Proceeding International Conference on Green Agro-Industry
Volume 4, 2020 | Pages : 260-264

Comparison of Some Pure Line of Sweet Corn at S-4 Generation in Growth, Yield Components, and Downy Mildew Disease Incidence

Bambang Supriyanta[1*] and Danar Wicaksono[1]

[1]Faculty of Agriculture, UPN Veteran Yogyakarta, Indonesia

*bambangsg2@gmail.com

Abstract.

Sweet corn (*Zea mays* var *Saccharata*) has high demand but susceptible to downy mildew disease. Downy mildew on maize is a major disease in maize plants and can cause yield losses of up to 100%. The purpose of this study was to obtain and compare information on the character of growth, yield components and downy mildew incidence on various sweet corn lines in the S-4 generation. The study was conducted from August until October 2019 in the Wedomartani Experimental Garden, Faculty of Agriculture, UPN Veteran Yogyakarta. Seven pure line of sweet corn: SB/1-1, SB/1-3, SB/1-4, SB/1-6, SB/2-1, SB/2-2, and 10-2A were planted using a Randomized Block Design with 3 Blocks. Each experimental unit consists of 3 rows and each row consisting of 20 plants. The growth properties: plant height, stem diameter and number of leaves were observed. The yield component: the number of ears, the length of the ear and the diameter of the ear were observed. Disease incidence was observed to determined resistance against downy mildew. Data were analyzed by analysis of variance with 5% significance, followed by Duncan's multiple range test with a level of 5%. SB/2-1 have significantly lowest height and B/1-4 have highest number of leave than other line. There is not significantly different on stem diameter and number of ears. SB/1-3 produce high ear diameter and length. SB/1-1 is having low disease incidence.

Keywords: Growth, Crop, Resistance, Sweet Corn, *Zea mays* var. *Saccharata*.

1. Introduction

The national sweet corn production is not able to fulfill market demand because it has low productivity and number of consumptions increased. Sweet corn (Zea mays var. Saccharata) is popular in developed and developing countries. The demand for sweet corn every year grow due to the population increasing. The Ministry of Industry describes that national sweet corn need increase 8.6 million tons per year in 2015 (Hanifah et al., 2018). The growth of sweet corn needed in line with changes in consumption patterns. Sweet corn is not only used as food, but also raw material for the corn sugar industry. Central Statistics Agency show that sweet corn imports increased by 6.26% per year because national sweet corn production has not been able to fulfill market demand. Low productivity is one of the main problems. The productivity is around 8.31 tons per ha with the potential yield about 14-18 tons per ha (Maryamah, 2017).

Corn downy mildew is one of the important disease cause low production of sweet corn. The disease cause by *Peronosclerospora maydis, P. philippinensis* and *P. sorghi. P. maydis* and *P. philippinensis* are common pathogen infected the corn. Both of it usually found in Java island (Rustiani *et al.*, 2015). Sweet corn at the age from 10 until 60 days after planting is susceptible with the disease (Pakki, 2014). Sweet corn will not produces any ear after infected by the disease (Soenartiningsih and Talanca, 2010). It will cause losses until 100% when it infect susceptible plant at the age between 10 and 15 days after planting (Talanca, 2013). Corn downy mildew disease needs a combination of disease management technologies such as tolerant varieties, induced resistant, biological agents, healthy cultivation techniques, and fungicides when needed.

High productivity and resistance sweet corn was obtained through plant breeding. Recessive mutation that occurs naturally in genes that control the conversion of sugar to starch in corn endosperm produce sweet corn. There are 13 mutant genes that improve sugar levels in sweet corn. The sugary gene (su), sugary enhancer gene (se), and shrunken (sh2) gene are the main genes that effect corn sweetness. Crossing is an process to increase genetic variability and obtain new superior genotype. Characterization is teh initial step to select prospective parent, and then the purification step by self-pollinating to obtain a homozygote plant population. Dialel crossing is one of the crossing that common used. Dialel crossing is a crossing between all pairs of parents without know of the potential yield of a hybrid combination, the value of heterosis, combining ability (general combining ability and special combining ability), and the alleged magnitude of genetic variation of a character (Sujiprihati, et al., 2012).

2. Method

The research was established at the Wedomartani Experimental Garden, Faculty of Agriculture, UPN Veteran Yogyakarta. It was conducted at August until October 2019. Sweet corn seeds from line: SB/1-1, SB/1-3, SB/1-4, SB/1-6, SB/2-1, SB/2-2, and 10-2A were obtained from the base population and used for the research. Nitrogen, phosphorus and potassium fertilizer 16:16:16, urea fertilizer, manure, natural growth regulators were used for the plant nutrients. Drip tape, spray hose, and sprinklers were used for the irrigation system. Furadan 3G and metarizium were used to control pest in the field.

This research was established by using a Completely Randomized Design with 3 replications. This study was a single factor experiment with 7 treatment: Bfa, Bfb, Bfc, Bfd, Sb1, Sb2, Sb3 and Sb4. Duncan's multiple range test at the real level $\alpha = 5\%$ was used for further tests (Gomes and Gomes, 1995). The research model was written as follows:

$$Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$$

Y_{ij} = Observational data

μ = General mean

τ_i = Estimation of the influence of sweet corn line

ε_{ij} = Estimation of trial fatigue estimator (error)

Monitoring variables were divide into three main focus: growth character, yield components and downy mildew disease incidence. The growth characters were observed

from plant height, stem diameter, number of leaves. The yield component were describe from number of ears, the length of the ear and the diameter of the ear. Downy mildew disease incidence show the comparison of the resistance level each line.

3. Result and Discussion

Table 1 shows that plant height was not significantly different except line SB/2-1 have significantly lowest height. There is not significantly different on stem diameter. SB/1-4 have highest number of leave but was not significantly different with SB/1-3 and SB/2-1. The morphological similarity of sweet corn number is more influenced by the presence of genotype factors than the growing environment.

Table 2 shows that the number of ears produced by the seven numbers was not significantly different. Sweet corn line SB/1-3 produce longest ear but not significantly different with SB/2-2, 10-2A, SB/1-4, and SB/2-1. Sweet corn line SB/1-3 produced higher diameter than other but was not significantly different with other line except SB/1-6.

Table 1. Plant height, stem diameter, and number of leaves of various sweet corn lines.

Sweet corn line	Plant height (cm)		Stem diameter (cm)		Number of leaves (piece)	
SB/1-1	154,89	a	2,14	a	7,44	c
SB/1-3	169,78	a	2,61	a	8,89	abc
SB/1-4	156,33	a	2,21	a	9,67	a
SB/1-6	116,22	b	2,02	a	8,00	bc
SB/2-1	160,56	a	2,41	a	8,89	abc
SB/2-2	155,56	a	2,20	a	7,67	bc
10-2A	167,78	a	1,93	a	9,11	ab

Note: The mean followed by the same letter in each column is not significantly different in Duncan's multiple range test at the significance level = 5%

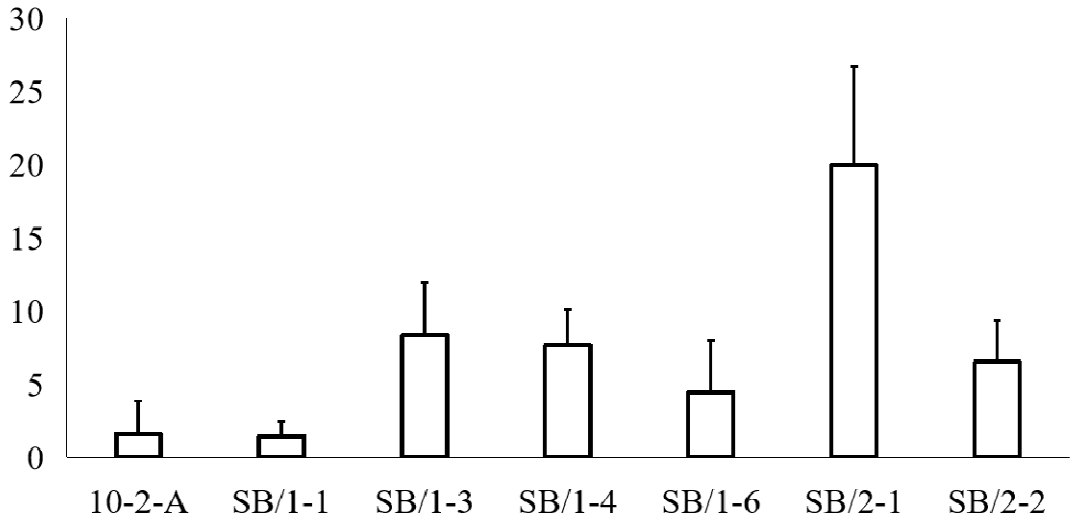
Table 2. Number, length , and diameter of the ears of some sweet corn lines.

Sweet corn line	Number of ears (piece)		length of ears (cm)		diameter of ears (cm)	
SB/1-1	1,56	a	13,89	b	4,39	ab
SB/1-3	1,67	a	17,84	a	4,60	a
SB/1-4	1,67	a	15,99	ab	4,51	a
SB/1-6	1,78	a	14,10	b	4,01	b
SB/2-1	1,78	a	15,82	ab	4,57	a
SB/2-2	1,67	a	17,29	a	4,40	ab
10-2A	1,67	a	17,44	a	4,43	ab

Note: The mean followed by the same letter in each column is not significantly different in Duncan's multiple range test at the significance level = 5%

Figure 1 shows that sweet corn line 10-2-A but it has low number of plant also. SB/1-1 have lowest disease incidence with high number of plant. SB/2-1 has highest disease incidence. SB/1-1 is potential as resistance parent because it has low disease incidence.

Figure 1. Mean of number of plant and disease incidence of various sweet corn lines.



	10-2-A	SB/1-1	SB/1-3	SB/1-4	SB/1-6	SB/2-1	SB/2-2
Number of plant	28,67	40,67	46,00	32,67	20,67	25,33	36,00

4. Conclusion

SB/2-1 have significantly lowest height and B/1-4 have highest number of leave than other line.There is not significantly different on stem diameter and number of ears. SB/1-3 produce high ear diameter and length. SB/1-1 is has low disease incidence.

Acknowledgment

Thank you to the Institute of Research and Community Service UPN Veteran Yogyakarta for providing this research grant.

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