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# The effect of herbicide 2, 4-d dimethyl amine 865 g/l on weeds, growth and yield of rice plants (*Oryza Sativa* l)

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**Abstract**
The existence of weeds without controlling on a rice (*Oryza sativa* L) field cultivation area can result in a large loss of rice production. Weed control using herbicide, was an effective way and a efficient way compared to other control techniques. This research aims to review the efficacy of herbicides 2, 4-D Dimethyl Amine 865 g/l on the growth of weeds in the cultivation of the rice paddies and influence 2, 4-d dimethyl amina 865 g/l on the growth and yield of rice. The experiment was conducted in Balendah Districts, Bandung Regency, West Java and the weed science laboratory at Padjadjaran University that lasted from December 2018 until march 2019. Experiment using the Randomize Block Design with 8 treatment and 4 replication. The type of treatment in this research consisted of: A (2,4-D Dimethyl Amine 865 g/l at a dose of 1,75 l/ha) B (2,4-D Dimethyl Amine 865 g/l at a dose of 1,50 l/ha) C (2,4-D Dimethyl Amine 865 g/l at a dose of 1,25 l/ha) D (2,4-D Dimethyl Amine 865 g/l at a dose of 1,00 l/ha) E (2,4-D Dimethyl Amine 865 g/l at a dose of 0,75 l/ha) weeding 3 and 5 week after planting, control (without weeding and without herbicides). The difference between treatments was tested using the Duncan test at real level of 5 %. The result showed that: Herbicide with active ingredients 2, 4 - D Dimethyl Amine is effective in controlling weeds found in rice plants and does not cause phytoctosisity of rice plants. Herbicide 2, 4-D Dimethyl Amine starting at a dose level of 0.75 l/ha is able to control the growth of weeds *Ludwigia octovalvis, Marsilea crenata* Presl, and *Monochoria vaginalis* (Burm. F.) C. Presl, starting at a dose of 1.00 l / ha is able to control *weed Echinochloa cruss galli* (L) Beauv, starting at a dose of 1.25 l / ha able to control *Cyperus difformis, Cyperus iria* L and *Fimbristylis miliacea* (L.) Vahl (L.) Vahle. Application of herbicide 2,4-D Dimethyl Amina 865 g./l had a good effect on the growth of the number of vegetative tillers per clump, the number of productive tillers per clump, the number of grains of rice per panicle, and the weight of the weight of dry milled grain.

**Keywords:** 2, 4-D Dimethyl amine 865 g/l, weed, herbicide, rice (*Oryza sativa* L)

## Introduction
Rice (Oryza sativa L.) is one of the food crop commodities that is a staple food for 95% of the population in Indonesia, because it has a major source of energy for the body. The need for rice today and the next few years will continue to increase due to population growth (Andani, 2008) [3]. According to the Badan Pusat Statistik (2017) [5] national rice demand in Indonesia is expected to increase by around 41.7 tons in 2030. Efforts to increase rice production continue to be done, but there are various obstacles in efforts to increase rice productivity, one of the constraints that is felt is the weed disturbance. Weed disturbance can cause a decrease in rice production in Indonesia.

Weeds as plant-disturbing organisms become the main biotic enemies for plant growth in producing high yields (Mandal *at al.*, 2002) [12]. The emergence of weeds in the area of paddy fields is a big problem in the cultivation of lowland rice. According to Sembodo (2010) [14] weeds are plants whose presence is not expected, because it can cause losses so humans try to control. Weed control in lowland rice cultivation can be done with several techniques such as mechanical or physical control, cultural culture control, biological control, chemical control and integrated control. Weed control is generally done now by Farmers is to use chemical compounds called herbicides. Weed Control Techniques using herbicides are very effective and efficient for large agricultural lands (Soerjandono, 2005) [16].

Herbicides are widely used to control weeds in lowland rice cultivation, one of which is a herbicide with the active ingredient 2, 4-D Dimethyl Amina. 2,4-D Dimethyl Amine herbicide is a selective post-emergence herbicide that is absorbed from the leaves through the stomata, attaches to the hairs of the leaves (Trichoma) or roots and is rapidly transplanted into meristematic tissue (Ahmadi *et al.*, 2009) [2]. The 2, 4-D herbicide Dimethyl Amine has the advantage of controlling year-long and annual broadleaf weeds. Herbicides will damage the growth of weeds by spurring abnormal growths such as curved and twisted weeds. Herbicide with the active ingredient 2, 4-D Dimethyl Amine can be used to control weeds of *Cyperus iria* L, *Monochoria vaginalis* (Burm. F.) C. Presl, *Limnocharis flava*, *Ludwigia octovalvis*, *Borreria alata*, *Fimbristylis littoralis*, and *Mikania micrantha* (Tomlin, 2004) [9].

Testing of an herbicide needs to be done to determine the effectiveness of the herbicide dose and study the effect of the application of herbicides in increasing the growth and yield of lowland rice.

## Materials and Methods

The study was conducted in the paddy field of the Faculty of Agriculture, Balendah District, Bandung Regency, West Java. The research location is at an altitude of 680 meters above sea level, while for drying and weighing weeds dry weights are carried out at the Weed Science Laboratory of the Faculty of Agriculture, Padjadjaran University. The time for conducting the research starts from December 2018 until March 2019.

The tools used to control weeds in land preparation are semi-automatic knapsack sprayers and SOLO brand T-jet nozzles, measuring cups, ovens, analytical scales, plastics, buckets for herbicide solvents, pipettes, squares, bamboo stakes used for experimental design, envelopes, meter and stationery to record observations. The ingredients used in this study were herbicide with active ingredients 2, 4 - D Dimethyl Amine 865 g / l, namely Agrimin 865 g / l, Urea fertilizer, NPK fertilizer and Ciherang rice varieties.

The treatments in this study were prepared using a randomized block design consisting of 7 treatments with 4 replications in each treatment. The treatment plan is as follows:

**Table 1:** Arrangement of Experimental Treatments

| No | Treatments | Dose (l/ha) |
|---|---|---|
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 |
| E | 2,4 – D Dimetil Amina 865 g/l | 0.75 |
| F | Manual weeding | - |
| G | Control | - |

Herbicide application is carried out 14 days after planting. Manual weeding is done 3 and 5 weeks after application. The control treatment is a comparison without weeding and is not treated with a dose of herbicide. Data processing is done by a variety of analysis methods. Homogeneity testing of various data from observations of weeds and rice plants was carried out further tests with the Duncan test at a 5% confidence level.

### Observation Parameters

#### 1. Weed Dry Weight

Sampling time is carried out 3 times, namely at the time of 3, 6, and 8 weeks after application. Weed dry sample data for each unit of treatment plot was taken using the 0.5 m x 0.5 m quadratic method at two different sampling points for each plot and at the time of weed sampling. Weed samples that have been taken will be selected based on the species, then weeds will be oven with a temperature of 80oC for 2 × 24 hours and then weighed the weed's dry weight.

#### 2. Phytotoxicity of Rice Plants

Phytotoxicity of the level of poisoning in rice plants will be visually assessed against each plant population contained in the tiled plots, then savings are carried out at 1, 2 and 3 weeks after application.

#### 3. Rice Plant Height

Observation of plant height was measured starting from the surface of the soil to the tip of the longest leaf and carried out in the vegetative growth phase, namely when the canopy of rice plants did not cover each other. Observations were made on 7 samples of plants taken randomly located in the middle of the row of plants. Plant height measurements were carried out at 2, 4 and 6 weeks after application. Plant height measurements are measured in cm.

#### 4. Number of Paddy Vegetative per Clump

The number of rice plants per clump was calculated from each clump of plants growing and plants that had fully opened leaves. At this stage tillers will continue to multiply until they are difficult to separate from the main stem. The main stem will give rise to secondary tillers, and tertiary tillers will grow from secondary tillers as the growth and development of plants grow longer and bigger. Observations were made on 7 plant samples taken randomly. Calculations are performed at 3, 6 and 8 weeks after application.

#### 5. Number of Productive Tillers per Clump

The number of productive tillers is the number of plants that produce panicles. The number of productive plants is calculated based on the number of panicles containing seeds coming out of the rice plant. Observations were made on 7 clumps of randomly determined plant samples. Calculation of productive plants is done one day before harvest.

#### 6. Number of Grains of Rice per Panicle

Counting the number of grains of rice for each panicle taken randomly and then averaged and observations made after harvest. Observation of the number of grains per panicle that is by calculating the average panicle of 10 panicles taken randomly from 10 clumps of rice plants in each treatment plot.

#### 7. Weight of Dry Milled Grain

Observation of the results of dried unhusked rice with 14% moisture content was carried out on a tile plot measuring 2.5 m x 2.5 m. According to Abe (2010) [1] the calculation to determine the 14% water content is done by threshing the grain in 10 clumps of rice which is then carried out by the oven in a oven for one day at 85oC. Measurements were taken after the harvest process was carried out.

## Results and Discussion

### 1. Weed Dry Weights

Dry Weights *Cyperus difformis* L

The results of statistical analysis of *Cyperus difformis* L weed dry weights can be seen in Table 2.

**Table 2:** Effect of Dimethyl Amine Herbicide 2, 4-D Application on Dry Weights of *Cyperus difformis* L

| Treatment | | Dose (l/ha) | Dry Weights (g) | |
|---|---|---|---|---|
| | | | 3 Weeks After Application | 6 Weeks After Application |
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 3.47 a | 4.87 a |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 3.31 a | 4.15 a |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 3.70 a | 4.91 a |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 7.48 ab | 8.49 ab |
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 10.58 ab | 11.22 ab |
| F | Manual weeding | - | 17.34 ab | 18.11 ab |
| G | Control | - | 19.93 b | 22.04 b |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test.

Based on Table 2 shows that in the treatment map application of herbicide 2,4-D Dimethyl Amine at a dose level of 1.25 l / ha, 1.50 l / ha and 1.75 l / ha showed significantly different results with treatment (G) Control. The largest dry weight value is in the treatment (G) Control, this is because the control treatment is not given any control to suppress the growth of weeds, whereas in the weeding treatment it is suspected that *Cyperus difformis* L weeds begin to produce seeds, so that when weeding weeds in the generative phase cause the spread of weed seeds or can be caused when the weeds do not pull up to the root, causing weed growth to continue. Administration of herbicide 2, 4-D Dimethyl Amine at the dosage level of 1.25 l / ha, 1.50 l / ha and 1.75 l / ha has a lower weed dry weight value than treatments D and E. This shows the level of low doses can only cause a small degree of poisoning in a population of weeds *Cyperus difformis* L (Chairul *at al*., 2000) [7].

Dry Weights *Ludwigia hyssopifolia*

The results of the statistical analysis of weed Ludwigia hyssopifolia dry weights can be seen in Table 3.

**Table 3:** Effect of Dimethyl Amine Herbicide 2, 4-D Application on Dry Weights of *Ludwigia hyssopifolia*

| Treatment | | Dose (l/ha) | Dry Weights (g) | |
|---|---|---|---|---|
| | | | 3 Weeks After Application | 6 Weeks After Application |
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 0.00 a | 0.00 a |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 0.00 a | 0.00 a |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 0.00 a | 0.00 a |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 0.00 a | 0.00 a |
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 0.00 a | 0.04 a |
| F | Manual weeding | - | 1.25 b | 2.93 b |
| G | Control | - | 8.12 c | 10.05 c |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test.

Based on Table 3 shows that the dry weight value of weed *Ludwigia hyssopifolia* in all herbicide treatment plots has significantly different values from (G) Control and (F) manual weeding, this shows that the application of herbicide application is able to control the growth of weed populations in the treatment plot. This active ingredient is able to be absorbed mainly through leaves and shoot germination, then translocated to all parts of the plant, so that the vegetative part experiences a disruption in cell division so that weed growth becomes depressed and its weight is low (Zimdahl, 2007) [22].

Dry Weights *Cyperus iria* L

The results of statistical analysis of weights of *Cyperus iria* L. weeds can be seen in Table 4.

**Table 4:** Effect of Dimethyl Amine Herbicide 2.4-D Application on Dry Weights *Cyperus iria* L.

| Treatment | | Dose (l/ha) | Dry Weights (g) | |
|---|---|---|---|---|
| | | | 3 Weeks After Application | 6 Weeks After Application |
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 0.30 ab | 0.80 ab |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 0.00 a | 0.00 a |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 0.00 a | 0.00 a |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 0.53 ab | 1.28 ab |
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 2.60 ab | 3.90 ab |
| F | Manual weeding | - | 0.35 ab | 1.45 ab |
| G | Control | - | 5.79 b | 6.62 b |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test.

Based on Table 4 shows that in observations 3 and 6 MSA growth of weed *Cyperus iria* L in treatment (B) with a dose level of 1.50 l / ha and treatment (C) dose 1.25 l / ha there is a significant difference with the treatment plot ( G) Control. Map of treatment (G) Control has the highest dry weight value of *Cyperus iria* L weeds. Weed treatment (F) has a weed dry weight value that is not significantly different from the control treatment. Based on the dry weight value of weeds *Cyperus iria* L has increased because these weeds have a wide adaptability to diverse environmental conditions. The high competitive level of weed puzzles is one of the worst weeds in the world that is difficult to control either manually or using herbicides (Blum *at al.* 2000; Webster 2004) [6, 20].

Dry Weights *Echinochloa cruss-galli* (L) Beauv

The results of statistical analysis of *Echinochloa cruss-galli* (L) Beauv weed dry weights can be seen in Table 5.

**Table 5:** Effect of Dimethyl Amine Herbicide 2.4-D Application on Dry Weights *Echinochloa cruss galli* (L) Beauv

| Treatment | | Dose (l/ha) | Dry Weights (g) | |
|---|---|---|---|---|
| | | | 3 Weeks After Application | 6 Weeks After Application |
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 0.83 a | 2.51 a |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 0.00 a | 0.00 a |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 2.84 ab | 4.99 ab |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 0.00 a | 0.00 a |
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 4.34 ab | 5.50 ab |
| F | Manual weeding | - | 2.40 ab | 4.27 ab |
| G | Control | - | 9.70 b | 14.48 b |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test.

Table 5 shows that in the application of 2, 4-D Dimethyl Amine herbicide, A, B and D yields have a significant effect on the growth of weed *Echinochloa cruss galli* (L) Beauv, this is indicated by the dry weight value of the plot of the herbicide application treatment is significantly different with treatment (G) Control. The treatments (C) 2,4 - D Dimethyl Amine at the dose level of 1.25 l / ha and (E) 2,4 - D Dimethyl Amine at the dose level of 0.75 l / ha had weed dry weight values that were not significantly different from Treatment (G) Control.

This is because the *Echinochloa cruss galli* (L) Beauv weed is a C4 plant that is classified as a C4 plant that is tolerant of heat conditions, high light intensity, high water consumption and high nitrogen consumption, so it is suspected that *Echinochloa cruss galli* (L) Beauv weed is still able to survive and grow although the application of herbicide was treated in the experimental plot.

Dry Weights *Fimbristylis miliacea* (L.) Vahl

The results of statistical analysis of dry weeds of *Fimbristylis miliacea* (L.) Vahl can be seen in Table 6.

**Table 6:** Effect of Dimethyl Amine Herbicide 2, 4-D Application on Dry Weights of *Fimbristylis miliacea* (L.) Vahl

| Treatment | | Dose (l/ha) | Dry Weights (g) | |
|---|---|---|---|---|
| | | | 3 Weeks After Application | 6 Weeks After Application |
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 0.22 a | 0.30 a |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 0.00 a | 0.00 a |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 0.00 a | 0.00 a |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 1.49 ab | 2.14 ab |
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 2.19 ab | 2.96 ab |
| F | Manual weeding | - | 3.00 b | 4.09 b |
| G | Control | - | 6.52 c | 7.51 c |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test.

Based on the data in Table 6 shows that all herbicide application treatments have significantly different values from the (G) Control treatment, where the highest weed dry weight value is in the (G) Control treatment. This is because no treatment is given in the control plot. The value of weed dry weight in the manual weeding plot (F) has increased, this is because weed *Fimbristylis miliacea* (L.) Vahl has a long root system and has seeds that can spread quickly, and can grow on wet soil to accelerate its growth (Mazidaturohmah *at al.*, 2018). According to Apriadi e*t. al.* (2013) [4] 2, 4-D herbicide is selective against broad and puzzles of broad-leaf weeds and is able to control *Fimbristylis miliacea* (L.) Vahl weeds at a dose level of 0.649 kg / ha to 1.279 kg / ha in lowland rice cultivation.

Dry Weights *Marsilea crenata* Presl.

The results of statistical analysis of dry weeds of *Marsilea crenata* Presl can be seen in Table 7.

**Table 7:** Effect of Dimethyl Amine Herbicide 2, 4-D Application on Dry Weights of *Marsilea crenata* Presl.

| Treatment | | Dose (l/ha) | Dry Weights (g) | |
|---|---|---|---|---|
| | | | 3 Weeks After Application | 6 Weeks After Application |
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 0.00 a | 0.00 a |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 0.00 a | 0.00 a |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 0.00 a | 0.00 a |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 0.00 a | 0.00 a |
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 2.93 a | 3.68 a |
| F | Manual weeding | - | 4.46 ab | 5.24 ab |
| G | Control | - | 8.94 b | 10.47 b |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test.

Based on Table 7 shows that in all plots with the application of herbicide has a significantly different value from the treatment (G) Control, this proves that herbicide with active ingredients 2,4-D Dimethyl Amine is a selective herbicide to control broadleaf weeds in rice plants rice fields without inhibiting the growth of major plants and are systemic (Kadir, 2007) [11].

Dry Weights *Monochoria vaginalis* (Burm. F.) C. Presl

Statistical analysis of dry weeds of *Monochoria vaginalis* (Burm. F.) C. Presl can be seen in Table 8.

**Table 8:** Effect of Dimethyl Amine Herbicide 2, 4-D Application on Dry Weights of *Monochoria vaginalis* (Burm. F.) C. Presl

| Treatment | | Dose (l/ha) | Dry Weights (g) | |
|---|---|---|---|---|
| | | | 3 Weeks After Application | 6 Weeks After Application |
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 0.00 a | 0.00 a |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 0.00 a | 0.00 a |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 0.00 a | 0.00 a |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 0.00 a | 0.00 a |
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 0.00 a | 0.00 a |
| F | Manual weeding | - | 1.38 a | 2.08 a |
| G | Control | - | 6.49 b | 7.52 b |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test.

Based on data in Table 8 shows the value of dry weights of *Monochoria vaginalis* (Burm. F.) weed C. Presl on all plots of herbicide application treatment has a significantly different value from the (G) Control treatment. This is because the leaves of weeds in broadleaf weeds are formed in apical meristem tissue which has very sensitive properties to chemicals. Apical meristems on broadleaf weeds are part of the stem that is formed as an open part that is sensitive to chemicals. This proves that the 2, 4-D herbicide Dimetil Amina is able to control the growth of weed *Monochoria vaginalis* (Burm. F.) C. Presl. Administration of herbicides with high dosage levels for weeds *Monochoria vaginalis* (Burm. F.) C. Presl can suppress the vegetative part rather than in the reproduction so that it shows that the herbicide puts a greater emphasis on weeds *Monochoria vaginalis* (Burm. F.) C. Presl (Monacco *at al.*, 2002) [13].

**2. Phytotoxicity of Rice Plants**

Phytotoxicity is the level of toxicity of the main plants caused by the application of herbicides. Based on observations made on lowland rice plants, the treatment of herbicide 2, 4-D Dimethil Amina showed no symptoms of poisoning in rice plants. This can be seen based on the assessment that has been carried out visually on rice plants, which showed no rice plants that experienced symptoms of poisoning after the application of herbicides.

**Table 9:** Phytotoxicity of 2, 4-D Dimethyl Amine Herbicides on Rice Crops

| Treatment | | Dose (l/ha) | Observation Time | | |
|---|---|---|---|---|---|
| | | | 1 Weeks After Application | 2 Weeks After Application | 3 Weeks After Application |
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 0 | 0 | 0 |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 0 | 0 | 0 |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 0 | 0 | 0 |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 0 | 0 | 0 |
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 0 | 0 | 0 |
| F | Manual weeding | - | | | |
| G | Control | - | | | |

Based on the data in table 9, poisoning caused by the application of herbicide 2,4-D Dimethyl Amine to lowland rice plants in observations 1, 2, and 3 weeks after application did not cause any indication of poisoning as indicated by a score of 0. Herbicide 2.4 - D Dimethyl Amine has selective properties which means it does not poison the main plant. According to Tjitrosoedirdjo *at. al.* (1984) [18] the application of selective herbicides only killed weeds without affecting the damage to the crop.

### 3. Rice Plant Height

The results of statistical analysis of rice plant height can be seen in Table 10. Based on Table 10 in observations 2, 4 and 6 weeks after application it appears that the treatment (B) at the dose level of 1.50 l / ha has the highest plant height. In the control treatment there are a lot of weeds that grow so that competition occurs in nutrients that result in stunted growth of rice plants. According to Simanjuntak *at. al.,* (2016) [15] the presence of weeds on cultivated land can lead to competition in water, light, and nutrients, which affect the growth of main Plants disturbed and yield loss occurs.

**Table 10:** Effect of Herbicide Dose Levels on Rice Plant Height

| Treatment | | Dose (l/ha) | Plant Height (cm) | | |
|---|---|---|---|---|---|
| | | | 1 Weeks After Application | 2 Weeks After Application | 3 Weeks After Application |
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 47.77 a | 67.61 a | 81.59 a |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 52.60 b | 67.80 a | 83.10 a |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 50.09 ab | 65.45 a | 82.61 a |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 47.85 a | 66.66 a | 82.22 a |
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 49.35 ab | 66.00 a | 82.48 a |
| F | Manual weeding | - | 47.52 a | 66.83 a | 82.39 a |
| G | Control | - | 47.31 a | 64.07 a | 81.52 a |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test.

### 4. Number of Paddy Vegetative Tiller per Clump

The results of the Statistical analysis of the number of tillers per family can be seen in Table 11.

**Table 11:** Effect of Herbicide Dose Levels on Number of Vegetative Tiller of Rice Plants per Clump

| Treatment | | Dose (l/ha) | Number of Vegetative Tiller | | |
|---|---|---|---|---|---|
| | | | 1 Weeks After Application | 2 Weeks After Application | 3 Weeks After Application |
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 31.78 bc | 42.21 bc | 50.64 cd |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 33.00 bc | 43.71 c | 51.46 d |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 31.97 bc | 42.71 bc | 50.43 cd |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 33.35 c | 39.78 bc | 46.75 cd |
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 34.89 c | 41.43 bc | 48.32 bcd |
| F | Manual weeding | - | 28.39 b | 37.67 b | 45.78 b |
| G | Control | - | 21.25 a | 29.14 a | 37.64 a |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test.

The results of the analysis of variance on the number of tillers in the clumps in Table 11 in observations 3, 6 and 8 weeks after application showed that there were significant differences in all treatments given herbicide, but no significant effect on control treatments. At the observation 3 weeks after application of treatment (E) 2,4-D Dimethyl Amine with a dose of 0.75 l / ha has the highest number of tillers and the lowest number of tillers in the treatment (G) Control. Treatment (B) 2, 4 - D Dimethyl Amine at a dose of 1.50 l / ha had the number of significantly more tillers and treatment (G) Control was lowest at 6 and 8 weeks after application. This shows that the herbicide is able to suppress the growth of weed populations so that there is no competition between growing space and nutrients with rice plants so that rice plants are able to produce large numbers of tillers. According to Jatmiko *at. al.,* (2002) [10] the level of competition between cultivated plants and weeds depends on soil conditions.

### 5. Number of Productive Tillers per Clump

The results of statistical analysis of the number of productive tillers per family can be seen in Table 12. Based on observational data obtained shows that the application of the dosage treatment of herbicide 2, 4-D Dimethyl Amina at a dose level of 1.50 l / ha was significantly different from the treatment (G) Control. The highest number of productive tillers was in the treatment plot (B) 2, 4 - D Dimethyl Amine 1.50 l / ha and the lowest was in the Control (G) treatment. N and P nutrient fertilization process is a nutrient that plays an important role in encouraging the success of a rice plant for the formation of the number of productive tillers (Dobermann and Fairhust, 2000) [8]. According to Widayat (2015) [21] the presence of weeds greatly determines the amount of productive tillers production, because this can lead to competition in terms of growing space.

**Table 12:** Effect of Herbicide Dose Levels on Number of Productive Tillers per Clump

| Treatment | | Dose (l/ha) | Number of Productive Tiller |
|---|---|---|---|
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 26.25 ab |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 26.75 b |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 23.00 ab |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 24.75 ab |

| | | | |
|---|---|---|---|
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 23.75 ab |
| F | Manual weeding | - | 24.75 ab |
| G | Control | - | 21.00 a |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test.

**6. Number of Grains of Rice per Panicle**

The results of statistical analysis of the number of grains of rice per panicle can be seen in Table 13.

**Table 13:** Effect of Herbicide Dose Level on the Number of Grains of Rice per Panicle

| Treatment | | Dose (l/ha) | Number of Grains of Rice per Panicle |
|---|---|---|---|
| A | 2,4–D Dimethyl Amina 865 g/l | 1.75 | 120.62 b |
| B | 2,4–D Dimethyl Amina 865 g/l | 1.50 | 122.40 b |
| C | 2,4–D Dimethyl Amina 865 g/l | 1.25 | 104.72 ab |
| D | 2,4–D Dimethyl Amina 865 g/l | 1.00 | 120,22 b |
| E | 2,4–D Dimethyl Amina 865 g/l | 0.75 | 112.37 ab |
| F | Manual weeding | - | 118.25 b |
| G | Control | - | 98.97 a |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test.

Based on data obtained from observations, it is shown that the treatment of the application of herbicide 2, 4-D Dimethyl Amine at all dosage levels tested was significantly different from the treatment (G) Control. Treatment (B) 2,4 - D Dimethyl Amine at a dose level of 1.50 l / ha has a tendency to yield a high number of grains per panicle that is equal to 122.40, whereas in treatment (G) Control of the number of grains per panicle tends to be low compared to other treatment. This is in line with the effectiveness of herbicides as chemicals used in weed control techniques in lowland rice plants, namely to kill or control weeds very effectively and efficiently and minimize the risk of damage to the environment (Supartama *at. al.,* 2013) [17].

**7. Weight of Dry Milled Grain**

The results of statistical analysis of the number of tillers per clump can be seen in Table 14.

**Table 14:** Effect of Herbicide Dose Levels on the Weight of Dry Rice Grain

| Treatment | | Dose (l/ha) | Milled Dry Grain (kg/plot) | Grain Dried (ton / ha) * |
|---|---|---|---|---|
| A | 2,4 – D Dimethyl Amina 865 g/l | 1.75 | 15.20 b | 6.46 |
| B | 2,4 – D Dimethyl Amina 865 g/l | 1.50 | 16.60 b | 7.06 |
| C | 2,4 – D Dimethyl Amina 865 g/l | 1.25 | 15.02 b | 6.38 |
| D | 2,4 – D Dimethyl Amina 865 g/l | 1.00 | 15.15 b | 6.44 |
| E | 2,4 – D Dimethyl Amina 865 g/l | 0.75 | 14.97 b | 6.36 |
| F | Manual weeding | - | 14.97 b | 6.36 |
| G | Control | - | 12.32 a | 5.23 |

Note: The average value marked with the same letter in the same column shows no significant difference at the 5% level according to the Duncan Test. * (not tested for statistical analysis)

Based on the data shows that the weight of the milled dry grain contained in Table 14, has a significantly different value in all plots that were treated with herbicide with (G) Control. The dry weight of the milled grain in the treatment plot with the application of herbicide has no significant difference. The largest weight of dry unhusked rice is in the treatment plot (B) 2, 4 - D Dimethyl Amine at the dose level of 1.50 l / ha, and the lowest in the control plot (G) Control. This shows that the presence of weeds in the control plot is very much so that it affects crop production. According to Jamilah (2013) [9] the decrease in rice yield due to the presence of weeds is directly proportional to the density of weeds so that weed control is needed.

**Conclusion**

Based on the results of experiments conducted in this study, it can be concluded that:

1. Herbicide with active ingredients 2, 4 - D Dimethyl Amine is effective in controlling weeds found in rice plants and does not cause phytoctosisity of rice plants.
2. Herbicide 2, 4-D Dimethyl Amine starting at a dose level of 0.75 l/ha is able to control the growth of weeds *Ludwigia octovalvis*, *Marsilea crenata* Presl, and *Monochoria vaginalis* (Burm. F.) C. Presl, starting at a dose of 1.00 l / ha is able to control *weed Echinochloa cruss galli* (L) Beauv, starting at a dose of 1.25 l / ha able to control *Cyperus difformis, Cyperus iria* L and

*Fimbristylis miliacea* (L.) Vahl (L.) Vahle. Application of herbicide 2,4-D Dimethyl Amina 865 g./l had a good effect on the growth of the number of vegetative tillers per clump, the number of productive tillers per clump, the number of grains of rice per panicle, and the weight of the weight of dry milled grain.

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