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The effect of methyl metsulfuron herbicide on weed control in paddy rice planting which was given organic compost straw

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Abstract
The presence of weeds in lowland rice plantations can cause a decrease in crop yields, so weeds must be controlled, one of the ways to control them is by using the Metsulfuron methyl herbicide. On the other hand good agricultural land must also have sufficient C-organic content to have good physical, chemical, and biological properties that support plant growth. This study aims to examine the effect of applying organic matter on the dose of methyl methulfuron herbicide application to weeds, growth and rice yields. The trial began in December 2017 until June 2018 which was carried out in the Rice Field of Cinunuk Village, Cileunyi District, Bandung Regency. Laboratory analysis was carried out at the Soil Fertility and Plant Nutrition Laboratory, Faculty of Agriculture, Padjadjaran University, Jatinangor, Sumedang Regency. Experiments were carried out using a dwi factor and carried out using a Compartmental Design Divided into a randomized complete basic design repeated three times, the main plot factor was organic material, consisting of two levels, namely: B1 (low C-organic content (1.86%)) and B2 (high organic C content (3.5%)), and subplot factor is the dose of the methyl Metsulfuron herbicide, consisting of five levels: D0 (without herbicide), D1 (methyl methulfuron dose 0.0010 kg ai / ha), D2 (methyl methulfuron dose 0.0020 kg ai / ha), D3 (methyl metsulfuron dose 0.0030 kg ai / ha), D4 (methyl metsulfuron dose 0.0040 kg ai / ha). The response variables observed included: weed dry weight, rice plant poisoning, growth and yield of rice plants. The results showed that between the treatment of low C-organic content (1.86%) and high C-organic content (3.5%) did not show significant differences in weed dry weight of each species, weed dry weight, growth and yield of rice plants. The treatment of methyl methulfuron herbicide from a dose of 0.0010 kg a.i. /ha to a dose of 0.0040 kg a.i. /ha affects the weed dry weight, number of vegetative tillers, number of productive tillers, and yield of rice plants.

Keywords: methyl methulfuron, C-organic, weed, herbicide, rice

Introduction

Rice is an important food crop commodity in Indonesia. Indonesians make rice a staple food. Ninety-five percent of Indonesia's population consumes these foods. Rice is able to meet 63% of total energy adequacy and 37% of protein (Norsalis, 2011) [8]. The need for rice as one of the main food sources of the Indonesian population continues to increase, because in addition to the population continues to increase with an increase of about 2% per year, there is also a change in population consumption patterns from non-rice to rice (Sitohang *et. al*, 2014) [17]. The success of rice cultivation is determined by various factors, one of which is quite an important role is the presence of plant pests, such as pests, diseases, and weeds. Weeds are pests that can inhibit the success of crop production, because they reduce yields both quantitatively and qualitatively (Zaman and Kato-Noguchi, 2017) [28]. During the period of plant growth, weeds are strong competitors who occupy the plant area and compete for crop growth factors (Siddiqui *et al*., 2010) [14].

The presence of weeds in lowland rice cultivation is one obstacle that can reduce crop yields. Yield loss due to weeds can be caused by various factors including the types of weeds present, the number of weed populations, the time of weed emergence in the rice crop phase, the length of weed competition with plants, and crop cultivation factors (Rao *et al.*, 2017) [12]. In addition to weeds can compete physically, weeds are also able to compete chemically with the release of allelopathic substances. The decrease in rice yield due to the presence of weeds is around 40–80% (Bangun, 1986). Due to the loss due to the presence of weeds in cultivation, weed control is absolutely necessary. Weed control can be done in various ways, namely mechanically, technical, biological, chemical culture with the use of herbicides, or in an integrated manner (Zimdahl, 2013) [29]. Among the various types of weed control that is most commonly done besides mechanical means, is the use of herbicides. The use of herbicides has various advantages over mechanical methods, including that weeds can be controlled in a short time, more effective for large areas, the risk of erosion and root damage can be avoided. Herbicides can control weeds that are difficult to weed by hand, overcome energy problems at the time required, enhance the quality of maintenance, and plant production more optimally. Herbicides that are often used in aeral rice fields include methyl methulfuron. Methyl methulfuron is a pre and post-emergence herbicide that can control the growth of several weed groups, especially the puzzle group and broad-leaf group. Metsulfuron methyl herbicide is a herbicide that can inhibit enzyme acetolactase synthase (ALS) (Rao, 2000) [11].

Soil is a factor that can affect the working power of an herbicide. The behavior of herbicides in soil is influenced by various physical, chemical, and biological processes which are very complex and dynamic processes, adsorption, photodecomposition, evaporation, leaching, degradation in soil (Tu *et. al.*, 2001) [23]. In the soil herbicides undergo adsorption and desorption. The adsorption and desorption balance for each soil type is different, the adsorption causes the concentration of herbicide in the soil solution to decrease. Rao (2000) [11] suggests that adsorption and desorption in soil are important keys that affect the efficacy of herbicides, the loss of herbicides and behavior in the soil as well as the side effects of residues that affect environmental health. Adsorption of herbicides on soil particles will determine the persistence of an herbicide in the soil, which corresponds to the time unit of the herbicide to remain active.

Herbicides will be effective in controlling weeds, if they are in the soil for a long time. The time required for an herbicide to remain active in the soil is known as herbicide persistence, which is influenced by various factors such as organic matter content in the soil, volatilization, photodecomposition, adsorption, washing, microbial degradation, and absorption by plants (Rahman *et al.*, 2011) [10]. Organic matter is an important part of the soil that can improve soil properties, both physical, chemical and biological soil properties (Afandi *et al.*, 2015) [1]. The existence of organic material is absolutely necessary and maintained in order to maintain harmony of ecological functions in the soil, sustainable production and environmental sustainability. Subowo (2010) [119] reports that intensively cultivated soils in Indonesia have low organic matter content. Las and Setyorini (2010) state that around 73% of agricultural land in Indonesia has C-organic soil content <2.00%, while the Ministry of Agriculture shows the fertility rate of paddy fields in Indonesia is decreasing at around 65% of ± 5 million ha of paddy land irrigation has an organic matter content of less than 2%, whereas in normal conditions fertile paddy fields usually contain organic material of at least 3% (Suriadikarta and Simanungkalit, 2006) [22]. Efforts to obtain optimal results for plant growth require the presence of organic material in the upper layer of at least 2% (Young, 1989) [27]. As a result of the declining organic matter content in the soil, it will disrupt the supply of water, air, nutrients for plants, and soil buffer to be reduced so that most of the inorganic fertilizer given to the soil becomes unavailable to plants. Subowo (2010) [19] revealed that low organic matter will result in low land productivity.

Organic matter plays a large role in the adsorption of herbicides in the soil. Adsorption of herbicides by organic materials affects the behavior of several herbicides in the soil namely biological activity, persistence, biodegradation, washing and evaporation (Stevenson, 1994). Information on how herbicides behave due to the provision of organic material is the basis of the effectiveness of herbicides to suppress weed growth and the impact of herbicides on environmental health. Rao (2000) [11] reports that administration of organic material will reduce the activity of herbicides and will increase the dose of herbicide application.

Based on the above, it is necessary to examine the effect of the application of methyl Metsulfuron herbsida in lowland rice fields that are given organic compost straw to the persistence of these herbicides in wetland rice fields and the growth of weeds, growth and yield of lowland rice.

Material and Method

This experiment was conducted from December 2017 to June 2018. The experiment was carried out in the rice fields of Cinunuk Village, Cileunyi District, Bandung Regency. The location of the land is located at an altitude of 660 meters above sea level and the type of rainfall is type B according to Schmidt and Ferguson (1951). The laboratory analysis was carried out at the Soil Fertility and Plant Nutrition Laboratory, Faculty of Agriculture, Padjadjaran University, Jatinangor, Sumedang Regency.

The compost material used in this experiment was rice straw mixed with bran. The herbicide tested in this experiment was the active ingredient methyl methulfuron. Plant seeds used are Ciherang cultivars. Fertilization is done using urea fertilizer (45% N), SP-36 fertilizer (36% P2O5), and KCl (50% K2O). Pest control is done with Dursban 1 PE and Matador 25 EC with applications adapted to the conditions on the ground, while bird control uses nets. The tools used in this study were analytical scales, ovens, knapsack sprayers, rulers and laboratory equipment to determine the persistence and residue of plants.

Field experiments are dwi factor experiments and are carried out using a Divided Plot Design in a complete randomized complete baseline design.

As the main plot factor is organic material, consisting of two levels, namely:

B1: Low C-organic content (1.86%)

B2: High organic C content (3.5%)

As a subplot factor is the dose of the methyl Metsulfuron herbicide, consisting of five levels:

D0: No herbicide

D1: Methyl methulfuron dose 0.0010 kg a.i. /ha

D2: Methyl methulfuron dose 0.0020 kg a.i. /ha

D3: Methyl methulfuron dose 0.0030 kg a.i. /ha

D4: Methyl methulfuron dose 0.0040 kg a.i. /ha

This experiment was repeated three times. Variance analysis data will be further tested by Duncan's Multiple Range Test at a 5% confidence level.

Response Variable

1. Dried weights weed

Weed dry weight observations were carried out on weeds taken from sample plots with a size of 0.5 m x 0.5 m at 7, 21, and 35 days after application. Weeds are cut above ground level, then dried in a drying oven at 800C until they reach a constant weight and are weighed. Dried weights were observed per species and other weeds.

2. Observation of Rice Toxicity

How to determine the level of plant toxicity by herbicides is based on the symptoms displayed, namely abnormal growth or late growth and chlorosis (Kearney and Kaufman, 1988). The percentage of plant poisoning by herbicides refers to the system issued by the Pesticides Commission (1984) carried out visually at 7, 21, and 35 days after application.

3. Growth and Yield of Rice Plants

Observation of the growth of lowland rice plants includes the number of vegetative tillers per clump and height of rice plants at 7, 21, and 35 days after application. Whereas the yield and yield components of rice observed were number of productive tillers per clump at 98 days after application, and milled dry grain.

Results and Discussion

1. Dried weights weed

Dried weights weed *Altenanthera sessilis* Results of analysis of variance showed that there was no influence of interdependence between organic matter content with the dose of methyl methulfuron herbicide on the dry weight of weed *Altenanthera sessilis* (Table 1). From Table 1 it can be seen that the independent effect of organic matter content did not provide a significant difference between treatments for the observation of the weed dry weight of *Altenanthera sessilis*. While all treatments of methyl methulfuron herbicide dosage from the dose 0.0010 kg ai / ha to the dose 0.0040 kg ai / ha gave an average number of dry weed *Altenanthera sessilis* which was not significantly different than the treatment without the application of herbicide at the observation 7 days after application. The observations 21 and 35 days after application gave the average number of dry weights of *Altenanthera sessilis* significantly different compared to treatments without the application of herbicides, this shows that all treatments of methyl methulfuron herbicide doses effectively suppressed the growth of weed *Altenanthera sessilis*. In line with the opinion of Wang *et al*. (2008) [25] that methyl methulfuron herbicide was effective in controlling broadleaf weeds in cereal plants.

Table 1: Effects of Various Organic Content and Methyl Metsulfuron Herbicide Doses on Dried Weights of *Altenanthera sessilis*

Treatment	**Average Weed Dry Weights (g/0,25m^2)**		
Ingredients C-Organic:	**7 days after application**	**21 days after application**	**35 days after application**
b1: Low C-organic content (1.86%)	0.28 a	0.09 a	0.27 a
b2: High organic C content (3.5%)	0.45 a	0.46 a	0.31 a
Dosage of Methyl Metsulfuron herbicide:			
d0: No herbicide	1.82 a	1.25 b	1.43 b
d1: Methyl methulfuron dose 0.0010 kg a.i./ha	0.00 a	0.23 a	0.00 a
d2: Methyl methulfuron dose 0.0020 kg a.i./ha	0.00 a	0.00 a	0.00 a
d3: Methyl methulfuron dose 0.0030 kg a.i./ha	0.00 a	0.00 a	0.00 a
d4: Methyl methulfuron dose 0.0040 kg a.i./ha	0.00 a	0.00 a	0.00 a

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

Dried weights weed *Ludwigia octavalvis*

The results of the analysis of variance showed that there was no interdependence between the content of organic matter and the dose of the methyl methulfuron herbicide on the dry weight of the weed *Ludwigia octavalvis* (Table 2). Table 2 shows that the independent effect of organic matter content did not provide a significant difference between treatments for the observation of *Ludwigia octavalvis* dry weight, whereas all treatments of methyl methulfuron herbicide dosage from a dose of 0.0010 kg ai / ha to a dose of 0.0040 kg ai / ha gave the average dry weight weed Ludwigia octavalvis significantly different compared to treatment without the application of herbicides at observations 7, 21, and 35 days after application. This shows that the use of methyl methulfuron herbicide dosage from a dose of 0.0010 kg a.i. /ha to a dose of 0.0040 kg a.i. /ha is able to control the *Ludwigia octavalvis* weed in lowland rice fields. This is due to the methyl methulfuron herbicide can inhibit the enzyme acetolactate synthase (ALS) which catalyzes the first general reaction in amino acid branching biosynthesis. valine, leucine and isoleucine (Brown and Cotterman, 1994).

Table 2: Effects of Various Organic Content and Methyl Metsulfuron Herbicide Doses on Dried Weights of *Ludwigia octavalvis*

Treatment	**Average Weed Dry Weights (g/0,25m^2)**		
Ingredients C-Organic:	**7 days after application**	**21 days after application**	**35 days after application**
b1: Low C-organic content (1.86%)	0.82 a	0.35 a	0.53 a
b2: High organic C content (3.5%)	2.25 a	0.14 a	1.81 a
Dosage of Methyl Metsulfuron herbicide:			
d0: No herbicide	7.67 b	1.23 b	5.40 b
d1: Methyl methulfuron dose 0.0010 kg a.i./ha	0.00 a	0.00 a	0.00 a
d2: Methyl methulfuron dose 0.0020 kg a.i./ha	0.00 a	0.00 a	0.00 a
d3: Methyl methulfuron dose 0.0030 kg a.i./ha	0.00 a	0.00 a	0.00 a
d4: Methyl methulfuron dose 0.0040 kg a.i./ha	0.00 a	0.00 a	0.00 a

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

Dried weights weed *Marsilea crenata*

The results of the analysis of variance showed that there was no interdependence between the content of organic matter with the dose of the methyl methulfuron herbicide on the dry weights of *Marsilea crenata* (Table 3). From Table 3 it can be seen that the independent effect of organic matter content does not provide a significant difference between treatments to the observed dry weight of *Marsilea crenata*, whereas all treatments of methyl methulfuron herbicide doses from the dose 0.0010 kg ai / ha to the dose 0.0040 kg ai / ha gives the average number of dry weights of Marsilea crenata that are significantly different compared to treatments without the application of herbicides at observations 7, 21, and 35 days after application. This shows that the use of methyl methylphurone herbicide dosage from a dose of 0.0010 kg a.i. /ha to a dose of 0.0040 kg a.i. /ha is able to control weed *Marsilea crenata* in lowland rice fields. In line with the opinion of Sondhia (2009) [18] that the methyl methulfuron herbicide is very effective in controlling broadleaf weeds.

Table 3: Effects of Various Organic Content and Methyl Metsulfuron Herbicide Doses on Dried Weights of *Marsilea crenata*

Treatment	**Average Weed Dry Weights (g/0,25m^2)**		
Ingredients C-Organic:	**7 days after application**	**21 days after application**	**35 days after application**

b1: Low C-organic content (1.86%)	0.45 a	1.72 a	1.27 a
b2: High organic C content (3.5%)	0.57 a	1.92 a	2.25 a
Dosage of Methyl Metsulfuron herbicide:			
d0: No herbicide	2.53 b	8.58 b	9.55 b
d1: Methyl methulfuron dose 0.0010 kg a.i./ha	0.00 a	0.37 a	0.00 a
d2: Methyl methulfuron dose 0.0020 kg a.i./ha	0.00 a	0.00 a	0.00 a
d3: Methyl methulfuron dose 0.0030 kg a.i./ha	0.00 a	0.00 a	0.00 a
d4: Methyl methulfuron dose 0.0040 kg a.i./ha	0.00 a	0.00 a	0.00 a

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

Dried weights weed *Pistia stratiotes*

The results of the analysis of variance showed that there was no interdependence between the organic matter content and the dose of the methyl methulfuron herbicide on the dry weights of *Pistia stratiotes* (Table 4).

Table 4: Effects of Various Organic Content and Methyl Metsulfuron Herbicide Doses on Dried Weights of *Marsilea crenata*

Treatment	**Average Weed Dry Weights (g/0,25m^2)**		
Ingredients C-Organic:	**7 days after application**	**21 days after application**	**35 days after application**
b1: Low C-organic content (1.86%)	1.11 a	1.57 a	1.01 a
b2: High organic C content (3.5%)	0.36 a	2.88 a	2.37 a
Dosage of Methyl Metsulfuron herbicide:			
d0: No herbicide	3.68 b	10.52 b	7.70 b
d1: Methyl methulfuron dose 0.0010 kg a.i./ha	0.00 a	0.60 a	0.75 a
d2: Methyl methulfuron dose 0.0020 kg a.i./ha	0.00 a	0.00 a	0.00 a
d3: Methyl methulfuron dose 0.0030 kg a.i./ha	0.00 a	0.00 a	0.00 a
d4: Methyl methulfuron dose 0.0040 kg a.i./ha	0.00 a	0.00 a	0.00 a

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

From Table 4 it can be seen that the independent effect of organic matter content does not provide a significant difference between treatments to the observation of *Pistia stratiotes* dry weight, whereas all treatments of methyl methulfuron herbicide doses from the dose 0.0010 kg ai / ha to the dose 0.0040 kg ai / ha gives the average number of dry weeds of *Pistia stratiotes* that are significantly different compared to treatments without the application of herbicides at observations 7, 21, and 35 days after application. This shows that the use of methyl methylphurone herbicide dosage from a dose of 0.0010 kg a.i. /ha to a dose of 0.0040 kg a.i. /ha is able to control Pistia stratiotes weeds in lowland rice fields. This is presumably because methyl methulfuron is systemic, absorbed by roots and leaves, and is transplanted acropetally and basipetal. Sensitive weeds will stop growing almost immediately after application and will die within 7–21 days.

Other Weed Dry Weights

Other weeds are types of weeds that were not found in the previous weed analysis, or did not become one of the dominant weeds found in the rice paddy planting area. This happens because of changes in weed species due to land management and irrigation systems. In accordance with the statement of Uluputy (2014) that the changes in weed species that occur due to soil processing, weeds that emerge come from weed seeds that are carried from agricultural tools.

The results of the analysis of variance showed that there was no interdependence between the content of organic matter and the dose of the methyl methulfuron herbicide on the dry weights of other weeds (Table 5). From Table 5 it can be seen that the independent effect of organic matter content does not provide a significant difference between treatments to other weed dry weight observations. This is in line with the results of research by Sitepu, *et al.* (2017) [16] that the treatment of straw compost has no direct effect on plant growth and yield. The treatment of methyl methulfuron herbicide at a dose of 0.0030 kg ai / ha and a dose of 0.0040 kg ai / ha gave an average number of weeds dry weights that were significantly different compared to treatments without the application of herbicides at observation 7 days after application, whereas at observation 21 and 35 days after the application of the methyl methulfuron herbicide treatment from a dose of 0.0010 kg ai / ha to a dose of 0.0040 kg ai / ha, the average dry weight of other weeds was significantly different than the treatment without the application of the herbicide. This shows that the use of methyl methulfuron herbicide dosage from a dose of 0.0010 kg a.i. /ha to a dose of 0.0040 kg a.i. /ha is able to control other weeds in lowland rice fields.

Table 5: Effects of Various Organic Content and Methyl Metsulfuron Herbicide Doses on Other Weed Dry Weights

Treatment	**Average Weed Dry Weights (g/0,25m^2)**		
Ingredients C-Organic:	**7 days after application**	**21 days after application**	**35 days after application**
b1: Low C-organic content (1.86%)	8.07 a	4.37 a	5.18 a
b2: High organic C content (3.5%)	3.03 a	6.77 a	4.32 a
Dosage of Methyl Metsulfuron herbicide:			
d0: No herbicide	11.37b	20.65 c	15.23 c
d1: Methyl methulfuron dose 0.0010 kg a.i./ha	10.25 b	5.22 b	7.60 b
d2: Methyl methulfuron dose 0.0020 kg a.i./ha	6.13b	1.98 a	0.92 a
d3: Methyl methulfuron dose 0.0030 kg a.i./ha	0.00 a	0.00 a	0.00 a

d4: Methyl methulfuron dose 0.0040 kg a.i./ha	0.00 a	0.00 a	0.00 a

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

2. Rice Plant Phytotoxicity

Observation of plant phytotoxicity due to the application of the methyl methulfuron herbicide was performed visually at 7, 14, and 21 days after application. Observations are based on some of the symptoms displayed, namely sprouts failure, stunted growth, abnormal growth, and chlorosis (Kearney and Donald, 1988).

From observations at 7, 14, and 21 days after application to plants in all experimental plots showed phytotoxicity symptoms due to the application of all doses of methyl methulfuron herbicide on a scale of 0 (no poisoning). This shows that the application of the methyl methulfuron herbicide up to a dose of 0.0040 kg a.i. /ha is safe to use for rice plants. According to Kirkwood (2002) several types of plants such as rice, corn, and cotton are tolerant of herbicides because they contain enzymes that can turn toxic substances into non-toxic plants, such as the enzyme nitralase, glyphosate oxidoreductase, phosphinothricin acetyl transferase, and 2, 4-D dioxygenase. Furthermore Widayat, *et al*. (2018) [26] reported that the use of the methyl methulfuron herbicide showed no symptoms of poisoning in lowland rice plants.

Table 6: Observation Results of Percentage of Phytotoxicity of Rice Plants Due to Herbicide Application Based on Scale issued by the Pesticide Commission (1984) at 7, 14, and 21 days after application

Treatment		Observation		
		7 days after application	14 days after application	21 days after application
b1d1	Low C-organic content + Methyl methulfuron dose 0.0010 kg a.i./ha	0	0	0
b1d2	Low C-organic content + Methyl methulfuron dose 0.0020 kg a.i./ha	0	0	0
b1d3	Low C-organic content + Methyl methulfuron dose 0.0030 kg a.i./ha	0	0	0
b1d4	Low C-organic content + Methyl methulfuron dose 0.0040 kg a.i./ha	0	0	0
b2d1	High C-organic content + Methyl methulfuron dose 0.0010 kg a.i./ha	0	0	0
b2d2	High C-organic content + Methyl methulfuron dose 0.0020 kg a.i./ha	0	0	0
b2d3	High C-organic content + Methyl methulfuron dose 0.0030 kg a.i./ha	0	0	0
b2d4	High C-organic content + Methyl methulfuron dose 0.0040 kg a.i./ha	0	0	0

3. Rice Plant Height

Based on analysis of variance shows there is no influence of interdependence between organic matter content with the dose of methyl methulfuron herbicide on the observation of rice plant height (Table 7). In Table 7 it can be seen that the treatment dose of organic matter did not have a significant effect between treatments between low, medium, and high C-organic content on rice plant height at observations 7, 21 and 35 days after application. Barus (2011) [3] reports the results of his research that the administration of straw compost to 10 tons / ha has no effect on the height of rice plants. The same was conveyed by Kadengkang *et al.* (2015) [5] in a study carried out in paddy fields, that the administration of straw compost from doses of 2.5 - 10 t / ha did not show differences in rice plant height.

The same thing happened in the treatment of methyl Methulfuron herbicide dosage, where the administration of the dose of methyl methulfuron herbicide was not significantly different than the treatment without the application of herbicide on rice plant height. Although the treatment of methyl methulfuron herbicide dosage was able to suppress the growth of weeds in the experimental plot so as to reduce the degree of competition between plants and weeds, but apparently herbicide treatments have not been able to influence the height of rice plants. This is possible because plant height is influenced not only by environmental factors but also by genetic factors. According to Sitohang *et al*. (2014) [17] which states that the genetic makeup equation is one of the causes of uniform appearance of plants. The genetic program is expressed in a variety of plant traits which include the shape and function of plants which produce diversity.

Table 7: Effects of Various Organic Content and Methyl Metsulfuron Herbicide Doses on Rice Plant Height at Observations 7, 21 and 35 days after application

Treatment	Observation of rice plant height (cm)		
Ingredients C-Organic:	7 days after application	21 days after application	35 days after application
b1: Low C-organic content (1.86%)	35.43 a	53.25 a	70.58 a
b2: High organic C content (3.5%)	37.77 a	56.06 a	72.99 a
Dosage of Methyl Metsulfuron herbicide:			
d0: No herbicide	35.95 a	54.02 a	67.03 a
d1: Methyl methulfuron dose 0.0010 kg a.i./ha	37.92 a	57.69 a	72.29 a
d2: Methyl methulfuron dose 0.0020 kg a.i./ha	38.40 a	52.62 a	73.28 a
d3: Methyl methulfuron dose 0.0030 kg a.i./ha	36.22 a	54.99 a	73.27 a
d4: Methyl methulfuron dose 0.0040 kg a.i./ha	34.51 a	53.96 a	73.05 a

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

4. Number of Paddy Vegetables per Clump

Results of analysis of variance showed that there was no interdependence between organic matter content and methyl methulfuron herbicide dosage on the results of observing the number of vegetative saplings of rice plants per family (Table 8). In Table 8 it can be seen that the treatment dosage of organic matter did not have a significant effect between treatments between low, medium, and high C-orgaik content on the number of vegetative tillers per family in clumps at observations 7, 21, and 35 days after application. This is in line with research by Sitepu *et al.* (2017) [16] that the application of straw compost did not have a different effect than other treatments on the growth of lowland rice. Furthermore, Prabowo (2008) [9] explained that most of the fertilizer applied to the soil cannot be used by plants because it reacts with other soil materials, so the fertilizer efficiency values are generally low to very low.

Table 8: Effects of Various Organic Content and Methyl Metsulfuron Herbicide Doses on the Number of Vegetative Tiller of Rice Plants per Clump at Observation 7, 21 and 35 days after application

Treatment	Number of Vegetative Tiller of Rice Plants per Clump		
Ingredients C-Organic:	**7 days after application**	**21 days after application**	**35 days after application**
b1: Low C-organic content (1.86%)	8.27 a	17.27 a	21.07 a
b2: High organic C content (3.5%)	9.40 a	19.40 a	21.27 a
Dosage of Methyl Metsulfuron herbicide:			
d0: No herbicide	7.50 a	15 a	18.33 a
d1: Methyl methulfuron dose 0.0010 kg a.i./ha	9.00 a	17.83 b	21.33 bc
d2: Methyl methulfuron dose 0.0020 kg a.i./ha	10.17 a	20.17 bc	23.33 c
d3: Methyl methulfuron dose 0.0030 kg a.i./ha	8.50 a	18.33 bc	22.33 bc
d4: Methyl methulfuron dose 0.0040 kg a.i./ha	9.00 a	20.33 c	20.50 b

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

As for the independent effect of methyl methyl sulfurone herbicide treatment, it showed that the observation of 7 days after the application of the herbicide dosage treatment was not significantly different from the treatment without herbicide on the number of vegetative tillers per rice family. Only at observations 21 and 35 days after application of all methyl methulfuron herbicide treatments dose of 0.0010 kg ai / ha, 0.0020 kg ai / ha, 0.0030 kg ai / ha, and a dose of 0.0040 kg ai / ha showed differences significantly compared to the non-herbicide treatment of the number of vegetative tillers per rice family. This means that the treatment of methyl methulfuron herbicide dosages that can suppress weed growth have a good effect on increasing the number of vegetative tillers. The less weed population in the area of cultivation, the competition with plants for water, sunlight, and nutrients can be suppressed so that growth and yield of plants will be optimal (Simanjuntak et. al., 2016) [15]. So to get good growth and crop yield, weed control, especially in critical periods, is very necessary (Maulana *et. al*., 2015) [7].

5. Number of Productive Tiller of Rice Plants per Clump

Results of analysis of variance showed that there was no interdependence between organic matter content and methyl methulfuron herbicide dosage on observations of the number of generative tillers of rice plants per family (Table 9). In Table 9 it can be seen that the treatment dosage of organic matter does not have a significant effect between treatments between low, medium and high C-organic content on the number of generative tillers of rice plants per family. The same thing was reported by Arifiani *et al.* (2018) [2] that in his research the provision of organic matter did not cause an increase in the amount of rice per clump.

The independent effect of the methyl methulfuron herbicide treatment dose of 0.0020 kg a.i. /ha showed a significantly different average rate compared to the treatment without herbicide on the number of productive tillers of rice plants per family. While the methyl methulfuron herbicide treatment dose 0.0010 kg ai / ha, 0.0030 kg ai / ha, and the dose 0.0040 kg ai / ha showed an average figure that was not significantly different from the treatment without herbicide on the number of productive tillers per clump, but the herbicide treatment showed an average number of productive tillers which tended to be higher than treatments without the application of herbicides. This means that the treatment of methyl methulfuron herbicide dosage which is able to suppress the growth of weeds gives a good effect on increasing the number of generative tillers. Anthralina *et. al.* (2015) revealed that methyl methulfuron is a systemic and selective herbicide, can be used pre and post-growth. The herbicide is able to stop the division of plant cells by blocking the action of the enzymes AcetoLactate Synthase (ALS) and AcetoHydroxy Synthase (AHAS) to inhibit the conversion of α-ketoglutarate into 2 acetohydroxybutyrate and pyruvate into 2-acetolactate which produces the amino acid chain chain valine, leucine, and isoleucine. Without essential amino acids, proteins cannot be formed and cause weeds to die. Furthermore Sumardi *et. al.* (2007) [21] asserted that the number of productive tillers that come out on rice is influenced by several factors, such as environmental factors that are inhibiting so that plants will respond by removing panicles with a smaller amount.

Table 9: Effect of Various Organic Content and Methyl Metsulfuron Herbicide Doses on Number of Productive Tillers of Rice Plants per Clump

Treatment	Number of Productive Tillers of Rice Plants per Clump
Ingredients C-Organic:	
b1: Low C-organic content (1.86%)	13.33 a
b2: High organic C content (3.5%)	13.80 a
Dosage of Methyl Metsulfuron herbicide:	
d0: No herbicide	10.17 a
d1: Methyl methulfuron dose 0.0010 kg a.i./ha	14.50 ab
d2: Methyl methulfuron dose 0.0020 kg a.i./ha	15.67 b
d3: Methyl methulfuron dose 0.0030 kg a.i./ha	14.33 ab

d4: Methyl methulfuron dose 0.0040 kg a.i./ha	12.67 ab

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

6. Weight of Dry Milled Grain

Based on the results of analysis of variance showed that there was no influence of interdependence between the content of organic matter with the dose of the methyl methulfuron herbicide on the results of observing the weight of the milled unhusked rice (Table 10). Harvesting must be done at the right time to maintain the quality and quantity of results. According to Krismawati (2011) [6] the harvest must be done if the rice grains are sufficiently considered to be ripe 90% with the characteristics of the whole plant appearing yellow, from all parts of the plant, only the upper feathers are still green; the contents of the grain are hard, but break easily with nails; Yellow cooking stage occurs 7 days after stadia cooking milk. Poor harvest time can reduce the quality of grain and rice.

In Table 10 it can be seen that the independent effect of the treatment of organic matter contents both low and high does not provide a significant difference between treatments to the observation of the weight of the milled dry grain. Kadengkang *et al.* (2015) [5] states that the provision of organic matter cannot directly influence the increase in yields of lowland rice. Sugiyanto (2007) [20] also emphasized that the application of organic matter was able to increase N levels gradually and was only seen to increase N accumulation in the soil during the third planting season.

All methyl methulfuron herbicide treatments dose 0.0010 kg ai / ha, 0.0020 kg ai / ha, 0.0030 kg ai / ha, and a dose of 0.0040 kg ai / ha provide an average number of observations of the weight of the dry milled unhusked rice. Significantly different compared without the application of herbicides. The methyl methulfuron herbicide treatment effectively suppressed the dry weight of weed Altenanthera sessilis, Ludwigia octavalvis, Marsilea crenata, Pistia stratiotes, and other weeds, and based on the data in table 10 the treatment of methyl methulfuron herbicide dose of 0.0020 kg ai / ha gave the highest milled dry grain weight. This shows that the competition between rice plants and weeds becomes small which in turn increases plant growth and the photosynthate partition used for panicle formation will increase.

Based on research that has been done that the presence of weeds is very disturbing productivity of rice plants and now that weeds can be controlled mechanically, can also be done chemically with the use of herbicides is a step to control weeds chemically but relatively safe both for users and for the main crop itself (Sastroutomo, 2001) [13]. Rice productivity depends on the interaction of various physiological and biological functions in plants. Higher percentages of filled grains are an indication of the higher photosynthetic efficiency of plants that produce higher yields (Channappagoudar *et. al.*, 2008) [4].

Table 10: Effect of Various Organic Content and Methyl Metsulfuron Herbicide Doses on the Weight of Dry Rice Milled Grain per 1 m^2

Treatment	**Weight of Dry Rice Milled Grain per 1 m^2**
Ingredients C-Organic:	
b1: Low C-organic content (1.86%)	34.39 a
b2: High organic C content (3.5%)	36.26 a
Dosage of Methyl Metsulfuron herbicide:	
d0: No herbicide	25.18 a
d1: Methyl methulfuron dose 0.0010 kg a.i./ha	35.00 abc
d2: Methyl methulfuron dose 0.0020 kg a.i./ha	45.21 c
d3: Methyl methulfuron dose 0.0030 kg a.i./ha	38.55 bc
d4: Methyl methulfuron dose 0.0040 kg a.i./ha	32.67 ab

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

Conclusion

1. There is no interdependence between the treatment of methyl methulfuron herbicide dosage and C-organic content to the weed dry weight of each species, other weed dry weights, rice plant height, number of vegetative tillers and number of productive tillers per family, and yield of rice plants.
2. 2. Between the treatment of low organic C-content (1.86%) and high organic C-content (3.5%) did not show any significant difference in weed dry weight of each species, weed dry weight, growth and yield of rice plants.
3. 3. The treatment of methyl methulfuron herbicide from a dose of 0.0010 kg a.i. /ha to a dose of 0.0040 kg a.i./ha affects the weed dry weight, number of vegetative tillers, number of productive tillers, and yield of rice plants.
4. 4. Treatment of methyl methulfuron herbicide up to a dose of 0.0040 kg a.i. /ha does not cause poisoning symptoms in rice plants.
5. 5. Treatment of methyl methulfuron herbicide with a dose of 0.0020 kg a.i. /ha is able to give the highest growth and yield of rice as much as 45.21 g / m2.

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