The Response Growth And Yeild of Sweet Corn at Various Plant Spacing And Oil Palm Empty Fruit Bunch (OPEFB) Compost

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Abstract: Sweet corn has good prospects for developing in order to support farmers' production and income. Maximum production is achieved when using suitable spacing. In addition to adjusting the right planting distance to increase production, it is necessary to add nutrients to the plants by providing organic fertilizer. This study aims to analyze the effect of the interaction between plant spacing and oil palm empty fruit bunch compost fertilizer doses as well as the single factor of spacing and oil palm empty fruit bunch compost fertilizer doses on the growth and yield of sweet corn. The study was held in the village of Padang Pangrapat, Tanah Grogot District, Paser Regency from December 2017 to March 2018. The study used a Randomized Block Design (RBD), factorial two factors with 3 tests. The first factor uses the treatment of Plant spacing (J) which consists of 3 levels, they are: (j1) = 60x20 cm, (j2) = 60x30 cm, and (j3) = 60x40 cm. The second factor is Empty Oil Palm Bunches (K) consisting of 3 levels, they are: (k1) = 1.2 kg plot-1, (k2) = 2.4 kg plot-1, and (k3) = 3.6 kg per plot. The results showed that plant spacing treatment had a very significant effect on plant height parameters 6 mst, number of leaves 4 mst, and weight of cob per plot. The oil palm empty fruit bunch compost treatment has a very significant effect on plant height of 4 and 6 mst. The interaction between the two treatments had a very significant effect on the plant height parameters aged 2, 4 and 6 mst, and the number of leaves aged 2 mst and 6 mst.

Keywords: Sweet Corn, Plant spacing, Palm Oil Empty Fruit Bunch Compost

I. Introduction

Sweet corn has good prospects for developing in order to support farmers' production and income. This is supported by the available planting area which is still quite wide and sweet corn is increasingly popular and is popular with the public. Sweet corn has a sweet taste because the sugar content is 5-6% higher than ordinary corn. Another advantage of sweet corn is that the production age is shorter because it can be harvested at the age of 60-70 days after planting (Suprapti, 2011).

Maximum production is achieved when using suitable spacing. The higher the level of density of a plant resulting in higher the degree of competition between plants in terms of getting nutrients and light. According to Williams and Yoseph, (1970) in Asro’LaelaniIndrayanti, (2010) Plant spacing is very influential on growth and yield plant. This will affect the leaf area, plant dry weight, system rooting, the amount of sunlight received, and the amount of nutrient which is absorbed from the soil.

In addition to adjusting the right planting distance to increase production, it is necessary to add nutrients to the plants by providing organic fertilizer. According to Makkasau and Mansjur, (2006) Organic fertilizers are fertilizers made from ingredients which can be renewed, recycled, overhauled by soil bacteria into elements that can be used by plants without polluting the soil and water. The organic material that can be used is Oil Palm Empty Fruit Bunch (OPEFB). The Oil palm empty fruit bunches contain various nutrients needed by plants, they are 0.7% Nitrogen, 0.13% Phosphorus, and 7% potassium (Nasrul and Maimun, 2009). The Oil palm empty fruit bunch compost has several advantages including being able to improve soil structure to become loose, helping to dissolve nutrients needed for plant growth, to be homogeneous and reduce the risk of carrying plant pests. The Oil palm empty fruit bunch compost is not easily washed and quickly seeps into the soil and can be applied to any season (Myung et al, 2005).

Based on the description above, research is needed to determine the distance planting and dosage of oil palm empty fruit bunch compost fertilizer that is right for the growth and yield of sweet corn.

This study aims to analyze the effect of the interaction between plant spacing and oil palm empty fruit bunch compost fertilizer doses as well as the single factor of spacing and oil palm empty fruit bunch compost fertilizer doses on the growth and yield of sweet corn.
II. Material And Methods

Time and place
The study was held in the village of Padang Pangrapat, Tanah Grogot District, Paser Regency, East Kalimantan. Research carried out from December 2017 until Maret 2018 since the opening of the land until harvest. Based on height place 0-15 m above sea level with red yellow podsolid soil type the texture of sandy loam and soil pH range from 5.5 to 5.9. Climate type tropics with temperatures of 27-31 C.

Materials and tools
The material used in this study is sweet corn seed Bonanza F1 varieties, oil palm empty fruit bunches, curacron insecticide, Furadan 3G, inorganic fertilizer (Urea, SP36) and dolomite lime.

The tools used are hoes, sickles, sprayers, write writing, signposts treatment, Gembor, pH meter, scales, meter, digital camera, termshoves and rulers

Experimental design
This study used a factorial Randomized Block Design (RBD) 2 factors with 3 tests. As the first factor is the spacing (J) consisting of 3 levels, they are:
- j1 = 60 x 20 cm
- j2 = 60 x 30 cm
- j3 = 60 x 40 cm
And the second factor is the compost of oil palm empty fruit bunches (K) consisting of 3 levels, they are:
- k1 = 2 tons ha-1 is equivalent to 1.2 kg plot-1
- k2 = 4 tons ha-1 is equivalent to 1.4 kg plot -1
- k3 = 6 tons ha-1 is equivalent to 1.6 kg plot-1

Research Implementation
1. Land Preparation
2. Composting
3. Installation of research signs
4. Provision of Compost
5. Planting
6. Plant Elimination
   - Watering
   - Embroidery
   - Weeding and piling
7. Harvest
8. Pest and Disease Control
9. Harvest

Observation
1. Plant Height (cm)
2. Number of leaves (strands)
3. COB Diameter (cm)
4. Cob Length (cm)
5. Planting cob weight (g)
6. Weight of Cob per hectare (kg)

Data analysis
The additive linear model used in analyzing each observed variable is:

Yijk = µ + αi + βj + σk + (βσ) jk + rijk

They are:
- i = 1,2,3 (groups)
- j = 1,2,3 (plant spacing treatment)
- k = 1,2,3 treatments of OPEFB compost dose
- Yijk = observation response to the i experimental unit which obtained a combination of j-level treatment from factor I and k-level from factor II
- µ = general midpoint
- αi = the influence of the i
- βj = the influence of the j-level from the plant spacing treatment
σk = the influence of the k-level of OPEFB compost treatment
(βj) jk = the influence of factor j level I intekasi from the plant spacing treatment and factor II from the OPEFB compost treatment
erijk = random effect of the experimental unit receiving the j-I and k-II factors in the i

To find out the growth and yield of sweet corn plants by spacing and giving OPEFB compost, data analysis was done using variance analysis. If the F calculated treatment < from F Table at the 0.05 level is not carried out further tests, but if the F calculated treatment > of F table at the level of 0.05 then carried out further tests using a 0.05 BNT test.

### III. Result

#### Plant Height (cm)

The results of the analysis of variance analysis showed that the interaction treatment (J x K) as well as the single factor of spacing (J) and OPEFB compost significantly affected the average height of sweet corn 6 weeks after planting can be seen in table 3.

**Table 3.** Average Plant Height (cm) Sweet Corn Age 6 Weeks After Planting in the Plant Spacing Treatment and OPEFB Compost

<table>
<thead>
<tr>
<th>Planting Distance (J)</th>
<th>OPEFB Compost (K)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>k1</td>
<td>k2</td>
</tr>
<tr>
<td>j1</td>
<td>130.09abc</td>
<td>113.14bc</td>
</tr>
<tr>
<td>j2</td>
<td>111.60d</td>
<td>146.54a</td>
</tr>
<tr>
<td>j3</td>
<td>93.30e</td>
<td>127.15bc</td>
</tr>
<tr>
<td>Average</td>
<td>111.66</td>
<td>128.94</td>
</tr>
</tbody>
</table>

* The average number followed by unequal letters shows significantly different in the 0.05 BNT test (Interaction BNT = 9.52)

The BNT test 0.05 showed an interaction (JxK) in the j2k2 treatment yields the highest plant 146.54 cm significantly different from the treatment others. Whereas the j2k3 treatment was significantly different from the j1k3, j1k2, j2k1, j3k1 but not significantly different in treatment j1k1, j3k2. On j1k3 treatment was significantly different from j2k1, j3k1 treatment but it was not different real j3k3, j1k2.

#### Number of Leaves (strands)

The results of the analysis of variance analysis showed that the interaction treatment (J x K) had a significant effect while the single factor of spacing (J) and compost OPEFB had no significant effect on the average number of leaves aged 6 weeks after planting can be seen attable 6.

**Table 6.** Average Number of Leaves (strands) of Sweet Corn aged 6 Weeks after Planting in the Distance Spacing Treatment and Giving OPEFB Compost

<table>
<thead>
<tr>
<th>Planting Distance (J)</th>
<th>OPEFB Compost (K)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>k1</td>
<td>k2</td>
</tr>
<tr>
<td>j1</td>
<td>9.33abc</td>
<td>7.67bc</td>
</tr>
<tr>
<td>j2</td>
<td>8.00abc</td>
<td>9.67a</td>
</tr>
<tr>
<td>j3</td>
<td>7.33a</td>
<td>9.00a</td>
</tr>
<tr>
<td>Average</td>
<td>8.22</td>
<td>8.78</td>
</tr>
</tbody>
</table>

* The average number followed by unequal letters shows significantly different in the BNT 0.05 (Interaction BNT = 0.80)

Based on BNT 0.05 showed the interaction treatment (J x k) on j2k2 treatment produced the average number of leaves at most 9.75 (strands) significantly different with all treatments except j1k1, j3k2.

#### Cob Diameter (cm)

The results of the analysis of variance analysis showed that the interaction treatment (J x K) and single factor both spacing (J) and compost OPEFB (K) had no significant effect on cob diameter.

#### Cob Length (cm)

The results of analysis of variance analysis showed that the interaction treatment (J x K) and single factor both spacing (J) and compost OPEFB (K) had no significant effect on the length of the cob.
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**Planting Cob Weight (g)**
The results of the analysis of variance analysis showed that the interaction treatment (J x K) and single factor both spacing (J) and compost OPEFB (K) had no significant effect on the weight of plant cobs.

**Cob Weight per Plot(kg)**
The results of analysis of variance showed the treatment of single factor plant spacing (J) significantly affected while the interaction (JxK) and single factor compost OPEFB (K) had no significant effect, on the average yield per plot of sweet corn can be seen in table 7.

**Table 7. Average Results of Sweet Corn Plots in the Distance Spacing Treatment and Giving OPEFB Compost**

<table>
<thead>
<tr>
<th>Planting Distance (J)</th>
<th>compost OPEFB (K)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>k1</td>
<td>k2</td>
</tr>
<tr>
<td>j1</td>
<td>6.682</td>
<td>5.331</td>
</tr>
<tr>
<td>j2</td>
<td>5.244</td>
<td>6.002</td>
</tr>
<tr>
<td>j3</td>
<td>2.733</td>
<td>3.918</td>
</tr>
<tr>
<td>Average</td>
<td>4.89</td>
<td>5.09</td>
</tr>
</tbody>
</table>

* The average number followed by unequal letters shows significantly different in the BNT 0.05 (BNT J = 1.52).

Based on the BNT 0.05 showed that j1 spacing treatment gave the heaviest average yield per plot of 6.284 kg which was significantly different from j3 treatment but not significantly different from j2.

**IV. Discussion**

Based on the analysis of plant spacing (J) treatments on average plant height significantly affected the addition of plant height, addition of number of leaves, and yield of plots. The BNT 0.05 showed that j2 spacing with a size of 60 x 30 cm produced a plant height of 6 MST that was better than the treatment. It is suspected that light reception and absorption of nutrients are more efficient. In accordance with the opinion (Asro ‘Laelani Indrayanti, 2010) a wide planting distance gives optimum growth space forget sunlight, nutrients and water so that a wide spacing can increase plant growth. Hidayat further (2011), said that the increase in plant height with wider spacing will increase growth because plant nutrients are sufficient. Another opinion from the results of the study (Sudarka 1994) in (Jasman.J. 2016) which states that the density of plants can also affect the population and the efficiency of the use of light, water and nutrients.

The BNT Test 0.05 test results showed that the planting distance of j2 60x30 cm showed very significant effect on the average number of leaves aged 4 weeks after planting during the vegetative period is thought to be spacing 60x30 cm enough to give space for leaf development so that leaf growth grows optimally and lack of competition between plants. According to Supriono (2000) that the use of spacing is getting tighter the smaller the number of leaves. This is due to the dense spacing, overlapping plants will occur. Furthermore, plants will respond by reducing leaf formation. The results of various plant spacing (J) treatments had no significant effect on average cob diameter, cob length and cob weight of planting. It is suspected that the diameter of the cob, the length of the cob, the weight of the cob of the crop is more influenced by environmental factors, such as high rainfall causing the area of the plant to be inundatedexcessive water so that the growth and yield of corn does not have a real impact. According to Barbieri and his friends (2000), climatic factors affect corn production. The general effect of excess water or flooding is deficiency Oxygen, while lack of water or drought will result dehydration in plants that affects the turgor cell zone can further inhibit plant growth (Fallah, 2006) agree with Champel 2003, plants doused with too much water could experience lack of oxygen because the soil runs out of the air space that it provides oxygen as for root cellular respiration. But there is a tendency on bar chart of planting distance j2 against the three planting distance parameters 60x30 cm showed quite good results.

The results of analysis of plant spacing (J) treatment on j1 60x20 cm on average plot production have a very significant effect on the number of production per plot. BNT Test 0.05 showed that the treatment distance of j1 60x20 cm produced the most corn production per plot compared to j2 and j3 treatments. This is suspected treatment denser planting distance such as 60x20 cm is the optimum planting distance for the purpose of sweet corn production. According to Hasan Basri Jumin (2002) that plant density has an inseparable relationship with the amount of yield to be obtained from a plot of land. Added (Erawati, and friends. 2016), Plant population (spacing) is one of the factors can affect crop yields. Increased corn yields can be soughtrough setting the planting density to reach the optimal population. Based on the results of analysis of various kinds of compost bunches of empty treatments soil palm (K) at k2 4 ton ha-1 at an average plant height show very significant effect on plant height 4 and 6 weeks after planting. This is suspected by giving oil palm empty fruit bunches compost can improve soil conditions and be able to provide nutrients insol. so that the nutrients needed by
sweet corn plants in phase vegetative fulfilled by the provision of oil palm empty fruit bunches compost which is a source of elements N, P, K and micro nutrients in need when plants are still young. This is consistent with the statement (Hidayat, 2011) on the vegetative growth of maize plants actively absorb N nutrients for the formation of chlorophyll and P elements for enlargement of stem diameter. This is different when the corn plant enters the generative phase, the existing P element is more widely used by plants for seed formation and vegetative plant growth will decrease.

Based on the analysis of the variety of treatments of OPEFB compost on the average number of leaves, ear diameter, ear length, and ear weight per crop had no significant effect. It is suspected that compost has been given many experience leaching and loss of nutrients needed plants due to high rainfall. This results in soil condition not good and the soil becomes less loose so it inhibits corn growth. In accordance with the opinion (Fallah, 2006) corn plants need a medium that is loose and fertile because of this plant requires good aeration and drainage.

Results of analysis of the various treatments at the average yield per plot, no real effect. This is allegedly because giving oil palm empty fruit bunches compost cannot trigger production per plot because of high rainfall, until the filling period cob. OPEFB compost do not have macro nutrients and sufficient microstructure for plants because it has been dissolved by the intensity of rainfall which is quite high. It is assumed that the elements N, P and K are not optimal to form the needs of nutrients for plants. The P element is very influential in the process of growth and formation of results (Warisno, 2007). If a plant N and P deficiency will cause imperfect cob development. Whereas K also uses in the formation of cob and seeds. So if plants lack K, the resulting cob is small and the tip is tapered (Efendi 2001).

The results of variance showed that the treatment of plant spacing and compost of oil palm empty fruit bunches (J X K) had a very significant effect on plant height and number of leaves aged 6 weeks after the plant. This is presumably because the wide spacing gives optimum growth space to get sunlight, nutrients and water so the spacing the width can increase plant growth. In accordance with the opinion of Hidayat (2011) which says that the increase in plant height with wider spacing will increase growth because plant nutrients are sufficient. And the provision of oil palm empty fruit bunches (OPEFB) compost can trigger the growth of vegetative parts of plants such as leaves and roots of sweet corn plants. Oil palm empty fruit bunches (OPEFB) compost can improve soil structure, so that soil conditions can store enough water, and water functions to carry nutrients into the plant tissue through the roots for further processing in photosynthesis, which in turn stimulates vegetative and generative formation. OPEFB compost, in addition to containing macro and micro nutrients, also contains organic matter useful for improving physical, chemical and biological soil properties. Agree with (Erwinsyah 2007) in (Rudy Hartono 2007) that the application of compost improves soil physical and chemical properties, in addition to being able to significantly increase plant height and weight.

V. Conclusion

Based on influence of the distance cropping and provision of compost bunches of empty palm oil on growth and results of sweet corn could be concluded as follows:

1. Treatment distance planting influential very real on the parameter tall plant age 6 mst, number of leaves 4 mst and heavy perpot cobs.
2. Measurement doses of fertilizer compost an empty palm oil on have an effect very real on the parameter of higher plants age 4 and 6 mst.
3. An interaction between treatment the distance cropping and the provision of turned into fertilizer compost bunches of empty oil palm has had a significant effect very real on high in plant age 2, 4, and 6 mst will number of leaves age 2 mst

References


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