UDC 633

APPLICATION OF VARIOUS TYPES OF MULCH ON THE GROWTH AND PRODUCTION OF SOYBEAN (GLYCINE MAX L. MERRIL) IN SUSTAINABLE AGRICULTURE SYSTEM

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Abstract
Utilization of natural resources to increase agricultural production is part of the concept of sustainable agriculture, the natural resources in question are rice husks, sawdust and other materials derived from nature. This study aims to determine the best type of mulch in increasing the growth and yield of soybean plants. This study used a one-factor Randomized Block Design (RBD) consisting of 5 treatment levels, namely: without mulch (F0), rice husk mulch (F1), wood sawdust mulch (F2), black plastic mulch (F3) and mulch silver plastic (F4). Each treatment was repeated 3 times so that there were 15 study plots. The results of the study by giving rice husk mulch gave better results than all types of mulch used. In observing the height of the soybean plants, at the ages of 20, 30 and 40 DAP, they were 18.39 cm, 20.49 cm and 22.80 cm respectively. The average number of leaves at the ages of 20 and 30 HST were 14 each. 33 pods and 29.27 pods, the average number of pods per plant was 177.67 pods, and the average seed weight per plant was 120.72 g. Utilization of rice husk mulch can increase the growth and yield of soybean plants.

KEY WORDS
Plastic mulch, rice husk, sawdust, soybean plants.

The increasing need for food, especially soybeans, means that various efforts need to be made to provide and maintain it. These efforts should not be separated from the concept of sustainable agriculture, namely ecological, economic and social balance and security for food consumption. One of the agricultural products that cannot be used optimally is; rice husks and sawdust or other materials of natural origin. Rice husk is the part or outer part of the rice grain that is removed in the milling process, which accounts for 20% of the total world rice production (759.6 million tons of world rice production in 2017, according to the Food and Agriculture Organization) [1].

The use of rice husk as mulch has long been used around the world because it can provide extraordinary benefits, especially in drier and cooler areas [2, 4]. In addition to reducing pollution, mulch has been shown to increase soil moisture, reduce soil erosion, and maintain soil temperature, so that it can help improve soil layers and soil fertility and soil biology [5]. Soil moisture affects mineralization [6], and can control some insect pests [7]. So that in the end it can increase plant growth [8]. The use of husk mulch can maintain soil moisture levels, maintain soil surface temperature, reduce erosion, slow down the impoverishment of K, and Si, increase C-organic, Mg, increase nutrient uptake of P and K, and increase soil aggregate stability and N and P translocation [9]. Husk mulch or mulch derived from other plant residues has low heat conductivity so that heat reaching the soil surface will be less than without mulch or mulch with high heat conductivity such as plastic [4]. This mulch has a reflectivity of about 45% so that 55% of the sunlight that is reflected and absorbed directly or indirectly will interact with the soil [4].

METHODS OF RESEARCH

This research was carried out in Baolan District, Tolitoli Regency, Central Sulawesi Province with an altitude of 10 m asl with an average temperature of 25ºC, carried out from

June to September 2021. The materials used were soybean seeds, chicken manure as basic fertilizer, mulch, vegetable pesticides.

The number of beds used was 15 beds with a bed size of 1 x 2 meters and a height of 30 cm, the distance between the treatment beds was 50 cm and the distance between replicates was 75 cm.

This study used a single factor randomized block design (RBD) consisting of 5 treatments, and was repeated 3 times, namely, F0: Without the use of mulch (control); F1: use of rice husk mulch; F2: use of sawdust mulch; F3: use of black plastic mulch; F4: use of silver plastic mulch.

The data obtained were analyzed using analysis of variance. If there is a real or very significant effect, then a 5% and 1% Honest Significant Difference (HSD) further test is carried out.

To determine the response of soybean plants to treatment, several components of growth and yield were observed as follows:

Plant Height (Cm)

Observation of plant height was carried out from the base of the plant growth on the soil surface which had been marked using standard stakes to the tip of the highest leaf. Measurements began when the plants were 10, 20, 30 and 40 Day after Planting (DAP) until male flowers appeared.

Number of Leaves (Streams)

Observation or counting of the number of leaves is carried out on leaves that have opened completely. Observations were made when the plants were 10, 20, 30 and 40 DAP until the plants produced male flowers.

Number of Pods Plant (Fruit)

The number of pods per plant was observed at harvest by counting the number of filled pods per plant on the sample plants

Seed Weight per Plant (Gr)

The weight of the seeds per plant was observed by weighing the weight of the seeds planted in each sample plant clump which were taken randomly**.**

RESULTS OF STUDY

The results of variance showed that the treatment of various types of mulch had no significant effect on soybean plant height at 10 DAP, significant effect at 20 DAP and highly significant at 30 and 40 DAP. The average height of soybean plants at 10, 20, 30 and 40 DAP, in the treatment of various types of mulch are presented in Table 1.

Table 1 – Average soybean plant height (cm) at ages 10, 20, 30 and 40 DAP in the treatment of various types of mulch

Various treatment mulch type	Plant height			
	10 DAP	20 DAP	30 DAP	40 DAP
Control	13,10	14,27 a	15,90 a	18,77 a
Rice husk	16,47	18,39 b	20,49 b	22,80 b
Wood sawdust	16,39	18,30 b	20,43b	22,35 b
Black plastic	16,19	18,26 b	20,28 b	22,24 b
Silver plastic	15,87	18,10 b	20,16 b	21,99 b

Note: Numbers marked with the same letter in the same column and row are not significantly different at the 5% HSD test level.

Number of Leaves (strands)

The results of variance showed that the treatment of various types of mulch had no significant effect on the number of leaves of the soybean plants at the ages of 10 and 40

DAP, but had a significant effect at the ages of 20, and 30 DAP. The average number of soybean plant leaves at the age of 10, 20, 30 and 40 DAP, in the treatment of various types of mulch is presented in Table 2.

Table 2 – Average number of soybean plant leaves (strands) at ages 10, 20, 30 and 40 DAP in the treatment of various types of mulch

Various treatment mulch type	Number of Leaves			
	10 DAP	20 DAP	30 DAP	40 DAP
Control	2	13,26 ab	17,86 a	35,6
Rice husk	2	14,33 b	29,27 b	45,4
Wood sawdust	1,98	13,80 ab	28,27 ab	45,26
Black plastic	1,86	13,26 ab	27,13 ab	39,66
Silver plastic	1,86	8,93 a	26,60 ab	39,4

Note: Numbers marked with the same letter in the same column and row are not significantly different at the 5% HSD test level.

Number of Pods Sample Plant (fruit)

The results of variance showed that the treatment of various types of mulch had a significant effect on the number of pods per sample plant at harvest. The average number of pods per sample plant at harvest in the various types of mulch treatments is presented in Table 3.

Table 3 – The average number of pods per sample plant (fruit) at harvest in the various types of mulch treatments

Various treatment mulch type	Average
Control	12,53 a
Rice husk	35,53 b
Wood sawdust	33,20 ab
Black plastic	20,80 ab
Silver plastic	19,53 ab

Note: Numbers marked with the same letter in the same column and row are not significantly different at the 5% HSD test level.

Seed Weight Sample Plant (gram)

The results of variance indicated that the treatment of various types of mulch had a significant effect on seed weight persample plant at harvest. The average seed weight per sample plant at harvest in the various types of mulch treatments is presented in Table 4.

Table 4 – Average seed weight per sample plant (grams) at harvest in the various types of mulch treatments

Various treatment mulch type	Average
Control	11,54 a
Rice husk	24,14 b
Wood sawdust	19,84 ab
Black plastic	15,06 ab
Silver plastic	12,01 ab

Note: Numbers marked with the same letter in the same column and row are not significantly different at the 5% HSD test level.

DISCUSSION OF RESULTS

The results of statistical analysis showed that the treatment of various types of mulch had no significant effect on soybean plant height at 10 HST, but had a significant effect at 20 HST and very significantly at 30 and 40 HST. Likewise, the number of leaves at the age of 10 and 40 HST did not have a significant effect, but it had a very significant effect at the age of 20 and 30 HST, where the type of rice husk mulch treatment gave better results compared to other types of mulch. This effect is suspected because rice husk mulch besides being able to

function as mulch can reduce soil erosion, maintain water availability in the soil and suppress weed growth, it can also add organic matter to the soil so that it can improve the physical, chemical and biological properties of the soil. Lowest humidity realized from control (No mulch) [10]. Most of the volatile components of rice husk are slowly lost during combustion and the main residue is silicate Rice husk constitutes about 20% of the weight of rice and its composition is as follows: cellulose (50%), lignin (25%–30%), silica (15%–20%), and humidity (10%–15%) [11]; [12]. Rice husk mulch retains soil moisture most effectively [13]. Rice husk is a source of organic fertilizer that is widely available among farmers. Adding rice husk to the land per plant means the same as adding organic fertilizer to the soil. The use of rice husk mulch can maintain soil moisture levels, maintain soil surface temperature, reduce erosion, slow down K and Si impoverishment, increase C-organic, increase Mg, increase P and K nutrient uptake, and increase soil aggregate stability and N and P translocation. [9] Mulching has the potential to increase soil organic carbon and total nitrogen content [14],

The availability of nutrients for soybean plants, especially nitrogen which comes from rice husk mulch, can be used by plants to support their growth, including plant height and number of leaves. Nitrogen is a macro element, which is generally required for vegetative growth of plants such as roots, stems and leaves [15]. This process is also influenced by root absorption of water and nutrients. mulch is beneficial because it maintains better soil and water status thus causing an increase in growth [16] Water is needed by plants, especially in the process of transforming materials resulting from photosynthesis to parts of the plant that need it, including the stems and leaves. If the whole process takes place optimally, the vegetative growth of plants will increase.

Based on the results of statistical analysis showed that the treatment using various types of mulch had a significant effect on the number of pods per sample plant and seed weight per sample plant, where rice husk mulch also showed a better effect. This is possible because rice husk mulch plays a role in protecting the soil surface from leaching and washing away of nutrients due to surface water flow. The advantage of using mulch from organic matter aims to maintain soil moisture, prevent soil compaction and add to soil humus. Another advantage of mulching is that it improves the life of soil organisms, adds soil organic matter, reduces soil water evaporation, has a positive effect in reducing the rate of evaporation and increases the use of groundwater by plants so that it has an impact on increasing production [17].

Mulch is proven to be able to maintain soil productivity levels because it can protect soil aggregates from the destructive power of raindrops, reduce the amount and speed of surface runoff, maintain soil temperature and moisture and can control weed growth [18]. Besides that, the influence of rice husk mulch on the yield components of soybean plants is also inseparable from the role of the element phosphorus which comes from the provision of rice husks. Fertilization is more aimed at increasing the amount and level of availability of nutrients in the soil, rice husk can increase the availability of phosphorus in the soil so that it can be absorbed by plants, to obtain phosphorus in the soil solution according to their needs, it is necessary to provide greater phosphorus beyond the fixation power of the soil, so that its availability in soil is more [4]

The availability of phosphorus in the soil strongly supports the generative growth of plants, affecting flowering time, the number of flowers formed, the number of fruits and the weight of fruits on plants. In this phase the compounds stored in the leaves and stems are transported and stored in the fruit, so that 75% of the phosphorus in the plant is contained in the fruit, causing the fruit to be formed to be more perfect both in quality and quantity, besides that the element Potassium contained in rice husk also plays a role. In the formation of proteins and carbohydrates. Potassium also plays a role in strengthening the plant body so that leaves, flowers and fruit do not fall easily. the content produced from rice husks is K2O and Na2O, and the levels are related to the type of soil and the amount of fertilizer used during the process of plant development, [19] Potassium is also a source of strength for plants in dealing with drought or attacks by pests and diseases, and can improve quality fruit produced [20]. Rice husk has a significant effect on potassium content [21].

CONCLUSION

The results of the study can be concluded that the use of rice husk mulch in sustainable farming systems provides better results on the growth of soybean plants, namely the observation of plant height, number of leaves, number of pods, and seed weight per plant.

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