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RESPONSE OF WEED SEED GERMINATION FROM FRUIT CROPS PLANTING SOIL TO APPLICATION OF METSULFURON METHYL HERBICIDE AND RICE HUSK BIOCHAR

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ABSTRACT

This study aims at determining the effect of pre-growth application of the herbicide metsulfuron methyl on soil mixed with rice husk biochar against the germination of weeds. This study used a factorial completely randomized design (CRD) with two levels of the herbicide metsulfuron methyl (0 g/ha and 300 g/ha) and four levels of rice husk biochar (0%, 5%, 10%, and 15% of the total of planting medium weight). The parameters observed were the number of weed sprouts, weed wet weight, and weed dry weight. The results showed that the interaction of the herbicide metsulfuron methyl and rice husk biochar had no significant effect on weed germination. The single treatment of the herbicide metsulfuron methyl gave a significant effect on the amount of weed sprout, weed wet weight, and weed dry weight. Herbicides can suppress the number of germinating weeds, weed wet weight, and dry weed weight by 39.3%, 83.7%, and 84.7%, respectively. While the single treatment of rice husk biochar showed a significant effect on the number of weeds and weed dry weight. The treatment of 15% rice husk biochar is best in reducing the number of weeds germination in the amount of 76.6%. Rice husk biochar has the potential to be an alternative to suppress weed seed germination in the soil without using herbicides.
Keywords: rice husk biochar, herbicide, metsulfuron methyl, weed germination

INTRODUCTION

Weeds are plants whose presence is considered detrimental to human interests, such as inhibiting the growth of cultivated plants through competition for water, nutrients, air, light, space, and containing of allelopathic content. This competition will have fatal consequences in the form of a decrease in potential and actual crop yields, a decrease in the actual yield of lowland rice with a transplanting system can reach 25.6%, and in direct spread rice it can reach 75.6% (Somowiyarjo, 2020).

In general, the magnitude of the effect of competition with weeds is determined by the level of soil fertility, plant and weed variety, soil moisture, land cultivation, and weed density (Kilkoda et al., 2015). Weeds Density is determined by how many of the weed seeds are stored in the seed bank of weeds successfully germinate. To prevent weed seeds germinate, it is necessary to have a control measures, whether it be physical, mechanical, technical culture, biological or chemical. Chemical control is the ways of controlling weeds using herbicides, and one of the most widely used to prevent weed germination is metsulfuron methyl herbicide active ingredient (Nelemans et al., 2017).

The herbicide metsulfuron methyl has the chemical name methyl 2-[(4-methoxy-6-methyl-1,3,5-triazine-2-yl) carbamoylsul famoyl] benzoate, first published by DuPont in 1984. Methyl metsulfuron is the active ingredient in herbicides. The sulfonylurea group which is systemic, can be used as a pre-growth and post-growth herbicide (Alesso et al., 2018) , which has low toxicity to mammals, low recommended dosage for use, and is also rapidly degraded in the soil (European Food Safety Authority, 2015) .

Pre- growth herbicides are applied to the soil surface, the purpose of which is to prevent weed seeds from germinating and kill weeds at the beginning of germination. Herbicide forms a thin layer of about 0-5 cm in below the soil surface, if exposed to and absorbed by radicle and / or plumule diffusionally when it penetrates the soil, it weed sprouts be poisoned (Djojosumarto, 2020) .

The way the active ingredient of the herbicide metsulfuron methyl works is to inhibit the action of the *acetolactate synthase* (ALS) and *acetohydroxy synthase* (AHAS) enzymes in the synthesis of aliphatic amino acids, namely valine, leusine , and isoleusine (Hang et al., 2012) . After exposure to compound phytotoxic of these active ingredients, the plants will suffer to cells and tissues to show symptoms of chlorosis, necrosis, and eventually died (Marble et al., 2016).

Metsulfuron methyl herbicide has a broad spectrum of control and is selective, plays an active role in controlling broadleaf weeds such as *Centrosema pubescens, Commelina benghalensis*, and grass weeds such as *Cynodon dactilon* in immature oil palm cultivation (N.H. Khasanah et al., 2014) .

It is also effective in controlling weeds *Ageratum conyzoides, Synedrella nodiflora, Axonopus compressus, and Cyperus kyllingia* in *producely* oil palm cultivation (Koriyando et al., 2014).

Metsulfuron methyl is also active in controlling broadleaf weeds *Borreria alata, Praxelis clematidea, Croton hirtus* and grass weeds *Axonopus compressus, Ottochloa nodosa* on which immature rubber plantations (Saputra et al., 2021).

In addition, metsulfuron methyl successfully controlled broadleaf weeds *Chenopodium album, Melilotus indica, Lathyrus aphaca, Rumex dentatus*, and grass weeds *Phalaris minor* in wheat cultivation in India. (Singh et al., 2015).

One of the agricultural wastes that can still be used to support the zero waste movement is rice husk, which is the outer hard skin of the rice grain, formed from silica and lignin, whose function is to protect rice during its growth period. Husk consists of about 20-25% of the weight of rice, obtained from by-products during the rice milling process. Rice husks can be used again as input on agricultural land cultivation directly or used as biochar and ash first.

Biochar is a carbon-rich material made through the pyrolysis process, which is an incomplete combustion process with temperatures between 100 and 600°C under conditions of limited oxygen. The results of the pyrolysis or carbonization of rice husks into biochar are carbon 26 - 41%, ash 29 - 46%, and water 5 - 9% (Siahaan et al., 2013).

Rice husk biochar is commonly used as an ameliorant or soil enhancer in agricultural crop cultivation to improve soil quality by improving soil physics, chemical, and biological properties, such as soil texture and structure, soil pH and CEC, and the number of beneficial microorganisms in the soil (Asridawati & Febrianti, 2019; VR Khasanah et al., 2020) .

By improving the properties of the soil, it is expected to create a conducive environment for plant growth and development, so as to increase the quantity and quality of cultivated plant yields (Gea et al., 2020; Lolomsait, 2016).

In addition, rice husk biochar is also known to have the ability to absorb agricultural chemicals such as pesticides and chemical fertilizers (Hussain et al., 2016). Then decomposed physics, chemically and biologically into compounds that are not harmful to the environment (Jing et al., 2018; Zhelezova et al., 2017).

Research using rice husk biochar in the application of the herbicide metsulfuron methyl and its relationship to weed control has not been carried out. Based on this, the purpose of this study was to study the effect of pre-growth application of herbicide with active ingredient metsulfuron methyl on soil mixed with rice husk biochar on the germination of weed seeds from the soil of fruit crops.

MATERIALS AND METHODS

1. Materials and Tools

The materials used in this study include: metsulfuron methyl 20% countaining herbicide (trade brand Ally 20 WG), black soil containing weed seed bank, and rice husk biochar.

The tools used include: plastic pots, semi-automatic hand sprayer, small shovels, hoes, scales, analytical scales, measuring cups, stationery, and others.

2. Research Implementation

The research was carried out in the Green House of experimental field, Faculty of Agriculture, Islamic University of Riau. The research took place from May 2018 to June 2018.

Black soil containing weed seeds was taken from land located in Tangkerang Labuai Village, Bukit Raya District, Pekanbaru City, is top soil with a depth of about 0-10 cm, previously planted with coconut, rambutan and jengkol trees, and previously not been contaminated with herbicides.

At the time of taking the soil, a primary survey was conducted to determine the types of weeds growing in the location, by visually observing the dominant weeds, then identifying the types of weeds.

The types of weeds that can be found at the site include broadleaf weeds, namely *Asystasia gangetica, Ageratum conyzoides, Oxalis barrelieri* and *Mimosa pudica*. As well as the narrow-leaved weeds, namely *Eleusine indica, Cyperus rotundus,* and *Cynodon dactylon.*

This study used a completely randomized design (CRD) with factorial pattern with 2 factors. The first factor is the dose of the herbicide metsulfuron methyl with 2 levels, namely: 0 gr/ha (H0) and 300 gr/ha (H1), and the second factor is the composition of rice husk biochar and soil with 4 levels, namely: 0% biochar + 100 % land (A0); 5% biochar + 95% soil (A1); 10% biochar + 90% soil (A2); and 15% biochar + 85% soil (A3).

The total weight of the planting medium (soil + rice husk biochar) in the pot is 2 kg. Soil and husk biochar are mixed evenly on the floor, then put in a plastic pot. The treatment was repeated 3 times, bringing the total to 24 experimental treatment units.

Herbicides were sprayed onto the soil surface with an application concentration of 0.67 gr/l water (300 g/ha), and left without watering for 17 days in a place that was shaded from the sun.

Then watering was carried out for 10 days from 18 DAS to 27 DAS (the day after spraying herbicides) as much as 200 ml per pot once a day. Sampling was carried out at 28 DAS (days after herbicide spray).

The parameter observed in this study was the number of germinated weeds, weed wet weight, and weed dry weight. In addition, observations were also made on the visible signs of damage and grouping the types of weeds that appeared. Observations began after watering and exposure to sunlight. Weed dry weight was measured after drying in an oven at 70°C for 48 hours.

Observational data were analyzed by analysis of variance (ANOVA) at the 5% level to determine whether the treatment had a significantly different effect on each observed response variable. To distinguish the mean value of the treatment, the Least Significant Difference (LSD) test was performed at the 5% level.

RESULTS AND DISCUSSION

1. Number of Weed Sprouts

The calculation of the number of weed sprouts was carried out to determine how much effect the residue of the active ingredient of the herbicide metsulfuron methyl and rice husk biochar had in suppressing and controlling the number of weed seeds germinated in the soil.

Table 1. The average value of the number of weed sprouts at 28 DAS (individuals).

Treatment	Composition of rice husk biochar				Average
	A0 (0%)	A1 (5%)	A2 (10%)	A3 (15%)	
No Herbicide (H0)	12.67	12.00	9.00	3.67	9.33[b]
Herbicide (H1)	8.67	6.33	6.33	1.33	5.67[a]
Average	10.67[b]	9.17[b]	7.67[b]	2.50[a]	
	KK = 44.20%	LSD H = 2.87	LSD A = 4.06		

The numbers in the rows and columns followed by the same lowercase letters showed no significant difference according to the LSD follow-up test at the 5% level.

Based on the results of the analysis of variance, it was found that the interaction between herbicide treatment (H) and rice husk biochar ameliorant treatment (A) did not have a significant effect on the number of weeds that germinated.

However, if you look at the average value, there was a decrease in the number of weed sprouts along with the addition of rice husk biochar in the herbicide or without herbicide treatment. So it can be seen that rice husk biochar did not reduce the efficacy of the herbicide metsulfuron methyl in this study.

Herbicide single treatment (H) showed a significant effect on the number of weeds that germinated. Likewise, the treatment of different compositions of rice husk biochar (A) gave a significant effect on the number of weeds that germinated.

After further testing the Least Significant Difference (Table 1), it can be seen that the treatment using herbicide (H1) showed a significant difference with the treatment without herbicide (H0). Herbicides can reduce the number of weed germination by 39.3% to 5.67 individuals.

Likewise in the ameliorant treatment of rice husk biochar, the composition of 15% husk biochar (A3) showed a significant difference compared to the treatment without rice husk biochar (A0). Giving ameliorant 15% rice husk biochar (A3) can suppress weed germination by 76.6% to 2.5 individuals. While the composition of the other rice husk biochar (A1 and A2) showed no significant difference with the treatment without rice husk biochar (A0).

The results of this study indicate that the application of rice husk biochar is actually more effective in suppressing weed germination in the soil compared to spraying herbicides, but requires a large amount of biochar. This is in line with research (Arif et al., 2012) which concluded that biochar applied to the soil can delay phenology and reduce weed density in maize cultivation.

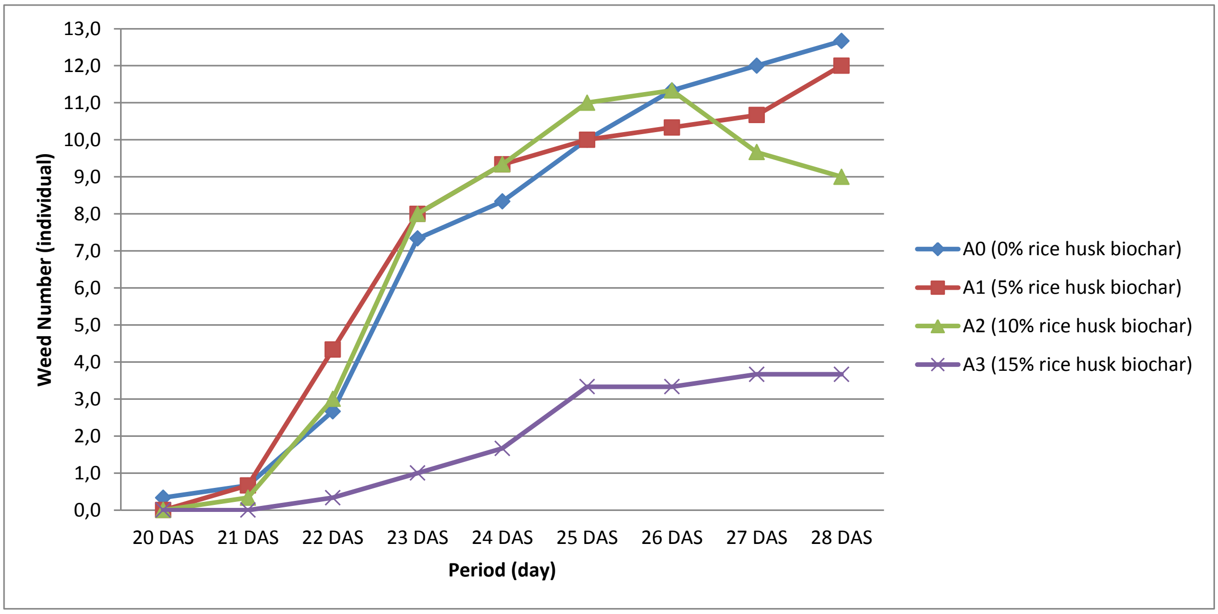

Figure 1. Graph of the increase in the number of weed sprouts in the treatment without herbicides (H0).

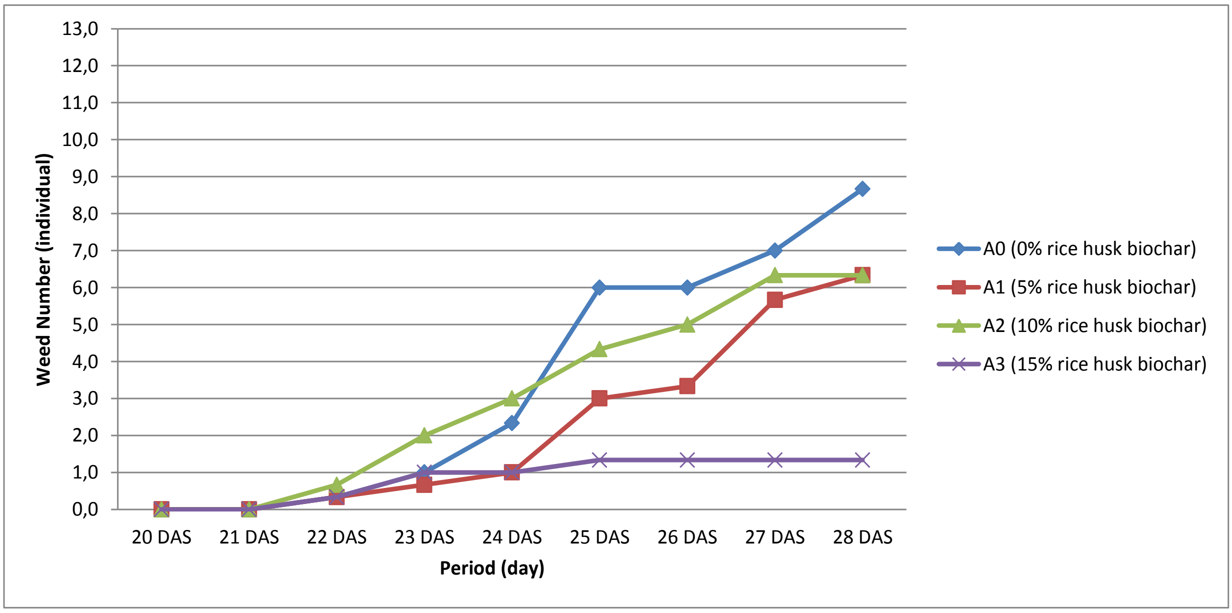

Figure 2. Graph of the increase in the number of weed sprouts in herbicide treatment (H1).

At the graph above (Figure 1 and Figure 2) , it can be seen that the appearance of weed sprouts in the treatment without herbicide (H0) started on the 3rd day of watering (20 DAS), while in the herbicide treatment (H1) weed sprouts began to grow, appeared on the 5th day of watering (22 DAS). In other words, the appearance of weed sprouts in the herbicide treatment was 2 (two) days late compared to the treatment without herbicides.

It indicates that the herbicide metsulfuron methyl has the potential to slow down the germination time of weed seeds, but the mechanism needs to be further investigated.

In common, the absorption of systemic herbicides in the soil by weed sprouts can occur in three ways, namely: (1) absorption by imbibition by weed seeds, (2) absorption by the roots of weed sprouts or radicles, and (3) absorption by shoots of weed sprouts or plumule (Djojosumarto, 2020).

Site of action of metsulfuron methyl herbicide is inhibiting ALS and AHAS enzyme that occurs in plant chloroplasts (Dezfulian et al., 2017). The enzymes ALS (*acetolactate synthase)* and AHAS (*acetohydroxy acid synthase)* are enzymes that play a role in the formation of aliphatic amino acids or BCAA (Branched-Chain Amino Acids) namely valine, leucine, and isoleucine, precisely at growing points or plant meristem tissue (Zakaria et al., 2018)

The BCAAs amino acids are very much needed by humans because they can increase muscle protein synthesis, so they are used as supplements for sports athletes. Whereas in plants, this amino acid can serve as a source of nitrogen (N) for golf course grass (turn grass) (Mertz et al., 2019), and can support plant respiration by directly or indirectly triggering the electron transport chain in mitochondria (Kochevenko et al., 2012).

Furthermore, in the treatment without herbicide (H0), the number of weed sprouts in A0, A1 and A2 continued to increase sharply after day 4 of watering (21 DAS) with germination rates of 1.43, 1.03 and 1.01 individuals/day, respectively. But weed growth in A3 was relatively constant. To noted, the number of weed sprouts in A2 seemed to decrease after 26 DAS due to caterpillar attacks.

While in the treatment with herbicides (H1), the number of weed sprouts in A0, A1 and A2 continued to increase slowly with a germination rate of 1.21, 0.95 and 0.53 individuals/day, and weed growth in A3 seemed to be more constant.

Although the rate of weed germination in the herbicide treatment was lower than the weed germination rate in the treatment without herbicide, it tends to increase slowly and approaches the number of weed sprouts in the treatment without herbicide, especially after the 7th day of watering.

It is caused due to residual active ingredient metsulfuron methyl herbicide in the soil gradually disappeared or degraded after watering for 10 days. The residue of the active ingredient metsulfuron methyl was actually found in the seepage water that was collected from the bottom of the pot (Arridho et al., 2019).

In other words, watering cause the active ingredient herbicide leached is gradually into the lower soil layers causing the active ingredients of herbicides in a layer of top soil gradually loses its efficacy as well. So that the herbicide metsulfuron methyl is not recommended during the rainy season.

Jansar & Bin Sahid, (2016) reported that the level of residual metsulfuron methyl herbicide in the river water that had close early with oil palm plantations increased sharply during the rainy season due to leaching.

And the possibility of other causes of loss or reduction in the active ingredient herbicide metsulfuron methyl is due to the adsorption of organic materials biochar (Hussain et al., 2016) and / or in decomposition by microorganisms such as *Escherichia coli* and *Saccharomyces cerevisiae* by means of de-esterification (Hang et al., 2012) .

Another interesting thing is the number of germination of weeds in the provision of 15% rice husk (A3) does not increase in the application of herbicides or without herbicide. I suspect that rice husk adsorb of water given, thus blocking the water imbibition entry into weed seeds. Because physiologically, weed seeds need water to start germination. Water is needed to soften the seed coat, carry oxygen, dilute protoplasm, and transport dissolved food .

In addition, water also functions to activate enzymes that will be used in respiration activities to break down carbohydrates, proteins and fats in the seeds, and the results of these metabolisms are needed for the growth and development of embryonic cells in weed seed germination.

This indicates that rice husk c biochar can be an alternative to suppress weed seed germination in the soil without using herbicides, as an effort to develop environmentally friendly agricultural cultivation.

As expressed by (Scott et al., 2015), that rice husk biochar potentially provide the best conditions in the soil to improve plant growth, but some kind of weed germination showed minimal response with the addition of biochar.

2. Weed Wet Weight

The wet weight of weeds illustrates how much metabolic yields were obtained and the water contained in the weeds after being treated with herbicides and rice husk biochar.

The results of the analysis of weed wet weight variance showed that the interaction between herbicide treatment (H) and rice husk biochar ameliorant (A) did not show a significant effect. Likewise, the single treatment of rice husk biochar (A) did not have a significant effect on the wet weight of weeds. Only a single treatment of herbicide (H) showed a significant effect on the yield of weed wet weight (Table 2).

Table 2. The average value of wet weight of weed sprouts at 28 DAS (mg).

Treatment	Composition of rice husk biochar				Average
	A0 (0%)	A1 (5%)	A2 (10%)	A3 (15%)	
No Herbicide (H0)	220.97	364.60	195.03	44.30	206.23[b]
Herbicide (H1)	59.23	36.37	32.00	6.57	33.54[a]
Average	140.10	200.48	113.52	25.43	
	KK = 82.80%	LSD H = 85.87			

The numbers in the rows and columns followed by the same lowercase letters showed no significant difference according to the LSD follow-up test at the 5% level.

Herbicide treatment (H1) gave a significant effect in reducing the wet weight of weeds, which was 83.7%. While the provision of rice husk c biochar if seen the average value, can also suppress the wet weight of weeds in the treatment of 10% and 15% rice husk biochar.

However, the uniqueness of the 5% treatment of rice husk biochar was that the wet weight of weeds increased, even though the number of weeds that germinated was smaller than that without rice husk biochar (table 1).

It is suspected that giving rice husk biochar in small or sufficient quantities actually provides a suitable environment for weed growth, both in the form of water and nutrients. Where water and nutrients are needed by weeds to carry out metabolic activities like cultivated plants, such as protein and lipid synthesis, photosynthesis and respiration, membrane and protoplasm formation, and other physiological activities. In addition, rice husk biochar can increase soil bulk density and reduce soil compaction, thereby providing good aeration for weeds.

This is in line with research (Chauhan, 2013) which concluded that rice husk biochar can increase the emergence of sprouts and biomass of duck grass weed (*Echinochloa colona*) and reduce the efficacy of several types of herbicides.

On the other hand, giving rice husk biochar in large quantities actually becomes an inhibiting factor in the absorption of water and nutrients needed by weeds. Especially the administration of 15% rice husk biochar, which can reduce the wet weight of weeds by 81.8% compared to without rice husk biochar.

The addition of rice husk biochar results in an increase in the C-organic content of the soil, so that if the soil has a lot of C-organic compared to nutrients (N, P, K, and so on), it can cause a process of reducing nutrient levels in the soil. by the activity of microorganisms or also called immobilization.

To noted, rice husk biochar which was applied in this study contained C-Organic 35.5%, Total N 1.42%, Water Content 35.8%, so that C/N was 25% (tested in the Central Plantation Services Laboratory Pekanbaru).

3. Weed Dry Weight

The dry weight of weeds illustrates how much metabolic products are produced and distributed in weeds after being treated with herbicides with the active ingredients of methyl metsulfuron and rice husk biochar.

Table 3. The average value of weed dry weight at 28 DAS (mg).

Treatment	Composition of rice husk biochar				Average
	A0 (0%)	A1 (5%)	A2 (10%)	A3 (15%)	
No Herbicide (H0)	17.60	26.93	14.07	3.03	15.41 b
Herbicide (H1)	3.83	2.37	2.77	0.43	2.35 a
Average	10.72 a	14.65 b	8.42 a	1.73 a	
	KK = 82.70%	LSD H = 6.35	LSD A = 8.98		

The numbers in the rows and columns followed by the same lowercase letters showed no significant difference according to the LSD follow-up test at the 5% level.

The results of the analysis of weed dry weight variance showed that the interaction between herbicide treatment and rice husk biochar ameliorant did not significantly affect weed dry weight. While the single treatment of herbicide and rice husk biochar each showed a significant effect on the dry weight of weeds. However, the calculated F value of rice husk biochar treatment was only slightly greater 0.02 compared to the F table value (Table 3).

After further testing of LSD, it can be seen that the herbicide treatment showed a significant difference compared to the treatment without herbicide, and succeeded in suppressing the dry weight of the weeds, which was 84.7%.

This shows that the penetration of metsulfuron methyl into the cells and tissues of weeds can be said to have succeeded in inhibiting the work of the ALS (*acetolactate synthase*) and AHAS (*acetohydroxyacid synthase*) enzymes in synthesizing the amino acids valine, leucine and isoleucine. Then followed by inhibition of cell division and translocation in the phloem vessels, which results in disruption of the distribution of metabolic products, then slowly weeds will die.

While in the treatment of rice husk biochar, only 5% husk biochar treatment (A1) showed a significant difference with the treatment without husk biochar (A0). But interestingly, the 5% husk biochar treatment did not reduce the dry weight of the weeds, instead causing the dry weight of the weeds to be greater than the control treatment.

On other words, giving 5% rice husk biochar treatment cannot be an alternative to suppress weed growth and germination, instead it provides nutrients that cause weeds to grow and develop properly.

4. Injury Symptoms

Figure 4 show that the herbicide metsulfuron methyl has an effect on the leaves and roots of weeds. Weed leaves exposed to herbicides show smaller stature and yellow color (chlorosis). Likewise, weed roots contaminated with herbicides showed black symptoms and no root branches were formed.

In other words, the leaves and roots of weeds provedto have experienced barrier s to growth due to the phytotoxic effect of the active ingredient herbicide metsulfuron methyl. While on treatment without herbicide weed look more fresher and do not show symptoms of poisoning (figure 3).

Figure 3 . Weed Sprouts in the treatment without herbicide (H0).

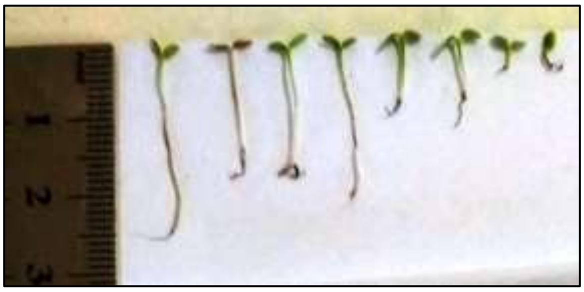

Figure 4. Weed Sprouts treated with herbicides (H1).

The symptoms that arise are due to the cessation of cell division at the growing point which causes the weeds to become stunted, damage to the phloem vessels which causes delays in the transportation of photosynthetic products to all parts of the weed, and failure of the formation of proteins needed to build chlorophyll, cell organelles, and most components that make up a plant. So that weed plants experience chlorosis and necrosis.

The cessation of activity begins with the inhibition of the synthesis of three of the ten essential amino acids produced by plants, namely the amino acids valine, leucine, and isoleucine or also called *Branched-Chain Amino Acids* (BCAAs). The inhibition of the synthesis of these three amino acids is carried out by the metsulfuron methyl compound by blocking the *pyruvate* and *ketobutyrate* molecules as precursors to approach the active site of the ALS (*acetolactate synthase*) and AHAS (*acetohydroxyacid synthase*) enzymes (Durigon et al., 2018).

Pyruvate is a product of the glycolysis process, in which two molecules of *pyruvate* will form the amino acids valine and leucine through the *acetolactate* pathway, while the amino acid isoleucine is formed from the combination of *pyruvate* and *ketobutyrate molecules* through the *acetohydrxybutyrate* pathway (Dezfuli an et al., 2017).

5. Weed Composition

Based on Table 4, it can be seen that the group of weeds that grew in this study was dominated by 173 broadleaf weeds, while only 7 individuals of narrow leaf weeds.

Herbicide with active ingredient metsulfuron methyl can suppress the number of weed sprouts in the soil, whether it comes from broad leaf weeds or narrow leaf weeds. What is meant by narrow leaf weed is a type of weed belonging to the families *Poaceae* (grass) and *Cyperaceae* (sedges), or which has one cotyledon or monocots. While broadleaf weed is a type of weed other than the two families that have two cotyledons or dicots.

Table 4. Number of sprouts of broadleaf weeds and narrowleaf weeds (individuals).

Treatments	Composition of rice husk biochar				Total
	A0 (0%)	A1 (5%)	A2 (10%)	A3 (15%)	
			Broad leaf weeds		
No Herbicide (H0)	36	34	26	11	107
Herbicide (H1)	25	19	19	3	66
Total	61	53	45	14	173
			Narrow leaf weeds		
No Herbicide (H0)	2	2	1	0	5
Herbicide (H1)	1	0	0	1	2
Total	3	2	1	1	7

In general, the absorption of herbicides by these two groups of weeds has a fundamental difference. Absorption by broadleaf weeds is generally through sprout roots or radicles, while herbicide absorption by narrow leaf weeds is through sprout shoots or plumules (Djojosumarto, 2020).

And then the active ingredients of the herbicide will be trans located to all parts of the weed plant that are the site of action of the herbicide such as leaves and meristem tissue on the stems and roots of weeds. This translocation can occur through the apoplast pathway which follows the transpiration pathway , or the symplast which follows the photosynthesis pathway.

The composition of weed variety is determined by the appropriate environment for their growth, such as soil type and soil chemical content (Arfianto, 2016). The other factors that influence it are light, land cultivation, plant cultivation methods, and plant density (Imaniasita et al., 2020).

So that, the population and community types of weeds can be different from one place to another on the types of crops that are same or different, and in a poor place elements of nutrients and rich elements nutrients.

CONCLUSION

In this study it can be concluded that the interaction between the herbicide metsulfuron methyl treatment and rice husk biochar treatment did not show a significant effect on weed germination, but each treatment showed a single effect.

The herbicide metsulfuron methyl gave a significant effect on the number of weed sprouts, weed wet weight, and weed dry weight. Herbicides can suppress the number of weed sprouts, weed wet weight, and weed dry weight by 39.3%, 83.7%, and 84.7%, respectively.

Likewise, the administration of rice husk biochar showed a significant effect on the number of germinated weeds and weed dry weight. Treatment of 15% rice husk biochar (A3) was the best in suppressing the number of weed germination, which was 76.6 %. While the treatment of 5% rice husk biochar could not suppress the number of weed sprouts, but instead caused the weight of weed sprouts to increase.

Based on this study, rice husk biochar did not reduce the efficacy of the herbicide methyl metsufuron and it turned out to have the potential as an alternative way to suppress weed seed germination in the soil without using herbicides with a ratio of rice husk biochar to soil of 1: 6, as an effort to develop friendly agricultural cultivation environment.

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