

# The Use of Mulch On The Growth And Yield of No Tillage Soybean Planting

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## ABSTRACT

*Soybean occupies the third most important position in the food crop group after rice and corn. Not yet achieved soybean production to meet domestic needs makes soybean imports continue to increase. Land management and mulch use are solutions if there are obstacles to soybean cultivation. No-tillage management is one of the promising ways of cultivating land developed to deal with some of the perfect tillage weaknesses. This research aims to get the type of mulch that can increase the growth and yield of soybean and get the right type of mulch for soybean in a system without tillage. This study used a randomized completed block design with 4 treatments: M1: without mulch, M2: straw mulch, M3: black silver plastic mulch alternating, M4: black silver plastic mulch entirely. Data from observations were analyzed with ANOVA (Analysis of variance) based on F test 5% and continued with Duncan's Multiple Range Test (DMRT) of 5%. The results showed that giving straw mulch and black silver plastic mulch had not increased soybean growth and yield significantly.*

**Keywords:** soybean, mulch, no-tillage

## INTRODUCTION

Soybean (*Glycine max* (L.) merr) is an annual leguminous plant in a low bush, upright growth, and dense leaves. Soybean has an important role as a source of vegetable protein that is useful for improving people's nutrition. Besides, soybeans are relatively cheaper than animal protein sources. According to Leeson [1], soybeans have a crude protein content of around 38% and oil around 20%. Indonesia was able to be self-sufficient in soybeans before 1975 with a consumption production ratio greater than 1.0 [2]

Planting in the former paddy fields has several advantages for growing soybeans, which is able to save energy, costs, and time which is usually done with a system without tillage. Soybeans will experience optimal growth if the growth requirements can be met if the cultivation techniques are appropriate. One technique that is able to help soybean growth is mulching; where mulch can also support soybean growth. Land management and mulch use are solutions

to control if there are obstacles to soybean cultivation. The advantages of without tillage include preventing erosion, maintaining biological diversity, populations of several types of weeds and invertebrate pests can be reduced, the efficiency of fertilizer use can be improved, planting intensity can be increased and therefore without tillage is also called conservation tillage technology [3]

Suitable mulching can change the microclimate of the soil so that soil water content can be increased, and weed growth can be suppressed. Mulch that is can be used, for example, rice straw, which is useful for suppressing the growth of weeds and changing the microclimate of the soil [4]. Besides organic mulch, you can also use inorganic mulch such as black silver plastic mulch. The purpose of this study is to obtain a type of mulch that can increase the growth and yield of soybeans and get the right type of mulch for soybean in a system without tillage.

## MATERIALS AND METHODS

This research was carried out in June - August 2019 in the former rice fields in Pengkok Village, Kedawung District, Sragen Regency, and the Ecology and Production Management Laboratory of the Faculty of Agriculture, Sebelas Maret University. This research is a single factor using a Randomized Completed Block Design (RCBD) with 4 experiments and each experiment was repeated 6 times to obtain 24 units of the experiment, namely: without mulch (M1), straw mulch (M2), black silver plastic mulch alternating (M3), and black silver plastic mulch entirely (M4).

The observed variables included plant height, number of branches, number of leaves, leaf area index, number of pods, number of seeds per plant, fresh weight of straw, dry weight of straw, the weight of seeds per plant, the weight of seeds per plot, and weight of 100 seeds. Data from observations were analyzed with an F-level test of 5% and continued with Duncan's Multiple Range Test (DMRT) of 5%.

**RESULTS AND DISCUSSION**

**A. General Conditions of Research**

**Table 1.** Initial Soil Analysis

No	Chemical Properties of Soil	Result	Unit	The award*
1	N Total	0,16	%	Low
2	P <sub>2</sub> O <sub>5</sub>	7,58	Ppm	Low
3	K <sub>2</sub> O	0,23	me%	Low
4	C Organic	1,14	%	Low
5	Org. Materials	1,97	%	Low
6	C/N Ratio	7,12	-	Low
7	pH	6,74	-	Neutral

\* = Awards according to the Soil Research Institute (2009)

Source: Results of Analysis of the Laboratory of Chemistry and Soil Fertility of FP UNS 2019

The results of the initial soil analysis showed that the soil used for the study contained nutrient content including N Total of 0.16% (low), P<sub>2</sub>O<sub>5</sub> of 7.58 ppm (low), K<sub>2</sub>O of 0.23 me% (low), C Organic of 1.14% (low), Organic Materials of 1.97% (low), C / N ratio of 7.12 (low), pH of 6.74 (neutral)

**B. Growth and Yield**

Plants in their growth are influenced by several factors, including genetic characteristics, environmental conditions, including soil and climate. Plant height will increase due to cell division and elongation. Low organic matter makes the land animals less, for example, worms to help loosen the soil and increase fertility.

**Table 2.** Growth and Yield Soybean

Observation Variable	Treatments			
	M1	M2	M3	M4
Plant Height (cm)	19,50 ab	22,60 b	18,22 a	19,22 a
Number of Branches	7,50a	6,78a	7,83a	7,33a
Number of Leaves	9,89a b	8,78 a	11,61 b	11,45 b
Leaf area index	2,40 ab	1,82 a	2,52 b	2,70 b
Number of Pods	18,90 a	17,11 a	17,39 a	12,95 a
Number of Seeds per plant (g)	26,44 a	31,83 a	34,89 a	22,78 a
Fresh Straw Weight (g)	48,60 a	53,77 a	70,46 a	54,55 a
Dry Straw Weight (g)	18,27 a	19,23 a	26,03 a	20,18a
Seed Weight per Plant (g)	5,63a	6,81a	6,66a	6,09a
Seed Weight per Plot (g)	81,92 a	54,43 a	59,02 a	83,18 a
Weight of 100 seeds (g)	18,90 a	19,96 a	21,36 a	21,18 a

**Notes:** The same line, numbers followed by the same letter are not significantly different based on DMRT 5%

Table 2 shows the control was not significantly different from all treatments, whereas straw mulch was significantly different from mulch black silver plastic alternating mulch and black silver plastic entirely. The average height of soybean means ranged from 18.22 cm to 22.60 cm.

The number of branches can be influenced by the concentration of the cytokinin hormone. Table 2 shows the use of mulch was not significantly different in all treatments. The average number of soybean branches ranged from 6.78 branches to 7.83 branches. The black silver plastic mulch treatment alternated between getting the number of branches 7.83 branches higher than the 7.50 branch control. The straw mulch treatment obtained 6.78 branches. According to Leopold and Kriedeman [5], suboptimal plant growth is possible to make plants not give results that are in accordance with the potential produced by the plants themselves.

Leaves are a significant part of the plant. The number of leaves formed will affect the photosynthesis process. Fitter and Hay [6]. States that the number of leaves and leaf area are the main factors of growth speed. Large growth is also influenced by the leaves with a greater number of leaf areas. The average number of soybean leaves ranged from 9.89 to 11.61 strands. The treatment of giving black silver plastic mulch alternating obtained the number of leaves, which

was 11.61 strands, and the treatment of black silver plastic mulch entirely 11,45 strands, both of which were significantly different from the treatment of straw mulch with a yield of 8.78 strands. The control treatment obtained 9.89 strands. The control treatment was not significantly different from the treatment of straw mulch and black silver plastic mulch treatment (Table 2). The average index of soybean leaf area ranged from 1.82 to 2.70. The treatment of black silver plastic mulch entirely obtained LAI of 2.70, which was not significantly different from the interlocking silver, black plastic mulch treatment that is 2.52. The treatment of mulch straw obtained LAI 1.82 lower than the control treatment with LAI acquisition of 2.40. According to Arifin and Jayaputra [7], that for soybean, the optimum leaf area index value is 4-5.

The administration of straw mulch and silver black plastic mulch in this study did not affect the formation of the number of pods (Table 2). According to Sirajuddin [8], the use of thicker mulch can store more water, prevent evaporation, and maintain soil moisture better. The use of mulch can reduce the value of soil moisture reduction. The average number of pods per soybean crop ranged from 12.95 to 18.90 pods. According to Prayogo et al. [9], the formation of pods can be stimulated with a system without tillage.

The formation of the number of seeds is not affected by mulching. Mulching was not significantly different in the number of seeds per plant (Table 2). The number of seeds per soybean crop ranged from 22.78 to 34.89 seeds. The control treatment obtained lower yields compared to the treatment of straw mulch, which was only 26.44 seeds. All treatments showed significantly different results, presumably because the number of pods per plant did not differ greatly in number, resulting in the number of seeds that did not differ much. This is supported by a statement from Pandiangan and Rasyad [10]. The number of seeds per plant will increase if the number of piths per plant increases. In addition, because it is influenced by rat pests around the land.

Mulching is not significantly different from fresh stover weight. The fresh weight of soybean stover ranged from 48.60 to 70.46 grams. The control treatment obtained lower yields than the mulch straw treatment that is only 48.60 grams. The straw mulch treatment obtained a yield of 53.77 grams. According to Herlina et al. [11], the use of mulch straw can reduce soil temperature by 0.2 °C as well as plastic mulch that can increase soil temperature by 1.8 °C compared to those without mulch. Mulching was not significantly

no-tillage soybeans can't be given black silver plastic or straw mulch.

different from dry strawweight. The dry weight of soybean straw ranges from 18.27 to 26.03 grams. The control treatment obtained lower yields than the mulch straw treatment that is only 18.27 grams. The provision of mulch is able to optimize nutrient uptake into plants, which makes the weight of the plant greater than without mulch. According to Harjadi [12], the process of photosynthesis will run well if more dry strawweight.

Giving mulch is not significantly different from seed weight per plant. The weight of seeds per soybean crop ranged from 5.63 grams to 6.81 grams. The treatment of straw mulch obtained a higher yield of 6.81 grams compared to silver, black plastic mulch interspersed with 6.66 grams. The mulch species did not differ significantly with respect to seed weight per plant. According to Dianita and Abdullah [13], dry weight can be influenced by the growth of plant leaves and stems. Mulching was not significantly different from seed weight per plot. The weight of seeds per soybean plot ranged from 54.43 grams to 83.18 grams or around 226,791.67 tons/ha to 346,583.33 tons/ha. In addition, the cause of the low yield of seeds per plot allegedly due to genetic factors and the presence of rodent pests. This is in accordance with the statement Sukmawati [14] growth and yield components do not affect seed weight but are more influenced by genetic factors. The quality of soybean seeds can also be determined by calculating the weight of 100 seeds, which can later determine the size of soybean seeds.

Mulching was not significantly different from the weight of 100 seeds. The weight of 100 soybean seeds ranged from 18.90 to 21.36 grams. The control treatment obtained lower yields than the mulch straw treatment that is only 18.90 grams. It is no different. Each treatment is suspected because the soil nutrients are low and more influential on plant genetic factors. According to Simanjuntak [15], in plants, there are genes that can affect the shape of the seeds and the weight of the seeds.

## CONCLUSIONS AND SUGGESTION

### Conclusions

Based on the results of the study can be concluded: Provision of mulch both straw and black silver plastic alternating and have not been able to significantly increase the growth and yield of soybeans in the no-tillage system

### Suggestion

Based on the results of the research that has been obtained, suggestions can be submitted that in planting,

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