Performance of Six Sweet Corn Hybrid in Marginal Land Use Drip Irrigation

B Supriyanta1*, D Wicaksono1, And Habib Razzokov2

1Department of Agrotechnology, Faculty of Agriculture, Universitas Pembangunan Nasional Veteran Yogyakarta, Jl. Padjajaran 104, Condongcatur, Depok, Sleman, Yogyakarta, Indonesia
2Associate Professor, Zarmed University, Samarkand, Uzbekistan

Abstract. Efforts to increase sweet corn production are carried out by utilizing marginal land equipped with drip irrigation. This effort requires assembling sweet corn hybrid seeds that are suitable for marginal land. Assembling hybrid varieties requires information related to the expected testing of several hybrid lines. The objective of this study is to examine the growth and yield potential of several combinations of F-1 expectation crosses in marginal land use drip irrigation. This study was conducted at the Experimental Garden of Faculty of Agriculture, UPN “Veteran” Yogyakarta. This study used a diallel cross design with three replications. The treatments were 10 numbers of sweet corn consisting of 7/5-1B, KD/1-3, and 50/4-2B as parents, KD/1-3 × 7/5-1B, KD/1-3 × 50/4-2B, 7/5-1B × KD/1-3, 7/5-1B × 50/4-2B, 50/4-2B × KD/1-3, 50/4-2B × 7/5-1B as F1 and the sweet corn variety Talenta for comparison. The observation variable consisted of plant height, number of leaves, stem diameter, ear height, male flowering age, female flowering age, ear length without husk, ear diameter without husk, weight of ear without husk and level of sweetness. Each variable was analyzed using variance with α = 5%. The results showed that the combination of the F-1 hope crosses which has the potential to become a hybrid variety is the combination of 50/4-2B × KD/1-3 crosses.

Keyword: Sweet Corn Hybrid, Marginal Land, Drip Irrigation, Growth Potential, Yield Expectation

1 Introduction

Sweet corn, scientifically known as Zea mays var. Saccharata, is a variety of corn encompassing horticultural crops. It enjoys widespread popularity in both developed nations such as the United States, Brazil, and France, as well as in developing countries.

1*Corresponding author email: bambang.supriyanta@upnyk.ac.id
The demand for sweet corn continues to rise annually, driven by the increasing global population. Sweet corn serves a dual purpose, not only as a food source but also as a key raw material for the corn sugar industry[1]. The rise in sweet corn consumption is in sync with shifting consumption habits. To meet the growing demand for sweet corn, there is a necessity to make corresponding efforts in sweet corn production. As reported by the Ministry of Industry in 2016, the national corn demand for the year 2015 stood at 8.6 million tons annually, roughly equivalent to 665 thousand tons per month[2]. Information provided by the Central Statistics Agency in 2015 reveals a consistent annual rise of 6.26% in sweet corn imports. This suggests that domestic sweet corn production has been insufficient to meet market requirements. One of the challenges encountered is the limited productivity of sweet corn. In Indonesia, the average sweet corn yield stands at 8.31 tons per hectare, whereas the potential yield could reach 14-18 tons per hectare[3].

The difficulty in growing crops arises from the presence of regosol soil, characterized by its poor productivity owing to various constraints related to the physical, chemical, and biological attributes of the soil [4]. This type of soil has a texture of sand to loam, and a soil depth of 30-60 cm, and has fast permeability, good drainage, with a moderate level of soil fertility [5].

Increasing the productivity of sweet corn and overcome the soil conditions can also be done with the right cultivation techniques, one of which is the provision of the right fertigation system. One type of fertigation technique (a combination of irrigation and fertilization systems, namely drip tape irrigation system). The drip fertigation system is the most efficient water and fertilizer application system. The efficiency of water use with this irrigation system can reach 80 - 95% [6]. The drip irrigation system can save water usage, because it can minimize water loss that may occur, such as percolation, evaporation and surface runoff, making it suitable for application in areas with limited water sources such as sandy lands [7].

Efforts to meet the needs of maize and increase maize productivity by using seeds hybrid. Corn hybrids can be produced from crossing pure lines. Strains on corn can be obtained through self-pollination (selfing). Hybrid maize varieties have been widely circulated in Indonesia. More than 30 hybrid maize varieties have been released and registered with the IAARD. Generally, hybrid maize has a higher productivity than free-fringed maize [8]. Because of the high yield of these hybrid varieties, one of the breeding activities, namely the assembly of new hybrid varieties with higher yield potential, is important. The assembly of hybrid varieties with high yield potential requires information regarding the lines to be used as parents. These lines need to be crossed with each other to get a superior combination of F-1 crosses. Furthermore, several cross combinations need to be tested to see the growth and yield potential.

2 Material and methods

Preparation of land before planting includes clearing the land from grass, soil processing, and constructing drainage channels. Soil processing was carried out by plowing and harrowing. The land was leveled and then divided into three blocks. Drains were made on each side of the compartment with a depth of 20-25 cm. Six hybrid line (Table 1) and TALENTA were planted in the planting hole at a depth of 3-4 cm with a spacing of 75 cm x 30 cm. Each planting hole was filled with 2 seeds then closed again using the soil without being compacted. Planting was carried out in rows according to the number.
Table 1. Six hybrid line use in this study

<table>
<thead>
<tr>
<th>No</th>
<th>Hybrid line</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KD/1-3 X 7/5-1B</td>
</tr>
<tr>
<td>2</td>
<td>KD/1-3 X 50/4-2B</td>
</tr>
<tr>
<td>3</td>
<td>7/5-1B X KD/1-3</td>
</tr>
<tr>
<td>4</td>
<td>7/5-1B X 50/4-2B</td>
</tr>
<tr>
<td>5</td>
<td>50/4-2B X KD/1-3</td>
</tr>
<tr>
<td>6</td>
<td>50/4-2B X 7/5-1B</td>
</tr>
</tbody>
</table>

The fertilizer rates for sweet corn plants were 100 kg urea/ha, 50 kg SP-36 / ha, and 200 kg ZA / ha. Time of application of fertilizer were: 0 day after planting (dap) Urea = 100 kg / ha, SP-36 = 50 kg / ha, age 15 dap ZA = 100 kg / ha, and age 35 dap ZA as much as 100 kg / ha (Agricultural Extension Agency, 2015). The method of applying fertilizer was poured 5 cm deep, 10 cm from the plant stem, and covered with soil. Weeding was done at the beginning of plant growth or adjusting land conditions. Pesticide consist Karbofuran 3% and Metarizium sp. were applied at seed planting hole to prevent pests.

Irrigation was carried out through a system of drip tape irrigation. Irrigation was carried out twice a day at 8 - 9 a.m. and 4 - 5 p.m. Water irrigation was taken from a well and kept on a water tank. A water pump delivered water from water tank to 12 drip tape for one block. Every planting line use a drip tape. Drip tapes consist hole every 30 cm in accordance with the planting spacing.

Observation was conducted to growth variable and production variable. Plant height was measured from the ground level to the tip of the highest leaf using a ruler/tape measure. Stem diameter of the stem was measured using a caliper on the stem 10 cm above the ground. Number of leaves were counted to all leaves that are fully open. Plant height, stem diameter, and number of leaves were observed at 3, 5, and 7 weeks after planting (wap). Flowering age is the age of plant when 50% of the plant in the treatment develop flower. Corn has male (tassel) and female flower. Male flowering age was recorded when male flower was producing pollen or develop antesis. Female flowering age was recorded when the silk grows more than 1 cm.

Production variables consist of amount of cobs per plant, ear length, diameter, and weight, and sweetness. The observation was conducted after harvesting. The ear length was observed from the tip to base. It was conducted to the ear which was filled with seeds only. The ear diameter was carried out using calipers in the middle of the ear. Ear weight was conducted to the ear with and without husk. Sweetness index or sugar content (Brix) was measured using a refractometer.

3 Result and discussion

Figure 1 shows that at 4 WAP, the highest height was KD/1-3 X 7/5-1B (93.68 cm) and the lowest was 50/4-2B X KD/1-3 (75.88 cm) but both are not significantly different from the Talenta variety as control. At 6 WAP the highest plant height was KD/1-3 X 50/4-2B (159.88 cm) not significantly different from Talenta, and the lowest was 7/5-1B X 50/4-2B (123.75 cm) significantly different from the Talenta variety. At the age of 8 MST, the plant height that was significantly different and higher than Talenta was (KD/1-3 X 50/4-2B).
(195.78 cm), and the lowest was 7/5-1B X 50/4-2B (139.16 cm) significantly different from Talenta variety.

Fig 1. Plant Height at 4, 6, and 8 weeks after planting (WAP). There is no noteworthy distinction observed among the bars marked with identical letters within each age group.

Based on Figure 2, at 4, 6, and 8 WAP the largest stem diameter was 7/5-1B X KD/1-3 (18.39 cm, 22.36 cm, and 23.50 cm respectively) and showed significant difference with the Talenta variety as a control.

Fig 2. Stem diameter at 4, 6, and 8 weeks after planting (WAP). There is no noteworthy distinction observed among the bars marked with identical letters within each age group.
Figure 3 shows that at the age of 4 WAP, the highest number of corn leaves in the combination of KD/1-3 X 7/5-1B crosses (7.42) was significantly different from the Talenta variety as a control. At the age of 6 MST, the highest number of leaves in the combination of KD/1-3 X 50/4-2B crosses (8.17) was not significantly different from the Talenta variety. Whereas at the age of 8 WAP, the highest number of leaves in the combination of KD/1-3 X 50/4-2B crosses was 12.25 and showed a significant difference with the Talenta variety as a control.

![Bar Chart](image)

**Figure 3.** The mean number of leaves of some sweet corn line at 4 WAP, 6 WAP and 8 WAP. There is no noteworthy distinction observed among the bars marked with identical letters within each age group. WAP = weeks after planting.

Figure 4 shows the mean flowering age of male and female flowering combinations of crossbreeding sweet corn and Talenta varieties. The longest flowering age for males in the combination of crosses 50 / 4-2B X KD / 1-3 was 56.00 days and the shortest in the combination of crosses KD / 1-3 X 7 / 5-1B was 51.67 days, both showed a difference with Talenta as the control. Meanwhile, the longest flowering age of females in the combination of crosses 50 / 4-2B X KD / 1-3 was 58.00 days, which showed a significant difference with Talenta varieties. The shortest flowering age was found in the combination of crosses KD / 1-3 X 7 / 5-1B and 50 / 4-2B X 7 / 5-1B for 55.33 days, which showed no significant difference with the Talenta variety.
Fig 4. The mean age of flowering in the combination of crosses and control. There is no noteworthy distinction observed among the bars marked with identical letters within each age group.

Figure 5 shows the mean results of the height of the ear, the weight of ear with weight, and the weight of ear without husk in a combination of crosses of sweet corn and varieties of Talenta. At the height of the ear, the highest average yield was the combination of KD / 1-3 X 50 / 4-2B crosses of 67.93 cm, which showed a significant difference with the Talenta variety, while the lowest average was the combination of crosses 7 / 5-1B X 50 / 4-2B of 45.52 cm was not significantly different from the Talenta variety.

The weight of the cob with the heaviest weight was in the combination of crosses 50 / 4-2B X KD / 1-3 of 419.92 g which showed a significant difference with the Talenta variety, and the lightest average yield was in the combination of crosses KD / 1-3 X 5 / 1B of 271.76 g was not significantly different from Talenta. While the weight of the ear without the heaviest cob was produced by the combination of crosses 50 / 4-2B X KD / 1-3 of 292.58 g, indicating a significant difference with the Talenta variety, the lightest average result was the combination of KD / 1-3 X 7/5 crosses. -1B of 179.18 g was not significantly different from Talenta.

Figure 6 shows the results for the variable ear length, diameter, and sweetness level in the combination of sweet corn crosses and talent varieties. In the ear length variable, the longest mean in the combination of crosses 50 / 4-2B X KD / 1-3 was 20.31 cm, indicating that it was not significantly different from the Talenta variety, while the shortest was in the combination of crosses 7 / 5-1B X 50 / 4-2B of 18.01 indicates a significant difference with the Talenta variety.
Figure 5. The mean of height of the ear from the soil, weight of ear with weight, and weight of ear without husk. There is no noteworthy distinction observed among the bars marked with identical letters within each age group.

The stem diameter with the largest means in the combination of KD / 1-3 X 50 / 4-2B crosses was 46.64 cm and showed a significant difference with the Talenta variety. Meanwhile, the smallest average yield was in the combination of KD / 1-3 X 7 / 5-1B crosses of 42.70 cm, not significantly different from the Talenta variety. The sweetness level with the sweetest average result was the combination of crosses 7 / 5-1B X 50 / 4-2B of 14.83 but did not show a significant difference with the Talenta variety. Meanwhile, the lowest average level of sweetness was in the combination of crosses 7 / 5-1B X KD / 1-3 of 11.42 which showed a significant difference from the Talenta variety.
4 Conclusion

Combination of the F-1 hope crosses which has the potential to become a hybrid variety is the combination of 50 / 4-2B X KD / 1-3 crosses.

References


