Influence of Fertilizing and Variety on Growth and Yield of Maize in Ex-Tin Land Central Bangka, Kepulauan Bangka Belitung

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ABSTRACT. Activities of tin mining have resulted an undulating landscape and deteriorated soil physical, chemical, and biological properties. Ex-tin land converted to lowland could be used to plant food crops, such as rice, maize, and soybean. Therefore, the dosage of fertilizer and the variety of maize used on ex-tin lands are needed to be studied. The aim of this study was to find out the influence of inorganic fertilizer and maize variety on ex-tin land on growth and yield of maize. The study was done in Perlang Village, Central Bangka, Kepulauan Bangka Belitung in September-December 2011. The study was arranged on split plot design. Main Plot was the variety of maize, namely (1) Gumarang, (2) Sukmaraga, and (3) Lamuru. Sub plot was the dosage of inorganic fertilizer, namely (1) urea 200, SP-36 150, KCl 100 kg/ha, (2) urea 250, SP-36 150, KCl 100 kg/ha, and (3) urea 300, SP-36 200, KCl 150 kg/ha. Each treatment combination was replicated 3 (three) times. Data were analyzed using ANOVA dan the mean of treatment was analyzed using DMRT at level 5%. Results showed that the fertilizing and variety significantly influenced on yield and growth of maize, but there was not interaction between fertilizing and dosage on yield of maize. Fertilizing on dosage urea 300, SP-36 200, KCl 150 kg/ha significantly gave the highest yield of maize (4.61 t/ha), but it was not significantly different compared to fertilizing dosage of urea 250, SP-36 150, KCl 100 kg/ha (4.47 t/ha). Variety of maize of Sukmaraga significantly gave the highest yield of maize (4.64 t/ha), but it was not significantly different compared to Gumarang variey (4.60 t/ha).

Key words: land, tin, fertilizer, maize

Introduction

Maize is one of the food crops that has a strategic role in the development of agriculture and the economy of Indonesia. This commodity has a multi-purpose function, both for food and feed. The need maize as industrial raw materials, food and beverages continues to rise 10-15% per year (Indonesia Agency for Agricultural Research and Development 2007).

Efforts to increase the national maize production can be done through expansion of planting area and increasing productivity of maize. Province of Bangka Belitung is one of the producers of tin. According to Ali (2008) as a result of mining smelters Islands Province has 1,645,414 ha of degraded land, and has 887 small lakes with an area of 1,712.62 ha under. Tin mining activities will have negative impacts on ecosystem degradation. Activities of tin mining have resulted an undulating landscape and deteriorated soil physical, chemical, and biological properties. The results of soil analysis conducted Setiadi (2002), showed tailing (ex-mine) has low soil fertility with a pH of acidic, CEC, C-organic and nutrient availability is low. Nurjahya et al. (2006) suggested that land mined tin smelters generally contain more than 90% sand, clay fraction less than 3%, very low organic matter content, water-holding power is very low, permeability power very quickly, the number of bacteria and fungi is very low.

Increasing the productivity can be executed through the use of high yielding varieties, fertilizers, and other farming technology components. Ex-tin mining land can be optimized for planting annual crops, such as maize, is one of the efforts to increase the productivity of ex-tin mining lands. Based on this situation, the study effect of variety and fertilizing on growth and yield of maize crop becomes important to be conducted.

The purpose of this research was to study the effect of variety and fertilization on the growth and yield of maize in ex-tin mining land in Central Bangka, Bangka Belitung.

Materials and Methods

Time and Site

The research was conducted in October-December 2011 in Perlang Village, District of Central Bangka, Kepulauan Bangka Belitung. The research was conducted...
in split plot design and replicated 3 (three) times. The main plots were varieties of maize, namely (1) Gumarang, (2) Sukmaraga, and (3) Lamuru. The subplots were fertilizers, namely (1) urea 200 kg/ha, SP-36 150 kg/ha, KCl 100 kg/ha (P1), (2) urea 250 kg/ha, SP-36 150 kg/ha, KCl 100 kg/ha (P2), (3) urea 300 kg/ha, SP-36 200 kg/ha, KCl 150 kg/ha (P3). Lime and organic fertilizer were used with 1 ton of lime and 2 ton of organic fertilizer per ha. Planting space used was 40 cm x 80 cm with two seeds per hole of planting.

Data Collected and Analysis

Data collected were initial soil chemical properties such as pH, nutrient status (P, K, Ca, Mg, Na, and C-organic), components of growth (plant height, stem diameter, leaf number, cob diameter, and cob length) and yields (weight of 1,000 seeds and yield) of maize crop.

The data were analyzed using descriptive and explanatory method growth and yield data were analyzed using analysis of variance analysis in Steel and Torrie (1981). If the F test showed a significant effect, then followed by Duncan’s Multiple Range Test at the 5% level.

Results and Discussion

Soil Properties Before Experiment

The results of laboratory analysis of soil chemical before experiment (Table 1) indicated that the soil is sandy clay textured soils with a pH value of the soil slightly acidic, very low content of N, P and K are low.

Based on the soil analysis result, it is informed that the soil used was deficient of N, P, K, Ca and Na element, so that it is important to apply external input such as fertilizers, organic fertilizers, and lime in order to neutralize the soil pH and fulfill nutrient needs of maize crop.

Agronomic Parameters

1. Plant height

The data analysis of plant height (Table 2) indicated that there was an interaction between varieties and fertilizers in plant height of maize. The interaction of Sukmaraga varieties with P3 fertilizer dose significantly gave the highest plant height (219 cm) compared with other treatment interactions.

2. Stem diameter and leaf number

The data analysis showed varieties used were not significantly different on stem diameter and leaf number of maize. Fertilizer doses used also were not significantly different on leaf number of maize. The fertilizer doses of P3 and P2 were significantly different compared to P1 on stem diameter of maize, namely 1.57; 1.51; and 1.28 cm, respectively.

3. Cob diameter

The data analysis of cob diameter (Table 4) indicated that there is an interaction between varieties and fertilizers in cob diameter of maize. The interaction Sukmaraga varieties with P3 fertilizer significantly gave the highest cob diameter (4.3 cm) compared with other treatment interactions.

Table 1. The results of soil analysis Perleng village, Central Bangka before planting

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameters</th>
<th>Value</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH H_2O</td>
<td>6.4</td>
<td>Slightly acidic</td>
</tr>
<tr>
<td>2</td>
<td>Organic-C (%)</td>
<td>0.72</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Total-N (%)</td>
<td>0.05</td>
<td>Very low</td>
</tr>
<tr>
<td>4</td>
<td>P_2O_5 Bray 1 (ppm)</td>
<td>12</td>
<td>Moderate</td>
</tr>
<tr>
<td>5</td>
<td>K_2O (HCl 25% mg/100g)</td>
<td>10</td>
<td>Low</td>
</tr>
<tr>
<td>6</td>
<td>Exchangeable-K (cmol(+)/kh)</td>
<td>0.19</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>Exchangeable-Ca (cmol(+)/kg)</td>
<td>2.19</td>
<td>Low</td>
</tr>
<tr>
<td>8</td>
<td>Exchangeable Mg (cmol(+)/kg)</td>
<td>1.29</td>
<td>Moderate</td>
</tr>
<tr>
<td>9</td>
<td>Exchangeable Na (cmol(+)/kg)</td>
<td>0.05</td>
<td>Very low</td>
</tr>
<tr>
<td>10</td>
<td>CEC (cmol(+)/kg)</td>
<td>2.85</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Texture</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sand (%)</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Silt (%)</td>
<td>8</td>
<td>Sandy loam</td>
</tr>
<tr>
<td></td>
<td>Clay (%)</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Effect of varieties and fertilizers, as well as its interaction on plant height (cm) of maize.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Fertilizer dose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
</tr>
<tr>
<td>Gumarang</td>
<td>174.57 Aa</td>
</tr>
<tr>
<td>Sukmaraga</td>
<td>176.17 Ab</td>
</tr>
<tr>
<td>Lamuru</td>
<td>174.04 Aa</td>
</tr>
</tbody>
</table>

Remark: Value followed by the same uppercase letter in the same row are not significantly different at 5% DMRT. Value followed by the lowercase letters in the same column are not significantly different at 5% DMRT.

P1: urea: 200 kg/ha, SP-36 150 kg/ha, KCl 100 kg/ha
P2: urea: 250 kg/ha, SP-36 150 kg/ha, KCl 100 kg/ha
P3: urea: 300 kg/ha, SP-36 200 kg/ha, KCl 150 kg/ha
The data analysis of cob length (Table 5) indicated that there is an interaction between varieties and fertilizers in cob diameter of maize. The interaction Sukmaraga varieties with P3 fertilizer significantly gave the highest cob length (15.89 cm) compared with other treatment interactions.

Data analysis results of growth parameters showed that there is interaction between varieties and fertilizer on plant height, cob diameter, cob length, while the parameters of stem diameter, number of leaves, and the weight of 1,000 grain production did not show any interaction. The highest growth parameter were gained by interaction between variety Sukmaraga and fertilizer P3. The highest stem diameter of P3 and P2 were significantly different compared to P1.

Sukmaraga variety combined to P3 has better agronomic variability compared to varieties Gumarang and Lamuru. It is indicated that sukmaraga was more adapted in ex-tin mining lands. It is stated that the adaptability of a plant variety depends on genetic factors. Genetic a plant causes of the differences between the plants to one another. If there is a difference between the two individuals in the same environment and can be measured, then the difference is derived from the variation of the genotypes of the plants. This shows that the variety of Sukmaraga was able to adapt in the environment (Agency for Agricultural Research and Development 2007; Ruchjaningsih et al. 2000).

The fertilizer dose of P3 gave the highest agronomic parameters, The highest stem diameter of P3 and P2 were significantly different compared to P1. This P3 fertilizer dose was able to fulfill the larger number nutrient need of crop It also indicated that the plant still requires the addition of macro nutrients (NPK) fertilizer for the growth of plants. Since soil availability of nutrients of N, P, and K are low, more crop response to fertilization (Krismawati and Firman 2005). One of the factors that affect the growth is the interaction between nutrients in the soil due to fertilizer. Interaction between nutrients occurs when delivery of one nutrient can affect the absorption, distribution and function of other elements (Mullen 1998; Chatterjee et al. 1987).

According Hairiah 2000, optimal fertilizer to add nutrients to the plants due to increased soil CEC and nutrient supply is going well. The addition of chemical fertilizers to support the supply of nutrients quickly available so that it will happen good synchronization between the release of nutrients from fertilizers and nutrients when the plants need it.

### Yield Parameters

The data analysis showed that there is no interaction between variety and fertilizer dose on weight of 1,000 seeds and yield of maize (Table 7). The yield of variety of
sukmaraga (4.64 t/ha) and gumarang (4.60 t/ha) were significantly different compared lamuru (4.07 t/ha). Fertilizer dose P3 was significantly different than P1 on yield of maize, but it is not significantly different compared to P2.

The yield of lamuru variety was significantly different than gumarang and sukmaraga variety. It could be understood since the growth of sukmaraga was better compared to gumarang and lamuru. Besides, varieties Sukmaraga has is categorized as tolerant variety to soil acidity. The use of high yielding varieties in different agroecosystem will give vary on growth dan yiled (Agency for Agricultural Research and Development 2007).

Application of higher dosa of fertilizer (P3 and P2) gave higher yield of maize compare P1. The use of high yielding varieties and fertilizer nitrogen is an important factor in the increase in production, due to increased potassium nutrients and affect seed weight (Syekhfani 1997). Nitrogen (N) is one of the macro nutrients that become major limiting crop production. According Edmeades et al. (1994), approximately 90% of the maize crop in the tropics on dry land and rainfed rice, the yiled can be increased with nitrogen fertilizer. This is because nitrogen is an essential nutrient that serves as the building block of amino acids, proteins and chlorofil are important in the process of photosynthesis, as well as the building block components of the cell nucleus. Nitrogen is generally required by maize at large amounts, but the numbers in the soil a little, so that nitrogen fertilizer is a must in order to obtain high yields. According to Fontes et al. (1997), nitrogen fertilization is important in terms of yield and quality of crops and the environmental pollution caused.

Besides nitrogen, plants also require phosphorus. The role of phosphorus is to increase the yield since phosphorus can be absorbed and stored in the seed. Maize adsorbs of 15 percent of a given amount of P, 0.72% percent is stored in seeds (Suharto 1991). The element potassium plays an important role in the formation and translocation of carbohydrates to increase the size and weight of seeds. While K nutrient provided sufficient nutrients for the translocation of potassium and carbohydrates. It is necessary in seed formation so as to increase production (Linga and Marsono 2006; Kasniari and Supadma 2007). Soepartini et al. (1994) explained that the fertilizer is too low to meet the needs of the plant to achieve an optimal production rate.

**Conclusion**

1. Sukmaraga variety gave the highest growth and yield of maize is high in ex-tin mining lands.
2. Fertilizer dose of 300 kg/ha urea + 200 kg/ha SP-36 + 150 kg/ha KCl gave the highest growth and yield of maize in ex-tin mining lands.

**References**


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