlling water hyacinth weeds up to 6 WAA. This is defined by the absence of weed development or renewal, becaused the vegetative propagation through stolons process to stop. Genetic variability caused by rapid clonal reproduction and predominance of vegetative propagation characterize the spread of invasive water hyacinth species (Zhang et al., 2010).

The weed biomass increased as the number of leaves gradually increased in the control treatment, suggesting a rise in vegetative growth. The reduced plant fresh weight that follows herbicide application is caused by several things, including the weakening of the leaf stalks and the separation of the leaves from the weeds' bodies. Synthetic auxin herbicide that mimics the growth-regulating hormone indole-3-acetic acid. Auxin excess in sensitive plants shows as leaf epinasty, bending of the stem and petiole, curling of the leaf and stem leaf blades, and general mortality (Grossmann, 2010).

Relative Growth Rate and Doubling Time. In addition to determining plant biomass, relative growth rate can also be used to describe an aquatic plant's capacity to absorb nutrients. Table 2 shows observational data on the effect of herbicide application on the RGR and DT of *Eichhornia crassipes* from 0 to 6 WAA. RGR and DT values are determined from measurements on the fresh weight of weeds.

Table 2. RGR and DT of the weed *E. crassipes.*

Treatment (Herbicide)	Rate (g a.i/ha)	RGR (%/Day)	DT (Day)
FPB 25 g/L	5	~	~
FPB 25 g/L	15	~	~
FPB 25 g/L	25	~	~
FPB 25 g/L	35	~	~
FPB 25 g/L	45	~	~
2,4-D DMA 825 g/L	1200	~	~
Penoxsulam 25 g/L	12.5	~	~
Control	-	0.0282	24.60

Note ~ = There is no value of RGR and DT.
FPB= Florpyrauxifen-benzyl

The use of the herbicides Florpyrauxifen-benzyl 25 g/L at dose of 5 to 45 g a.i/ha, Penoxsulam 25 g/L, and 2,4-D DMA 825 g/L can reduce the RGR and DT of weed by up to 6 WAA. Due to a decrease in weed fresh weight values, which was shown by weed death at the end of the observation, weed RGR and doubling time values were not obtained in all herbicide treatments (Table 2). Water hyacinths have a high or low relative growth rate, depending on the season, the availability of nutrients, the density of the plants, sunlight, and environmental factors (Astuti and Indriatmoko, 2018).

The RGR value for water hyacinth in the control treatment was 0.02825%/day. The result for the doubling time in the control treatment (without herbicides) was 24.60 days. Comparing the *Eichhornia crassipes* plant to other varieties of aquatic weeds like *Salvinia* sp., *Lemma* sp., and *Spirodela* sp., it tends to have a low RGR value and a relatively long doubling time (Astuti and Indriatmoko, 2018). Rich nutrient supplies for plants can speed up relative growth and reduce the length of time between doublings. Water hyacinth weeds can multiply at a rate of 6.40 to 7.26% per day in conditions of high nutrient availability, which allows them to rapidly cover the entire water's surface (Prasetyo et al., 2021).

Number of *E. crassipes* Leaves. The results showed that the application of herbicide Florpyrauxifen-benzyl 25 g/L doses of 5 to 45 g a.i/ha could significantly affect the control treatment up to 6 WAA and could reduce the number of leaves of the weed *Eichhornia crassipes* (Table 3). The herbicide Florpyrauxifen-benzyl 25 g/L dose of 5 to 45 g a.i/ha showed significantly different values from the herbicides 2,4-D DMA 825 g/L dose of 1200 g a.i/ha and penoxsulam 25 g/L dose of 12.5 g a.i/ha at 6 WAA.

Table 3. Number of leaves of the weed *E. crassipes.*

Treatment (Herbicide)	Rate (g a.i/ha)	Number of Leaves		
		0 WAA	4 WAA	6 WAA
FPB 25 g/L	5	8.95 a	3.20 c	0.00 d
FPB 25 g/L	15	9.00 a	2.75 d	0.00 d
FPB 25 g/L	25	8.85 a	2.00 e	0.00 d
FPB 25 g/L	35	8.95 a	1.60 f	0.00 d
FPB 25 g/L	45	9.05 a	1.45 f	0.00 d
2,4-D DMA 825 g/L	1200	8.85 a	2.95 d	3.30 c
Penoxsulam 25 g/L	12.5	9.40 a	7.55 b	4.10 b
Control	-	9.20 a	20.15 a	23.00 a

Note: The average value following the identical letter is not significantly different, according to the Scott-Knott test, at the 5% significance level. FPB= Florpyrauxifen-benzyl.

After the application of the herbicides 2,4-D DMA 825 g/L and Penoxsulam 25 g/L, at 6 WAA observations showed that each weed clump was still producing leaves. The weed biomass increased as the number of leaves gradually increased in the control treatment, indicating an increase in vegetative growth. At high doses, the weed separates from the body, the petiole rots, and the leaf stalk collapses. The weed's body balance is thrown off by its uncontrolled growth. According to Chinnusamy et al. (2012), uncontrolled cell division and proliferation as well as turgidity changes are to blame.

Number of *E. crassipes* Clumps. The results showed that the use of the herbicide Florpyrauxifen-benzyl 25 g/L had a significant effect on the untreated treatment up to 6 WAA and could prevent the growth of *Eichhornia crassipes weeds* (Table 4). The mother plant's new plantlets (daughter plants) were unable to be spread by the herbicide. The herbicide Florpyrauxifen-benzyl 25 g/L dose of 5 to 45 g a.i/ha showed significantly different values from the herbicides 2,4-D DMA 825 g/L dose of 1200 g a.i/ha and penoxsulam 25 g/L dose of 12.5 g a.i/ha at 6 WAA. Compared to the control treatment, all herbicide treatments showed values that were significantly different.

The total number of weed clumps at 6 WAA increased in the control treatment. The mother plant's new plantlets generated more daughter plants, and this was accompanied by an increase in the rate of relative growth, fresh and dry weight, and leaf number.

Table 4. Number of clumps of the weed *E. crassipes.*

Treatment (Herbicide)	Rate (g a.i/ha)	Number of Clumps		
		2 WAA	4 WAA	6 WAA
FPB 25 g/L	5	1.00 b	1.00 c	0.00 d
FPB 25 g/L	15	1.00 b	1.00 c	0.00 d
FPB 25 g/L	25	1.00 b	1.00 c	0.00 d
FPB 25 g/L	35	1.00 b	1.00 c	0.00 d
FPB 25 g/L	45	1.00 b	1.00 c	0.00 d
2,4-D DMA 825 g/L	1200	1.00 b	1.50 b	1.75 b
Penoxsulam 25 g/L	12.5	1.00 b	1.00 c	1.00 c
Control	-	2.13 a	2.93 a	3.17 a

Note: The average value following the identical letter is not significantly different, according to the Scott-Knott test, at the 5% significance level. FPB= Florpyrauxifen-benzyl.

Weeds will maintain continually photosynthesis to sustain their lives in a steady environment. Environmental factors have a big impact on how water hyacinth weeds grow and develop in a body of water. Sunlight, nutrients, pH, salinity, manner of reproduction and dissemination, as well as other biotic variables, are significant elements influencing the growth of *Eichhornia crassipes* weed (Soedarsono et al., 2013). The optimum pH range for *Eichhornia crassipes* from 6.5 to 8.5 (Gaikwad and Gavande, 2017). If the pH is either above or below this range, water hyacinth growth will be inhibited. During the research, the pH of the water ranged from 6.92 to 7.52, which favoured the growth of water hyacinth weeds.

Weed Dry Weight of *Eichhornia crassipes.* Table 5 shows observational data and statistical analysis of the impact of herbicide application on the weed *Eichhornia crassipes*' average dry weight at 2 to 6 WAA. Water hyacinth weeds were successfully controlled by the herbicide Florpyrauxifen-benzyl (FPB) 25 g/L at a dose level of 5 to 45 g a.i/ha, according to data obtained at 2 to 6 WAA (Week After Application), as indicated by a gradual decrease in the average value of dry weight and significantly different values compared to the control treatment.

Table 5. Weed dry weight of *E. crassipes*.

Treatment (Herbicide)	Rate (g a.i/ha)	Weed Dry Weight (g)		
		2 WAA	4 WAA	6 WAA
FPB 25 g/L	5	2.21 c	0.43 c	0.00 d
FPB 25 g/L	15	1.90 d	0.28 c	0.00 d
FPB 25 g/L	25	1.83 d	0.24 c	0.00 d
FPB 25 g/L	35	1.72 e	0.19 c	0.00 d
FPB 25 g/L	45	1.59 e	0.15 c	0.00 d
2,4-D DMA 825 g/L	1200	1.91 d	0.29 c	0.35 c
Penoxsulam 25 g/L	12.5	2.68 b	2.47 b	1.79 b
Control	-	4.69 a	6.78 a	8.57 a

Note: The average value following the identical letter is not significantly different, according to the Scott-Knott test, at the 5% significance level. FPB= Florpyrauxifen-benzyl.

The herbicide 2,4-D DMA 825 g/L and herbicide Florpyrauxifen-benzyl 25 g/L at a dose of 15 g a.i/ha at 2 to 4 WAA had comparable dry weight values and no significant differences. The herbicide Florpyrauxifen-benzyl 25 g/L dose of 5 to 45 g a.i/ha showed significantly different values from the herbicides 2,4-D DMA 825 g/L dose of 1200 g a.i/ha and penoxsulam 25 g/L dose of 12.5 g a.i/ha at 6 WAA. The reduction in dry weight of *Eichhornia crassipes* was induced by the herbicide Florpyrauxifen-benzyl (FPB) ability to act as an IAA hormone imitator that functioned rapidly in association with an increased in weed metabolism. Uncontrolled gene expression is started by proteins that are involved in plant regulation (Parry et al., 2009; McCauley et al., 2020).

Susceptible weeds began to show leaf curling and rolling three days after the application of auxin synthetic herbicides. Chlorosis and necrosis of the leaf blade up to the petiole then occurred as a result. Rolling leaves can reduce the amount of leaf surface sunlight absorbed, and limiting total photosynthesis (Nio and Lenak, 2014). The growth of weeds not treated to herbicides will not be inhibited, and they will continue to actively perform photosynthesis. The control treatment revealed a gradual increase in weed biomass, followed by vegetative growth, an increase in leaf numbers, and the number clumps.

Leaf stalks from the weed *Eichhornia crassipes* become brittle and float on the surface of the water in response to herbicides, while other sections that have decayed down below the surface of the water deteriorate more quickly. Only in the control treatment did weeds remain standing and float above the water's surface (Figure 1).

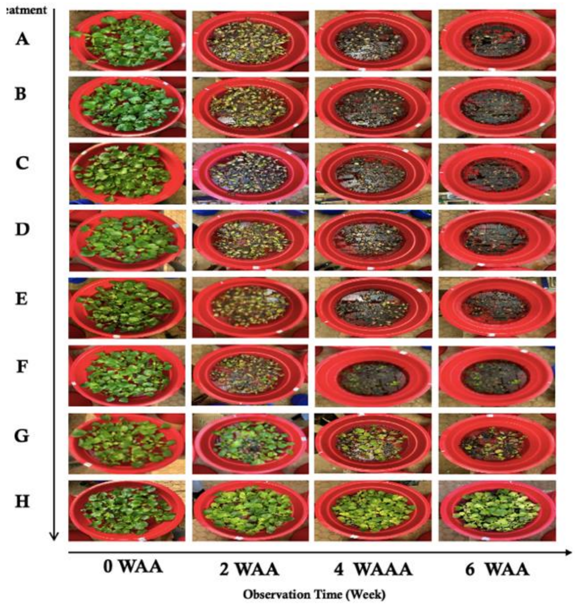

Fig 1. Effect of herbicides on *E. crassipes* weed damage symptoms: Herbicide treatments (g a.i/ha): A. FPB 5 g, B. FPB 15 g, C. FPB 25 g, D. FPB 35 g, E. FPB 45 g, F. 2,4-D DMA 1200 g, G. Penoxsulam 12.5 g, H. Control (without herbicide).

Growth Reduction Percentage (%). The herbicide Florpyrauxifen-benzyl 25 g/L is effective for controlling *Eichhornia crassipes* up to 6 WAA. This is shown by the dry weight value of 0.00 g (Table 5) at doses of 5 to 45 g a.i./ha, with a growth reduction of up to 100% of total weed mortality (Table 6).

Table 6. Growth reduction percentage of the weed *E. crassipes*

Treatment (Herbicide)	Rate (g a.i/ha)	Growth Reduction (%)		
		2 WAA	4 WAA	6 WAA
FPB 25 g/L	5	52.87 b	93.65 a	100.00 a
FPB 25 g/L	15	59.43 a	95.86 a	100.00 a
FPB 25 g/L	25	60.92 a	96.48 a	100.00 a
FPB 25 g/L	35	63.27 a	97.21 a	100.00 a
FPB 25 g/L	45	66.15 a	97.78 a	100.00 a
2,4-D DMA 825 g/L	1200	59.32 a	95.75 a	95.83 b
Penoxsulam 25 g/L	12.5	42.68 c	63.60 b	79.00 c
Control	-	0.00 d	0.00 c	0.00 d

Note: The average value following the identical letter is not significantly different, according to the Scott-Knott test, at the 5% significance level. FPB= Florpyrauxifen-benzyl.

The herbicide Florpyrauxifen-benzyl 25 g/L dose of 5 to 45 g a.i/ha showed significantly different values from the herbicides 2,4-D DMA 825 g/L dose of 1200 g a.i/ha and penoxsulam 25 g/L dose of 12.5 g a.i/ha at 6 WAA. All herbicide treatments showed significantly different values from the control treatment. The herbicide Florpyrauxifen benzyl 25 g/L at the dosage level of 5 to 45 g a.i/ha had the highest growth reduction percentage value up to 100% when compared to the herbicides 2,4-D DMA 825 g/L dose 1200 g a.i/ha up to 95.83% and Penoxsulam 25 g/L dose 12.5 g a.i/ha up to 79.00%.

At 6 WAA, all herbicide treatments resulted in growth reduction percentage ranging from 79.00% to 100%. According to Mudge et al. (2021), the herbicide Florpyrauxifen-benzyl at a dose level of 14.8 – 58.9 g a.i/ha can reduce the total biomass of *Eichhornia crassipes* weeds by 90 – 100% when compared to uncontrolled treatments. The effectiveness of the new synthetic auxin herbicide Florpyrauxifen-benzyl at a low dose is comparable to the previous herbicide at the maximum dose. So, this new active agent herbicide can be used at a lower dose for aquatic weed control, thereby reducing the environmental risk it poses.

Conclusion

Herbicide Florpyrauxifen-benzyl 25 g/L, start with a dose of 5 g a.i./ha, effectively controls *Eichhornia crassipes* with a growth reduction rate of 100 % up to 6 WAA. Water hyacinth can grow at a slower rate by decreasing their relative growth rate, doubling time, number of leaves and clumps when treated with the herbicide Florpyrauxifen-benzyl 25 g/L. The efficient use of herbicide Florpyrauxifen-benzyl 25 g/L can be an alternative method for controlling aquatic weeds in Indonesia.

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