Growth and production of sweet corn (*Zea mays saccarata sturt* L) with soil treatment and number of seeds per planting hole

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Abstract. Sweet corn production in Indonesia from is volatile and unstable. Unoptimal production of sweet corn in North Sumatra is caused by land conditions, plant populations, pest and disease level of soil fertility. Effective and efficient soil tillage, crop spacing and number of seeds will affect the physical properties of the soil and plant productivity. This study aims to observe the best planting and tillage methods for maize. This study used a split plot design which is repeated three times with two factors, i.e. 3 levels of number of seeds per planting hole and 3 levels of soil tillage. The results showed that the treatment of tillage and the number of seeds per planting hole give significant effect on the parameters of sweet corn plant height, stem diameter, and total production. The interaction of these two factors showed an influence on the parameters of sweet corn plant height. The treatment of 2 seed per planting hole and 1 time of soil tillage show the best productivity compared to other treatments.

1. Introduction
Sweet corn (*Zea mays* L. Saccharata Sturt) or better known as Sweet corn is one of the most popular horticultural commodities in the United States and Canada. Sweet corn has been known in Indonesia since the 1970s [1]. Sweet corn production in Indonesia from 2012 to 2015 fluctuated and was unstable. Sweet corn production in 2012 was 19,377,030 tons, 18,506,287 in 2013 was 18,506,287 tons, in 2014 was 19,033.00 tons and in 2015 was 19,610,000 tons [2]. The production of sweet corn plants that are not optimal in North Sumatra Province is caused, among others, by land conditions, plant populations and soil fertility levels. There are several ways in relation to these efforts, one of which is the application of microorganisms and soil management systems [3]. Tillage can be done to improve texture, structure and porosity so that the soil becomes loose. Effective tillage will be able to obtain a better state of soil physical properties in order to maintain good soil conditions for plants [4]. In addition to tillage and spacing, the number of seeds per planting hole also affects maize productivity. The number of seeds more than one per planting hole will increase the plant population per hectare [5]. Regulating the number of seeds per planting hole and spacing is one way to minimize competition for sunlight, water and nutrients.
2. Materials and methods
This research was carried out in Sei Mencirim Village, Sunggal District, Deli Serdang Regency, North Sumatra Province at an altitude of 40 m above sea level. This research was conducted from June 2020 to August 2020. This study used a Split Plot Design (RPT) using 2 treatment factors, namely. The first factor was the tillage method (P) as the main plot consisted of P0 (without tillage), P1 (1 time tillage) and P2 (2 tillage). The second factor was the provision of seeds per planting hole (B) as subplots consisting of B1 (1 seed per planting hole), B2 (2 seeds per planting hole), and B3 (3 seeds per planting hole).

2.1. Plant maintenance
Planting is carried out after 2 weeks of tillage application and maintenance includes watering, weeding at 2 weeks after planting, NPK fertilization is given when the plants are 2 weeks old and 5 weeks after planting. Pest and disease control is adjusted to the intensity of pest and disease attacks.

2.2. Data analyst data
Processing using SPSS statistical program (ver. 17). The data obtained were analyzed using variance at level = 5%. If there is a significant effect between test treatments, it is continued with Duncan's Multiple Distance Test (DMRT).

3. Result and discussion
3.1. Plant height (cm)
Application of tillage and seed per hole had a significant effect on plant height and the interaction of both had a significant effect on plant height. The highest plant height was found in P1 (1 time tillage) 178.45 cm, and the best seed at B1 (1 perforated seed) was 177.81 and the highest interaction between the two was found in P1B1 with an increase in plant height of 181.58 cm and the lowest interaction was found in P2B3 of 160.88 cm. This is because by processing the soil once, it makes the soil loose so that the roots of the plants enter the soil more easily and it is easier to absorb the nutrients contained in the soil used by plants for their growth. This is reinforced by the opinion of Suwardjono (2004) which states that a good soil structure makes roots develop well so that the area of absorption of nutrients is wider [3]. This is in accordance with Berkelaar (2011) who argues that the use of seeds per planting hole affects growth because it directly deals with competition between plants in one clump [6]. A smaller number of seeds per planting hole will give the plant space to spread and deepen roots.

| Age (WAP) | Soil Tillage | Seed/Planting hole | Average |
|-----------|--------------|---------------------|---------|
|           | P0 (with out tillage) | B1 (1Seeds/hole) | B2 (2seeds/hole) | B3 (3 seeds/hole) |         |
| 6 WAP     |              | 178.00b            | 172.06c | 181.58a | 177.21a |
|           | P1 (1 time tillage) | 181.58a            | 178.31b | 175.47c | 178.45a |
|           | P2 (2 time tillage) | 173.86c            | 164.43d | 160.88d | 166.39b |
|           | Average      | 177.81a            | 172.02c | 173.10b | 174.02  |

Note: The numbers followed by different letters show a significant difference according to Duncan's Multiple Range Test at the level of α = 5%.

3.2 Stem diameter (cm)
Soil tillage application and seeding per hole had a significant effect on stem diameter and their interaction did not significantly affect stem diameter. The highest stem diameter was found in P1 (1 time tillage) 22.59 cm, and the best seed in B1 (1 hole seed) was 23.20 and the highest interaction
between the two was found in P1B1 with a plant stem diameter of 24.47 cm. And the lowest interaction was found in P2B3 of 17.91 cm.

This is due to the relatively low plant population of sweet corn plants that do not shade each other so that they can meet the needs of solar radiation and nutrients. According to Bilman (2011), this happens because the bigger and denser the corn plants will spur the plants to absorb nutrients, water, light, for plant height growth [7]. Sufficient plant needs for growth elements will stimulate the increase in plant height and the formation of new leaves. Berkelaar (2011) argues that the use of seeds per planting hole has an effect on growth because it directly deals with competition between plants in one clump [6]. A smaller number of seeds per planting hole will provide space for plants to spread and deepen roots.

### Table 2. Plant diameter (cm) sweet corn age 6 WAP on soil processing and seed treatment per hole.

| Age (WAP) | Soil Tillage | B1 (1 Seeds/hole) | B2 (2 seeds/hole) | B3 (3 seeds/hole) | Average |
|-----------|--------------|-------------------|-------------------|-------------------|---------|
| 6 WAP     | P0 (without tillage) | 22.80             | 19.77             | 18.58             | 20.38b  |
|           | P1 (1 time tillage)  | 24.47             | 20.97             | 22.33             | 22.59a  |
|           | P2 (2 time tillage)  | 22.33             | 19.37             | 17.91             | 19.87c  |
|           | Average         | 23.20a            | 20.03b            | 19.61b            | 20.95   |

Note: The numbers followed by different letters show a significant difference according to Duncan’s Multiple Range Test at the level of α = 5%.

### 3.3 Total production

Soil tillage application and seeding per hole had a significant effect on total production and both interactions had no significant effect on total production. The highest total production was found in P1 (1 time tillage) 17.90 kg, and the best seed at B2 (2 perforated seeds) 17.27, and the highest interaction was found in P1B1 with a total production of 18.43 kg and the lowest interaction was found in P0B1 of 13.70 kg.

This is in accordance with the BPPT literature (2015) which states that for optimal growth the soil must be loose, fertile and rich in humus [8]. Sweet corn has a strong root system because corn roots consist of primary roots, literal roots, horizontal roots and aerial roots [9] so that loose soil is needed to support the root system. Sweet corn cultivation with 1 time tillage gives the best results from several parameters measured. This is because a good tillage system will support roots in supplying nutrients properly.

According to Suryana (2003), one of the determinants of maize productivity is plant population which is closely related to spacing and seed quality [10]. To meet the population of these plants, seed viability is recommended to be more than 95% because in cultivation it is not allowed to replant plants that do not grow because the chance for normal growth is very small and usually the cobs that are formed do not contain seeds.

### Table 3. Total production (kg) of sweet corn in soil and seed processing treatments per hole.

| Soil Tillage | B1 (1 Seeds/hole) | B2 (2 seeds/hole) | B3 (3 seeds/hole) | Average |
|--------------|-------------------|-------------------|-------------------|---------|
| P0 (without tillage) | 13.70             | 15.50             | 16.03             | 15.07b  |
| P1 (1 time tillage)  | 18.43             | 18.26             | 17.00             | 17.90a  |
| P2 (2 time tillage)  | 17.00             | 18.06             | 17.90             | 17.65a  |
| Average       | 16.37b            | 17.27a            | 16.97b            | 16.87   |
Note: The numbers followed by different letters show a significant difference according to Duncan's Multiple Range Test at the level of $\alpha = 5\%$.

4. Conclusion
Treatment of tillage that has growth, the best production is P1 (1 time tillage) compared to other tillage. The treatment of the number of perforated seeds that gave the most effective effect on growth and the best production was 2 seeds per planting hole. The interaction of tillage treatment and the treatment of the number of perforated seeds that resulted in the best growth and production was 1 time till age by giving 2 seeds per planting hole.

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