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Effectiveness of Herbicida dosage 2,4-D dimetil amina 866 g/l on weed in spring-food (*Oryza sativa* L.) cultivar inpari 48

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Abstract
Weeds become competitive plants for rice plants in obtaining nutrients, water, light, space and allelopathy. This study aims to determine the effect of the herbicide 2,4-D dimethyl amine 866 g/l to control weeds on the growth and yield of rice plants. This research was conducted from February 2023 to May 2023 at the Agricultural Development Training Research Center (SPLPP), Faculty of Agriculture, Padjadjaran Ciparay University, Jlengkong Village, Baleendah District, Bandung Regency, West Java Province. The experiment used a randomized block design (RBD) with six treatments and four replications. The experiment consisted of four herbicide treatments with the active ingredient 2,4-D dimethyl amine 866 g/l with doses A: 1.5 l/ha, B: 2.l/ha, C: 2.5 l/ha, D: 3 l /ha, E: manual weeding treatment and F: control treatment. The results showed that the application of the herbicide with the active ingredient 2,4-D dimethyl amine 866 g/l at a dose of A: 1.5 l/ha to 3 l/ha had a good effect on suppressing weed growth and yields of lowland rice production and the herbicide dose was 2, 4-d Dimethyl aminan 1.5 l/ha is the most effective dose in suppressing the growth of weeds Sphenoclea zeylanica, Hordelymus E., Cyperus esculentus, Limnocharis flava, Poa trivalis, Fimbristylis dichtoma, Luwdwigia octovalvis, Luwdwigia peruviana found in rice cultivation land paddy fields, and affects the number of tillers of rice plants, rice yields and does not cause phytotoxicity to rice plants.

Keywords: Phytotoxicity, weeds, herbicide 2,4-d Dimethyl Amine, rice

Introduction

Rice is the main foodstuff for the Indonesian people, acting as an economic commodity. The economic implication is that when there is an increase in people's income, it will be followed by an increase in demand for rice quantity and better rice quality [1]. Rice production in 2017 reached around 29.13 million tonnes of rice, in 2018 it was 32.42 million tonnes of rice, in 2019 it was 31.31 million tonnes of rice, in 2020 it was 31.33 million tonnes of rice, in 2021 it was 31.36 million tonnes of rice and in 2022 it was 32.07 million tonnes of rice [2]. Based on the data, it can be concluded that rice production during 2017-2022 tends to be unstable, indicating the need to increase rice production for the future of Indonesia.

problems, including the selection of varieties, the degradation of land fertility, the conversion of agricultural land to non-agricultural land, and the attack of plant disrupting organisms, one of which is weeds [3]. The presence of weeds in paddy rice fields can suppress the growth and production of rice [4] and have a negative impact on cultivated plants, both directly by inhibiting plant growth and indirectly by reducing crop production [5]. Weeds on agricultural land need to be controlled, weed control is done chemically because it is more effective and efficient [6].

The use of herbicides can help to reduce the number of weed populations and control in a relatively short time in plantations. The selection of the right herbicide can determine the success in controlling weeds. The type of herbicide is very important for weed control because herbicide active ingredients have selectivity properties against certain weeds to determine the type of herbicide that is suitable for controlling weeds [7]. One of the active ingredients of herbicides is 2,4-D dimethyl amine.

Based on the results of the research, 2,4-D dimethyl amine herbicide can cause weeds to wither, change the colour of the leaves to burn necrosis and dry. This herbicide is effective for controlling weed species from the broadleaf group, namely Ageratum conyzoides, Hedera helix up to 100%, Euphorbia hirta L., Paedaria foetida, weed species, namely Cyperus kylinga E. by 44.44% within one week [8]. In general, the persistence of herbicides in the soil is shorter than insecticides and varies from a few weeks to several years, depending on the structure and nature of the soil and the water content in the soil. Low persistence herbicides indicate that the duration of biological activity of herbicides in the soil is low [9]. This research is important to determine its effectiveness in suppressing weed growth and its effect on the production of paddy rice.

Matherials and Methods

This research was conducted from February 2023 to May 2023 at the Agricultural Development Training Research Centre (SPLPP), Faculty of Agriculture, Padjadjaran University Ciparay, Jelengkong Village, Baleendah District, Bandung Regency, West Java Province. Materials that need to be prepared in this study are rice variety Ciherang cultivar Inpari 48 Blast (Appendix 1), herbicide with active ingredient 2,4 D dimethyl amine 866 g/l (WEEDROL) and fertilisers Urea, TSP and KcL. The tools used were semi-automatic back sprayer and T-jet nozzles, kater, measuring cup, pipette, analytical balance and Picture This application.

Rice planting is done by transplanting, at the age of 14-21 days the seedlings are transplanted. Herbicide application was carried out once at 12 days after transplanting (HST) by spraying herbicides to the entire soil surface evenly. The first fertilisation at planting time, at the age of 3 weeks after

planting, and at flower primordia, or according to local recommendations. Maintenance of rice plants is done as well as possible so that the objectives of the experiment can be achieved. Harvesting was done after 110 days after transplanting (HST).

The design used in this experiment was a Randomised Group Design methods consisting of 6 treatments and each treatment was repeated 4 times so that there were 24 plots. Each plot contained 240 plants so there were a total of 5,760 plants. The experimental plot units consisted of 3 m x 5 m plots with a distance of 20-30 cm between treatment plot units. Grouping

was done based on field conditions, the determination of each treatment in one group was done in such a way that the distribution of weeds was evenly distributed or the conditions in the group were relatively uniform. The treatment observed was the application of herbicide doses made from the active ingredient 2,4-D dimethyl amine 866 g/l, while the treatments tested consisted of: (A). Herbicide treatment 2,4-D Dimethyl Amine 866 SL at a dose of 1.5 l/ha. (B). Herbicide treatment of 2,4-D Dimethyl Amine 866 SL at a dose of 2 l/ha. (C).Herbicide treatment of 2,4-D Dimethyl Amine 866 SL at a dose of 2.5 l/ha. (D). Herbicide treatment 2,4-D Dimethyl Amine 866 SL at a dose of 3 l/ha. (E). Manual weeding. (F). Control (no weed control). This treatment was conducted with the observed variables, weed dry weight, plant height, number of tillers and milled dry grain yield. Data processing was carried out using the analysis of variance method, if the treatment showed a significant effect then Duncan's further test was carried out on the differences between treatments at the 95% confidence level.

Results and Discussion

Dry Weight Observation

1. Dry Weight of *Sphenoclea zeylanica*

The dry weight of Sphenoclea zeylanica weeds at 3 and 6 MSA observations can be seen that the herbicide treatment of 2,4-D dimethyl amine at a dose of 1.5 l/ha to 3.5 l/ha is significantly different from the manual treatment and significantly different from the control treatment. This is because the herbicide compound 2,4-D dimethyl amine can cause weed growth to be inhibited. The results of statistical analysis of the average dry weight of Cyperus esculentus weeds carried out at 3 and 6 MSA can be seen in the following table:

Table 1

	Treatment	Dosage (l/ha)	Observation	
			3 MSA	6 MSA
A	2.4 D dimetil amina 886 g/l	1.50	0.00 a	0.00 a
B	2.4 D dimetil amina 886 g/l	2.00	0.00 a	0.00 a
C	2.4 D dimetil amina 886 g/l	2.50	0.00 a	0.00 a
D	2.4 D dimetil amina 886 g/l	3.0	0.00 a	0.00 a
E	Manual action	-	0.13 a	0.13 a
G	Control	-	0.30 b	0.30 b

2. Dry Weight of *Hordelymus europaeus.*

The dry weight of Hordelymus europaeus weeds at 3 and 6 MSA observations showed the effect of herbicide application made from active 2,4-D dimethyl amine on paddy rice cultivation land at a dose of 1.5 l/ha to 3 l/ha at 3 MSA observations was not significantly different from manual treatment and control treatment and at 6 MSA observations significantly different from the control treatment. This can be caused by weed growth at 6 MSA which still has not fully emerged and shows that weed control treatment in paddy rice cultivation has a positive impact in suppressing weed growth. The results of statistical analysis of the average dry weight of *Hordelymus europaeus* weeds conducted at 3 and 6 MSA can be seen in the following table:

Table 2

	Treatments	Dosage (l/ha)	Observation	
			3 MSA	6 MSA
A	2,4 D dimetil amina 886 g/l	1.50	0.20 a	0.00 a
B	2,4 D dimetil amina 886 g/l	2.00	0.23 a	0.10 a
C	2,4 D dimetil amina 886 g/l	2.50	0.08 a	0.08 a
D	2,4 D dimetil amina 886 g/l	3.00	0.13 a	0.00 a
E	Manual action	-	0.08 a	0.15 a
G	Control	-	0.38 a	2.90 b

3. Dry Weight of *Cyperus esculentus*

The dry weight of Cyperus esculentus weeds at 3 and 6 MSA observations showed the effect of herbicide application made from active 2,4-D dimethyl amine on paddy rice cultivation land at a dose of 1.5 l/ha to 3 l/ha still results that are not significantly different from manual treatment and significantly different from the control treatment. The use of herbicides made from 2,4-D dimethyl amine and manual treatment gives a good effect in suppressing weed growth when compared to manual treatment (without any treatment). The results of statistical analysis of the average dry weight of Cyperus esculentus weeds conducted at 3 and 6 MSA can be seen in the following table:

Table 3

	Treatments	Dosage (l/ha)	Observaation	
			3 MSA	6 MSA
A	2.4 D dimetil amina 886 g/l	1.50	0.00 a	0.00 a
B	2.4 D dimetil amina 886 g/l	2.00	0.00 a	0.00 a
C	2.4 D dimetil amina 886 g/l	2.50	0.00 a	0.00 a
D	2.4 D dimetil amina 886 g/l	3.00	0.00 a	0.00 a
E	Manual action	-	0.13 a	0.13 a
G	Control	-	0.30 b	0.30 b

4. Dry Weight of *Limnocharis flava*

The results of the analysis of the dry weight of Limnocharis flava weeds at 3 and 6 MSA observations can be concluded, the use of herbicides made from active 2,4-D dimethyl amine on paddy rice cultivation land at a dose of 1.5 l/ha to 3 l/ha is not significantly different from manual and contour treatments at 3 MSA observations but significantly different from the contour treatment at 6 MSA observations. The results of statistical analysis of the average dry weight of Limnocharis flava weeds conducted at 3 and 6 MSA can be seen in the following table

Table 4

	Treatments	Dosage (l/ha)	Observation	
			3 MSA	6 MSA
A	2.4 D dimetil amina 886 g/l	1.50	0.00 a	0.00 a
B	2.4 D dimetil amina 886 g/l	2.00	0.00 a	0.00 a
C	2.4 D dimetil amina 886 g/l	2.50	0.00 a	0.00 a
D	2.4 D dimetil amina 886 g/l	3.00	0.00 a	0.10 a
E	Manual action	-	0.00 a	0.18 a
G	Control	-	0.00 a	1.08 b

5. Dry Weight of *Poa trivalis*

The results of the analysis of the dry weight of Poa trivalis weeds at the observation of 3 and 6 MSA in paddy rice cultivation fields showed the effect of the use of herbicide 2,4-D dimethyl amine at a dose of 1.5 l/ha to 3 l/ha showed no difference with manual treatment and control at the observation of 3 MSA but at the observation of 6 MSA the use of herbicides at the dose above was significantly different from the control treatment. This shows that if no control of weeds is carried out, the growth of weeds will be normal so that it can interfere with the growth of cultivated plants. The results of statistical analysis of the average dry weight of Poa trivalis weeds conducted at 3 and 6 MSA can be seen in the following table

Table 5

	Treatments	Dosage (l/ha)	Observation	
			3 MSA	6 MSA
A	2.4 D dimetil amina 886 g/l	1.50	0.00 a	0.00 a
B	2.4 D dimetil amina 886 g/l	2.00	0.00 a	0.00 a
C	2.4 D dimetil amina 886 g/l	2.50	0.00 a	0.00 a
D	2.4 D dimetil amina 886 g/l	3.00	0.00 a	0.10 a
E	Manual action	-	0.00 a	0.08 a
G	Control	-	0.00 a	0.55 b

6. Dry Weight of *Fimbristylis dichtoma*

The dry weight of Fimbristylis dichtoma weed at 3 and 6 MSA in paddy field cultivation still showed the same result. The use of herbicides made from the active ingredient 2,4-D dimethyl amine at a dose of 1.5 l/ha to 3 l/ha was not significantly different from the manual treatment and control at 3 MSA observation, however, at 6 MSA the use of herbicides 2,4-D dimethyl amine at doses above and manual treatment was significantly different from the control treatment. The results of statistical analysis of the average dry weight of Fimbristylis dichtoma weeds conducted at 3 and 6 MSA can be seen in the following table

Table 6

	Treatments	Dosage (l/ha)	Observation	
			3 MSA	6 MSA
A	2.4 D dimetil amina 886 g/l	1.50	0.00 a	0.00 a
B	2.4 D dimetil amina 886 g/l	2.00	0.00 a	0.00 a
C	2.4 D dimetil amina 886 g/l	2.50	0.00 a	0.00 a
D	2.4 D dimetil amina 886 g/l	3.00	0.00 a	0.10 a
E	Manual action	-	0.00 a	0.40 a
G	Control	-	0.00 a	1.73 b

7. Dry Weight of *Ludwigia octovalvis*

The dry weight of Ludwigia octovalvis weeds at the observation of 3 and 6 MSA in paddy rice cultivation fields still showed the same results, namely, there was no significant difference between the use of herbicides made from 2,4-D dimethyl amine at a dose of 1.5 l/ha to 3 l/ha with manual treatment and control at the observation of 3 MSA, however, at the observation of 6 MSA the use of herbicides 2,4-D dimethyl amine with doses above and manual treatment was significantly different from the control treatment. The results of statistical analysis of the average dry weight of Ludwigia octovalvis weeds conducted at 3 and 6 MSA can be seen in the following table:

Table 6

	Treatments	Dosage *(l/ha)*	Observation	
			3 MSA	6 MSA
A	2.4 D dimetil amina 886 g/l	1.50	0.00 a	0.00 a
B	2.4 D dimetil amina 886 g/l	2.00	0.00 a	0.00 a
C	2.4 D dimetil amina 886 g/l	2.50	0.00 a	0.00 a
D	2.4 D dimetil amina 886 g/l	300	0.00 a	0.10 a
E	Manual action	-	0.00 a	0.28 a
G	Control	-	0.00 a	1.25 b

8. Dry Weight of *Ludwigia peruviana*

dry weight of Ludwigia peruviana weeds, there is an effect of herbicide application made from the active ingredient 2,4-D dimethyl amine 886 g/l on the control of Luwdwigia peruviana weeds in paddy rice cultivation fields, namely from doses of 1.5 l/ha to 3 l/ha not significantly different from the control treatment and not significantly different from manual weeding from the observation of 3 MSA and the use of herbicides with the above doses significantly different from the control treatment. This shows that the use of herbicides made from the active ingredient 2,4-D dimethyl amine has a significant effect in suppressing the growth of Luwdwigia peruviana weeds in paddy rice cultivation. The results of statistical analysis of the average dry weight of Ludwigia peruviana weeds conducted at 3 and 6 MSA can be seen in the following table:

Table 7

	Treatments	Dosage (*l/ha*)	Observation	
			3 MSA	6 MSA
A	2.4 D dimetil amina 886 g/l	1.50	0.00 a	0.00 a
B	2.4 D dimetil amina 886 g/l	2.00	0.00 a	0.00 a
C	2.4 D dimetil amina 886 g/l	2.50	0.00 a	0.00 a
D	2.4 D dimetil amina 886 g/l	3.00	0.00 a	0.10 a
E	Manual action	-	0.00 a	0.13 a
G	Control	-	0.00 a	0.55 b

9. Dry Weight of Total Weed

Total weed dry weight There was an effective dose of herbicide 2,4-D dimethyl amine 866 g/l that gave the best effect on the control of weeds Sphenoclea zeylanica, Hordelymus E..., Cyperus esculentus, Limnocharis flava, Poa trivalis, Fimbristylis dichtoma, Luwdwigia octovalvis, Luwdwigia peruviana found in paddy rice cultivation land is a dose of 1.5 l/ha which is significantly different from other dose treatments and is the lowest dose in herbicide treatment to control weeds in paddy rice cultivation land.These results indicate that herbicide spray rotation can be done every 6 MSA to control weeds in rice cultivation, where farmers usually spray herbicides with excessive and erratic time which can pollute the environment and increase weed resistance. The results of statistical analysis of the average dry weight of total weeds conducted at 3 and 6 MSA can be seen in the following table:

Table 8

	Treatments	Dosage (l/ha)	Observation	
			3 MSA	6 MSA
A	2.4 D dimetil amina 886 g/l	1.50	0.25 ab	0.60 a
B	2.4 D dimetil amina 886 g/l	2.00	0.23 ab	0.20 a
C	2.4 D dimetil amina 886 g/l	2.50	0.08 a	0.15 a
D	2.4 D dimetil amina 886 g/l	3.00	0.13 a	1.25 ab
E	Manual action	-	0.60 b	5.05 b
G	Control	-	1.50 c	16.28 c

Height of Plants per Plot

The results of statistical analysis of the effect of various doses of herbicide 2,4-d dimethyl amine on the height of paddy rice plants 3 and 6 MSA can be seen in Table:

Table 9

	Treatments	Dosage (l/ha)	Observation	
			3 MSA	6 MSA
A	2.4 D dimetil amina 886 g/l	1.50	54.50 a	69.53 a
B	2.4 D dimetil amina 886 g/l	2.00	54.98 a	69.10 a
C	2.4 D dimetil amina 886 g/l	2.50	52.70 a	69.93 a
D	2.4 D dimetil amina 886 g/l	3.00	53.83 a	69.43 a
E	Manual action	-	54.80 a	70.30 a
G	Control	-	55.00 a	69.60 a

At 3 to 6 MSA, it can be seen that all herbicide doses of 1.5 l/ha to 3 l/ha were not significantly different from the manual weeding treatment and the control treatment. At 3 to 6 MSA it can be seen that the treatment of all doses of herbicide 2,4-D dimethyl amine is not significantly different from the control

and not significantly different from the manual weeding treatment. This can be caused by the genetic nature of plants that have characters or characteristics. In accordance with the statement [10] that high diversity in the generative phase indicates that the character is more influenced by genetic factors.

Number of Tiller of Rice Plant

The results of statistical analysis of the effect of various doses on the number of tillers of rice plants in paddy rice cultivation can be seen in Table:

Table 10

	Treatments	Dosage (l/ha)	Observation	
			3 MSA	6 MSA
A	2.4 D dimetil amina 886 g/l	1.50	39.80 c	50.15 e
B	2.4 D dimetil amina 886 g/l	2.00	35.55 b	47.93 d
C	2.4 D dimetil amina 886 g/l	2.50	34.33 b	41.75 c
D	2.4 D dimetil amina 886 g/l	3.00	31.78 b	40.63 b
E	Manual action	-	30.00 a	39.73 b
G	Control	-	24.85 a	37.60 a

Based on the data in Table, the number of tillers of rice plants, it can be seen that all herbicide treatments at a dose of 1.5 l/ha are significantly different from herbicide treatments at doses of 2 to 3 l/ha and significantly different from manual weeding and control treatments at observation 3 and at 6 MSA it can be seen that the treatment of all doses of herbicide 2,4-D dimethyl amine is significantly different from the control and significantly different from the manual weeding treatment. at observation 3 Weeks After Application and 6 MSA it can be seen that the herbicide treatment 2,4-D dimethyl amine at a dose of 1.5 l/ha is significantly different from all treatments.

Milled Dry Grain Yield

The results of observation data and statistical analysis of the effect of various doses on the weight of dry grain yield of paddy rice plants can be seen in Table:

Table 11

	Treatments	Dosage (l/ha)	Result
			g/64 rumpun
A	2.4 D dimetil amina 886 g/l	1.50	3377.60 d
B	2.4 D dimetil amina 886 g/l	2.00	3129.44 c
C	2.4 D dimetil amina 886 g/l	2.50	3029.44 b
D	2.4 D dimetil amina 886 g/l	3.00	3007.16 b
E	Manual action	-	2960.64 a
G	Control	-	2898.72 a

The average herbicide treatment of 2,4-D dimethyl amine at a dose of 1.5 l/ha gave grain yields that were significantly different from the other treatments. The application of herbicide 2,4-D dimethyl amine at a dose of 1.5 l/ha was able to produce higher rice yields than the results of corn plants with other treatments because, with this dose being able to further inhibit the growth of weeds so that, the growth of rice plants was not much disturbed.

Phytotoxistas

The results of statistical analysis of the effect of various doses on the number of tillers of rice plants in paddy rice cultivation can be seen in Table:

Table 12

	Treatments	Dosage (l/ha)	Observation		
			1 MSA	2 MSA	3 MSA
A	2.4 D dimetil amina 886 g/l	1.50	0	0	0
B	2.4 D dimetil amina 886 g/l	2.00	0	0	0
C	2.4 D dimetil amina 886 g/l	2.50	0	0	0
D	2.4 D dimetil amina 886 g/l	3.00	0	0	0
E	Manual action	-	0	0	0
G	Control	-	0	0	0

Based on the data of Table, phytoxicity of rice plants, it can be seen that the use of herbicides made from the active ingredient 2,4-D dimethyl amine does not interfere with the growth of paddy rice plants because, this herbicide is a type of pre-emergence herbicide and is selective and low resistance.

Conclusions

Based on the data from the research analysis above, it can be concluded as follows

1. Herbicides made from 2,4-D dimethyl amine were able to suppress the growth of Sphenoclea zeylanica, Hordelymus E., Cyperus esculentus, Limnocharis flava, Poa trivalis, Fimbristylis dichtoma, Luwdwigia octovalvis, Luwdwigia peruviana and total weeds. Herbicides made from 2,4-d dimethyl amine had a good effect on weed dry weight, weed growth in rice cultivation and rice yield.
2. Herbicides made from 2,4-D dimethyl amine at a dose of 1.5 l/ha effectively suppress weed growth, and do not cause phytotoxicity in rice plants.

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