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Utilization of gamal biomass (*Gliricidia sepium*) as organic mulch on corn (*Zea mays* L.) plants on dry land

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Abstract. This research aimed to determine the effect of giving gamal leaf mulch on nitrogen uptake of maize (*Zea mays* L.). The purpose of this research is to provide information to farmers to develop and improve the yield of corn plants through the use of organic mulch leaves. This study used a randomized block design (RBD), which consisted of 3 treatments repeated 3 times so that 9 experimental units were obtained. Each treatment was: without mulch (control plot) (M0), plastic mulch (M1), gamal biomass mulch (M2). The results obtained in this study indicate that the treatment of gamal leaf organic mulch (M2) showed the best results based on the observation of weight production of 100 plants with production reaching 8.87 kg, on observing the weight of 100 seeds which weighed 26.22 g for 100 seeds, and weight seeds/production plots reach 177.33 kg/plot and reach 4.43 tons/ha if converted to ha.

1. Introduction

Corn is a food crop commodity that has great potential to be developed in Indonesia, the use of corn is not only limited to human consumption needs but also as a raw material for food for livestock and also for other industrial needs. The success of corn cultivation is greatly influenced by many factors, including, cultural techniques, temperature, and intensity of sunlight, rainfall, and growing media. Land as a planting medium is one of the most critical factors in the management of farming, and this is because the success of increasing agricultural land production depends on the ability to cultivate land resources optimally and sustainably.

Merauke Regency is one of the locations that are suitable for the development of corn cultivation, according to data from the Badan Pusat Statistik of Merauke Regency, the average production of corn kernels per ha is 3.5 tons [1]. The constraints in the management of corn farming are the availability of water that is insufficient for the growth and production of corn crops because most of the conditions in agricultural land in Merauke Regency are rainfed and high temperatures result in increased evaporation on the ground so that drought stress often occurs.

Sumadi (2009) stated that the productivity of land and crop yields on dry land tends to be low because the fertility level in dry land is not sufficient, water sources are limited so that the needs of plants to grow and produce are not fulfilled [2].



Referring to the existing challenge, to meet the needs of corn plants, it is necessary to increase the productivity of corn plants. One way that can be done to increase the production of corn is by manipulating the growing environment such as the use of mulch. Mulch is a crop cover material that is intended to maintain soil moisture and suppress weed growth and disease to make plants grow well. One type of mulch that is easily available and available in a farmer's environment and is environmentally friendly is organic mulch. Organic mulch does not cause adverse effects on health because of its primary natural ingredients. Because of that also plants can absorb it easily. Organic mulch comes from natural ingredients that are easily broken down like plant debris and reeds [3].

According to Saragih (2008), the use of organic mulch can help in improving soil structure so that it becomes loose and is a source of nutrients for plants. Besides, the use of organic mulch helps improve soil aeration and drainage [4]. The use of organic mulch in the cultivation of corn plants has often been done, but it is not widely known as the right type of organic mulch to increase growth and better production of corn plants. The use of organic mulch is an appropriate alternative because organic mulch consists of organic matter from plant residues (rice litter, sawdust, corn stems), pruning from hedges, leaves and branches that will improve fertility, structure and indirectly will maintain soil aggregation and porosity, which means it will retain the capacity of the soil to keep water, after decomposition [5].

One alternative source of nutrient raw materials used as liquid organic mulch is from natural ingredients containing nitrogen, one of which is gamal leaves. Gamal is a plant of the family Leguminosae which contains a variety of essential nutrients that are high enough to meet nutrients for plants in general. Leaf tissue of gamal plant contains 3.15% N, 0.22% P, 2.65% K, 1.35% Ca, and 0.41% Mg [6]. At Merauke Regency, we can find a lot of gamal plants growing wild or made into hedges, so that the use of inexpensive and environmentally friendly inputs needs to be encouraged to achieve sustainable agriculture.

This study aimed to determine the effect of gamal leaf mulch on nitrogen uptake of corn plants (*Zea mays* L).

2. Methods

2.1. Time and place

This research was conducted in Yasa Mulya Village, Tanah Miring District, Merauke Regency, Papua Province, which is geographically located between 137°-141° East Longitude and 5°-9° South Latitude, in the dry season from May to August 2018.

2.2. Research design

The research method used was a randomized block design (RBD), consisting of 3 treatments with 3 replications, so 9 unit experiments were obtained. Each treatment was: (M0) without mulch (control plot); (M1) plastic mulch; (M2) mulch gamal biomass. The parameters observed were: the weight of 100 maize plants (kg); the weight of 100 seeds (g); production (kg/plot). In this study, gamal plants were planted 6 months before the study, to obtain biomass.

3. Results and discussion

Corn crop production can be seen in table 1 below.

Table 1. Average dry corn production at 14% moisture content

Treatment	Corn weight / 100 plants (kg)	Weight of 100 seeds (g)	Production kg/ plot	Production kg/ha
M0	6.5 ^a	22.52 ^a	130.00	3250.00
M1	8.13 ^b	23.98 ^a	162.67	4066.67

M2	8.87 ^b	26.22 ^a	177.33	4433.33
BNT 0.05	1.16	5.52		

Values within a column with different superscript letters are significantly different

Based on table 1, the highest weight of corn kernels in units of 100 cobs of corn plants is shown in the treatment of gamal leaf mulch (M2) with a weight reaching 8.87 kg / 100 cobs and then followed by plastic mulch treatment (M1) with a weight of 8.13 kg / 100 the lowest COB and weight in the treatment without mulch (M0) weighing 6.5 kg / 100 cob. Based on continued analysis of BNT it can be stated that M2 is significantly different from M0; M2 is significantly different from M1, and M2 is not considerably different from M1.

In observing the weights of 100 corn kernels, it can be seen that all treatments were not significantly different from each other. But based on corn kernels weight of 100 seeds, M2 treatment showed the highest weight of 26.22 g / 100 seeds, followed by M1 with a weight of 23.98 g / seed and M0 22.52 g / 100 seeds. Likewise, in the observation of production (kg/plot), the highest production is shown in the M2 treatment with a value reaching 177.33 kg/plot and when converted to ha units, the products produced using the gamal leaf mulch treatment is 4433.33 kg/ha or 4.43 tons/ha.

Application of organic mulch derived from gamal plants (M2 treatment) is able to withstand the rate of evaporation and increase the water content in the soil. This provides benefits for corn plants that are shallow-rooted in nutrient absorption. The diversity of roots in this system is also able to take and distribute nutrients so that it can be used by corn plants. In addition, organic mulch is also able to withstand erosion so that land productivity can be maintained or improved.

Legume plants (in this case gamal) which are used in making mulch are a great source of nitrogen for annual crops and can improve soil properties. Monoculture corn cultivation on dry land with low rainfall intensity is very susceptible to evaporation so that it can inhibit nutrient absorption by plant roots making it necessary to cover the soil with mulch.

According to Saragih (2008), the use of organic mulch can help in improving soil structure so that it becomes loose and is a source of nutrients for plants. In addition, the use of organic mulch helps improve soil aeration and drainage [4]. The use of organic mulch in mustard plant cultivation has often been done, but there is not much known the right type of organic mulch to increase the growth and production of better mustard plants.

The use of organic mulch is an appropriate alternative because organic mulch consists of organic matter from plant residues (rice litter, sawdust, corn stalks), pruning from hedges, leaves, and branches that will improve fertility, structure and indirectly maintain soil aggregation and porosity, which means that it will maintain soil capacity to hold water after decomposition [5].

In soil surfaces, mulch serves to maintain soil moisture, reduce soil evaporation, and increase water infiltration into the soil, thereby affecting maize production. Sukmawati (2013) estimated that the contribution of N from *Leucaena* and gamal (*Gliricidia*) to corn plantations is around 42 kg N/ha [7]. This can make efficient use of N from 18% -33%. For comparison, the efficiency of N use is 36% by *Leucaena* pruning for corn plants. The results of long-term mulch farming trials have shown that by applying pruned *Leucaena*, even without N application, corn yields can be maintained for years at a reasonable level of around 2 tons per hectare.

Corn production in the M0 treatment showed results that were not much different from the average maize production in Merauke Regency in the last 5 years even though the population in each treatment plot was the same which was 2000 maize plants/plot. This is presumably due to the low rainfall at the time of the study, thus affecting the ability of roots to absorb nutrients supplied and result in the process of filling seeds in corncobs.

4. Conclusion

The results showed that the amount of corn production on dry land was influenced by the mulch treatment applied. The production of maize in M2 using gamal leaf mulch yields better

results and is significantly different from other treatments. The total production average in M2 treatment in the area of 400 m² reached 177.33 kg/plot or reached 4433.33 kg/ha (4.43 tons) if converted to hectares. Corn production in this study is much higher compared to the corn production of Merauke farmers in the last 5 years which only reached 3.53 tons/ha.

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