



STUDY OF GROWTH AND YIELD OF WATERMELON WITH AWARDED OF THE MULCH AND GOAT MANURE IN THE PADDY FIELDS OF NORTH SUMATERA, INDONESIA

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ABSTRACT

Create free trade between countries in the impact of globalization of trade competition tighter, especially on horticulture. The study aimed to identify the type of mulch and dosage of manure for promoting growth and watermelon in the paddy fields that have been carried out in Paya Itik Dusun 3 Village, Galang, Deli Serdang, North Sumatera on Februari to April 2016. The research was a field experiment using a split plot design in a randomized block design of two factor three replications. Mulch as the main plot consists of: mulch straw, silver-black polyethylene, black-silver polyethylene, and goat manure dosage as the sub plot consisting of: 0 t/Ha, 10 t/Ha, 20 t/Ha, and 30 t/Ha. The results showed that silver-black polyethylene mulch and manure dosage of 30 t/Ha resulted in plant length, number of productive internode, and fruit weight per plot of the highest watermelon plants. The silver-black polyethylene mulch treatment is also able to suppress the attack of pests and diseases of watermelon plants, and is able to suppress weed growth.

KEYWORDS: Watermelon, straw mulch, polyethylene mulch, inventory pest and diseases.

INTRODUCTION

The increasing opening of free trade between countries in the era of globalization has resulted in an increasingly tough trade competition, especially in horticultural commodities. Indirectly, farmers must come face to face if they do not want to be left out in global competition. To deal with this competition, measures need to be taken to left by other developing countries, such as providing technology cultivation watermelon easier and efficient.^[1]

Including one of a breed of watermelon to certain horticultural crops annuals who have significant meaning for social development household economy and those involving the state. Watermelon cultivation development have the prospect of bright as can support the efforts to increase the income of farmers high because the value of its economy.^[2] However, in North Sumatera, cultivation watermelon dropped every year due to transfer function of farmland be settlement, and plantation, besides caused also by the lack of technology and guidelines cultivation watermelon to farmers. On the other hand, consumer demand for watermelon continue to rise, while central cultivation watermelon in North Sumatera is in some districts, Serdang Bedagai, Langkat, and Deli Serdang.^[3]

Efforts to increase watermelon production can be done through extensification and intensification. Extensification efforts undertaken to increase the production of watermelon is the use of paddy fields after the rice harvest, while the intensification effort is by applying mulch and goat manure.

Materials that can be used as mulch include the remains of plants (litter and straw) or polyethylene (black-silver plastic mulch). Straw mulch has a higher reflectance than the polyethylene mulch.^[4] According to,^[5] mulch of straw or mulch derived from other crop residues have low heat conductivity so that heat to the surface of the ground will be less than without mulch or mulch with high heat conductivity such as polyethylene. The application of mulch polyethylene more adopted by farmers through the cultivation of plants of chili (*Capsicum annum L.*), while in cultivation watermelon still do not usually done because mulch suitable for plant watermelon still unknown.

Polyethylene and straw mulch are mulch widely used for horticultural crops and can increase the production of chili,^[6,7] as well as potato on the medium.^[8] The use of mulch can suppress the damage levels of chili fruit due

to anthracnose.^[9] The use of mulch can also suppress weed growth, soil compaction, erosion, and can retain moisture in the root zone.^[10,6]

Goat manure is one type of manure that contains many organic compounds, environmentally friendly, abundant availability and can reduce production costs and increase crop production through the improvement of soil structure. Continuous use of goat manure has a positive impact on soil fertility^[11], thus facilitating the development of plant roots. Well-developed plant roots will more easily absorb water and nutrients available in the soil so that plants can grow and develop optimally and produce high production. In line with the results of the study^[12] and ^[11] in maize crops indicating that the provision of goat manure can increase the weight of freshly swollen cobs, fresh weight of cobs without klobot and cob worth selling. Although the provision of goat manure has been widely used for food crops and horticulture. However, its utilization for watermelon plant in paddy field is not yet widely reported, so it is necessary to do research to know the type of mulch and the proper dosage of manure to increase the growth and yield of watermelon in paddy field.

MATERIALS AND METHODS

The research was conducted in paddy field of Paya Itik village 3, Galang District, Deli Serdang Regency, North Sumatera in February to April 2016.

The research was a field experiment using a split plot design in a randomized block design of two factor three replications. Mulch as the main plot consists of: mulch straw, silver-black polyethylene, black-silver polyethylene, and goat manure dosage as sub plot

consisting of: 0 t/Ha, 10 t/Ha, 20 t/Ha, and 30 t/Ha. The variables observed were plant length (cm), number of productive internode, fruit weight (kg), pest and disease inventory that attacked watermelon plant.

Research Implementation

Before the planting, especially done seeding seedling watermelon using polybag size 20 cm x 30 cm with the media planting loose soil and sterile. The seeds sown in polybags contain one seed per polybag and are placed under shade. Seedlings are watered twice daily with water. While waiting for the growth of watermelon seedlings in the nursery, the land is cleared of weeds and the soil leveled with a hoe, and then made a plot experiment with the size of each plot 4 m x 2 m. Further application of goat manure with the appropriate dosage of treatment (2 weeks before planting) (Figure 1A).

Before planting, a hollow mulch of polyethylene was punctured with a distance of 60 cm x 90 cm in diameter according to the spacing used (Figure 1B), while the straw mulch was applied at planting time with straw as much as 15 kg/plot around the part watermelon plants. Furthermore, after the seedlings of watermelon aged 10-12 days in the nursery and already have leaves 2-3 strands, the seeds transferred to the land that has been provided with a spacing of 60 cm x 90 cm, then given the basic fertilizer in the form of urea fertilizer, SP-36, and KCl each 20 g per planting hole.

Data Analysis

Data were analyzed using ANOVA; further testing used Duncan Multiple Range Test (DMRT) at 5% significant level. Data were analyzed using the Statistical Analysis System (SAS) Software 9.1.^[13]



Figure 1: Seedling of watermelon seeds in polybag (A), and planting of watermelon seedlings with polyethylene mulch (B)

RESULTS AND DISCUSSION

Watermelon Plant Growth

Based on statistical analysis showed that mulch and goat manure treatment was significantly different to the watermelon length of 7 weeks after planting (WAP) and

the number of watermelon planting plants aged 9 WAP, while the combination of treatment between mulching and manure goat had no significant effect on the length plants and number of productive watermelon plant (Table 1).

Table 1: The length of plant and the number of productive internode watermelon due to mulching and manure goat.

Mulches	Length of plant (cm) 7 WAP	Number of productive internode (internode) 9 WAP
Straw	289.32 b	7.10 b
Polyethylene silver-black	311.74 a	7.65 a
Polyethylene black-silver	246.09 c	6.98 b
Manure goat (t/ha)		
0	271.25 c	6.33 d
10	280.23 b	7.11 c
20	287.16 a	7.44 b
30	290.90 a	8.09 a
Interaction	(-)	(-)

Note: Rows in the same column followed by unequal letters differ significantly at the 5% level based on the Duncan test

(-) Interaction was not significantly different

Table 1 showed that mulch treatment and goat manure have a significant effect on the length of internode watermelon aged 7 WAP and the number of productive internode watermelon aged 9 WAP. The length of plant and the number of productive internode watermelon is higher in the treatment of silver-black polyethylene mulch compared to the mulch of straw and the silver-black polyethylene mulch. The length of plant and the number of productive internode watermelon in the treatment of 30 t/ha of goat manure were also higher than the dosage of goat manure 0 t/ha, 10 t/ha and 20 t/ha.

The length of plant and the number of productive internode watermelon are higher in the treatment of the silver-black polyethylene mulch compared with the mulch of straw and the silver-black polyethylene mulch because the silver-colored surface has the advantage of reflecting most of the received sunlight. The magnitude of this reflection of solar radiation affects the decrease of heat flowing into the soil, which can lower the temperature of the soil. The magnitude of the reflection of solar radiation also affects the increased acceptance of solar radiation by the leaves of the watermelon plant, thereby increasing the absorption of sunlight for the process of photosynthesis.^[14,15] The result of the photosynthesis process will be used by cells that are growing and growing,^[16] such as the increase in the length of plant and the addition of productive internode of the watermelon.

Similarly, in the treatment of hay mulch which can reflect most of the sunlight, but straw mulch is also able to increase water absorption and can prevent heat loss, so the reflected heat is smaller than in silver-black polyethylene mulch treatment.^[15]

The length of plant and the number of productive internode watermelon are increasing in line with the increased dosage of goat manure. In line with the results of the study^[17] which stated that the treatment of goat manure dosage was significantly different in all plant growth parameters including plant height, stover wet and

dry weight. Similarly, the results of the study^[18] which stated that the provision of goat manure gives a real effect on plant height, leaf number, and stem diameter.

Goat manure is a fertilizer derived from faeces of goats in the form of feces removed from digestion with nutrient content of about 51.24% C, 0.84% N, 0.49% P, 0.47% K, 1.46% Ca, 0.21% Mg, and 60% water.^[19] The high content of N causes goat manure significantly affect the length of plant and the number of productive internode watermelon. According to^[20] nitrogen fertilization will increase protein levels and cellulose levels in plant tissues that will spur vegetative growth of the plant.

Watermelon Crop Yields

Based on statistical analysis showed that mulch treatment and goat manure significantly different to watermelon weight per plot (Table 2).

Table 2: Watermelon fruit weight per plot (g) due to mulching and manure goat.

Mulches	Fruit weight per plot (g)
Straw	3225.00 ab
Polyethylene silver-black	3459.20 a
Polyethylene black-silver	3128.30 b
Manure goat (t/ha)	
0	2840.00 c
10	3167.80 b
20	3426.70 ab
30	3648.90 a
Interaction	(-)

Note: Rows in the same column followed by unequal letters differ significantly at the 5% level based on the Duncan test

(-) Interaction was not significantly different

Table 2 showed that the weight of the fruit per plot is heavier in the treatment of silver-black polyethylene mulch compared with the treatment of straw mulch and silver-black polyethylene mulch. This is due to the nature of the silver-black polyethylene mulch which can retain

groundwater content from excessively high evaporation^[8,5,4,21,6] so that the water content in the soil can be maximally utilized for magnification and cell extension. Its silver surface can reflect most of the sunlight that canopy can exploit for photosynthesis. The availability of water and sunlight will enhance the process of photosynthesis in plants. The increased process of photosynthesis will be followed by an increase in photosynthate to be used by plants for growth and fruit weight gain.^[16]

Increased dosage of goat manure is also followed by increased fruit weight per watermelon plot (Table 2). This is due to goat manure able to improve soil fertility,

improve soil structure with soil aggregate, aeration and water holding strength, and cation exchange capacity. Good soil structure makes roots well developed, thus increasing the area of uptake of nutrients. With the increasing area of nutrient uptake, more nutrients can be absorbed by plants for growth and development, so the weight of plant fruit also increases.^[22] In line with the results of the study^[23,11] which suggests that increasing the dosage of goat manure can increase the growth and yield of sweet corn. Similarly, the results of the study^[10] suggesting that the average weight of cob per hectare in various treatments is increasing with increasing dosage of goat manure.

Inventory Plant Pests and Diseases on Watermelon

Table 3: Pests found in watermelon cultivation for research (Febuary to April 2016).

Image of Pest	Image of Plant	Age of plants	Symptoms Attacks and controls
		2 dap	The stem is disconnected in the attack by the cricket pest (<i>Gryllidae</i>) attacking the bottom of the stem of the watermelon plant. The number of affected plants is small and only insertion is carried out
		3 dap	Caused by a grasshopper insect (<i>Valanga nigricornis</i>) attack symptoms that break from the base on the yellow stem, the roots of the plant do not develop well and then the plant becomes withered
		9 dap	The plants are attacked by grayak caterpillars (<i>Spodoptera litura</i>) that attack the leaves of the watermelon plant so that the leaves become hollow-bolong. This pest control is treated using insecticides

Note: Photos are private collections

Table 4: Diseases that attack watermelon plants for research (February to April 2016).

Symptoms of plant	Age of plants	Symptoms Attacks and controls
	20 dap	Caused by fungus or often also called leaf crackle disease in watermelon plants. Symptoms of the attack caused the leaves of watermelon plants yellow and then dry

Note: Photos are private collections

Observation of pest and disease inventory was done from watermelon plant moved to land until harvest. Pests that attack on the watermelon plant starting from the age of 2 days after planting (DAP) to 9 DAP. The pests that attack watermelon plants include: crickets, grasshoppers, and grayak worms (Table 3). While diseases that attack watermelon plants are only wilt diseases caused by fungi (Table 4). The occurrence of pests and diseases is caused by the changing climate every day, and also caused by not doing the seed treatment before planting, so that the watermelon plants that have just been transferred to the research field susceptible to pests and diseases. Pests and plant diseases affect the growth of watermelon plants, so the growth of plants becomes inhibited.

Watermelon plants most susceptible to pests and diseases is a plant with straw mulch treatment. At the age of 9 DAP, the plant is attacked by grayak caterpillar that attacks the leaf part of the plant. Plants are also attacked by fungal diseases due to lower soil temperatures and high humidity than silver-black polyethylene mulch,^[15] causing the fungus to grow easily and develop.

In addition, in plants treated with mulch straw, weed growth was more than in plants given mulch-silver polyethylene mules and silver-black polyethylene muls. This is due to a given straw mulch decomposition that produces organic materials and hata elements of plants that cause the soil to be porous and fertile so as to facilitate weeds grow and develop. Whereas in plants given silver-black polyethylene mules and silver-black polyethylene mules, the entire surface of the soil is covered by mulch, only the part of the plant grows not covered by mulch, so that weed growth can be inhibited.

Polyethylene mulch with a silver top surface will reflect most of the sunlight so that the process of photosynthesis becomes more optimal because all plant canopies get enough sunlight. With the magnitude of the reflection of sunlight causes the planting conditions are not too humid, thus reducing the disease and expel the insects pests plant pests. The black color on the polyethylene mulch will absorb the heat coming from the sunlight, so the temperature around the roots of plants becomes warm and will increase the absorption of nutrients from the soil.

In addition, the black color also prevents sunlight penetrating into the soil that suppress the growth of weed seeds. Mulch of silver-black polyethylene also protects the soil surface regardless of the splashing of rainwater, thus reducing the likelihood of occurrence of plant disease diseases that can originate from the soil.^[19] The use of silver-black polyethylene mulch can accelerate crop production, increase yield per unit area, efficient in the use of fertilizers and water, reduce erosion, reduce pest and plant diseases, and inhibit weed growth.^[24]

CONCLUSION

Silver-black polyethylene mulching on watermelon increased length of plant, number of productive internode, and fruit weight per plot of the highest watermelon, as well as reduce outbreak of severe pest attacks, diseases and weeds from the straw mulch and polyethylene silver-black mulch.

Goat manure dose of 30 t/Ha can increase the length of the plant, the number of productive segments, and the fruit weight per plot of the highest watermelon plants compared to the dosage of manure 0 t/Ha, 10 t/Ha and 20 t/Ha.

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