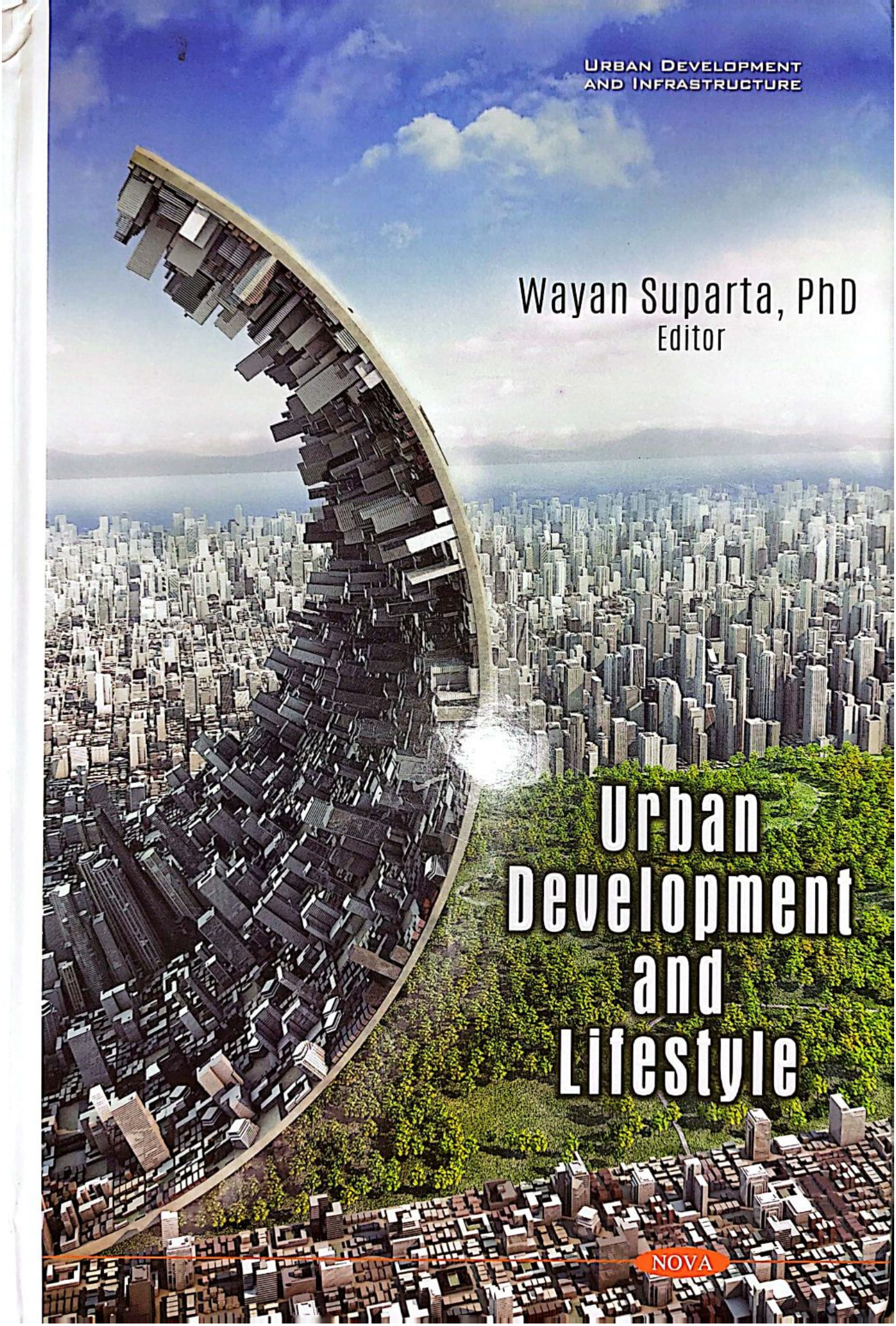

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URBAN DEVELOPMENT AND LIFESTYLE

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URBAN DEVELOPMENT AND INFRASTRUCTURE

URBAN DEVELOPMENT AND LIFESTYLE

WAYAN SUPARTA
EDITOR

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As Professor at the Universitas Pembangunan Jaya, with daily activities in lecturing, doing research, as well as water resources development planning, I really praise the Nova Science Publishers for publishing selected papers from "2020 International Conference on Urban Sustainability, Environment, and Engineering (CUSME 2020)". Hence, this publication would be useful for professionals, reseachers, scholar, policymakers, and NGO. I believe that currently, many professionals would like to give more attention on development of sustainable urban. In addition, this publication could be used as reference for City authorities to make appropriate policy choices to protect the provision of equitable housing, health, and transportation services.

Prof. Ir. Frederik Josep Putuhena M.Sc., Ph.D
Center for Urban Studies – Universitas Pembangunan Jaya

Urban Development and Lifestyle are trend issues for the cities around the world. Learning from experiences is the most effective way to support the cities to be sustainable developed. This book offers the knowledge sharing among countries which covers variety of cities' issues. It also provides the great lessons for researchers, officers and policy makers on coping with several urban problems.

Associate Professor Sarintip Tantanee, Ph.D.
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Chapter 32

THE SCREENING OF GROWTH, YIELD COMPONENT, AND RESISTANCE OF VARIOUS SWEET CORN LINES AGAINST DOWNY MILDEW ON S-3 GENERATION

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UPN Veteran Yogyakarta, Indonesia

ABSTRACT

Sweet corn (*Zea mays* var. *Saccharata*) is the result of a recessive mutation that occurs naturally in genes that control the conversion of sugar into starch in corn endosperm. There are three main genes that affect the sweetness of corn, namely the sugary gene (su), the sugary enhancer gene (se), and the shrunken gene (sh2). Downy mildew on maize is a major disease in maize plants and can cause yield losses of up to 100% if it infects susceptible plants at the age of 10-15 days after planting (HST). The purpose of this study was to obtain information on the character of growth, yield components and resistance to downy mildew on various sweet corn lines in the S-3 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: BFa, BFb, BFc, BFd, BFe, BFf, and BFg were planted using a Randomized Block Design with 3 Blocks. Each experimental unit consists of 3 rows and each row consists of 20 plants. The growth properties: plant height, stem diameter and number of leaves were observed. The yield component: the number of ear, the length of the ear and the diameter of the ear were observed. Disease incidence was observed to determine the resistance against downy mildew. Data were analyzed by analysis of variance with 5% significance, followed by Duncan's multiple range tests with a level of 5%. The results showed that for the characteristic of growth there was no difference in effect on all strains used. Lines that have good ear lengths are BFa, BFe,

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BFf, and BFg. All lines have large ear diameter except BFg. Line BFc, BFd, BFe, BFb, and BFg have high resistance of downy mildew than other lines. Sweet corn Bff has better characteristic of growth and productivity. Sweet corn Bfc has lowest downy mildew disease incidence.

Keywords: growth, yield, resistance, sweet corn, Zea mays var. Saccharata

INTRODUCTION

Sweet corn (*Zea mays* var. *Saccharata*) is a type of corn that includes horticultural crops. It is very popular in developed countries like America, Brazil, France, and developing countries. The need for sweet corn every year increases due to the growing population. Sweet corn is not only used as food, but also raw material for the corn sugar industry. The increasing consumption of sweet corn is in line with changes in consumption patterns. The increasing demand for sweet corn needs to be supported by efforts to fulfill sweet corn production. National corn demand in 2015 reached 8.6 million tons per year or around 665 thousand tons per month [1]. The data shows that the sweet corn imports are increased by 6.26% per year. This indicates that national sweet corn production has not been able to fulfill market demand. One obstacle faced is the low productivity of sweet corn. The productivity of sweet corn in Indonesia is 8.31 tons ha-1 on average with the potential yield of sweet corn reaching 14-18 tons ha-1 [2].

One of the obstacles in the cultivation of sweet corn is the Corn Downy Mildew Disease caused by *Peronosclerospora maydis* [3] *Rhizoctonia solani* [4], and *Helminthosporium* sp. [5]. Downy Mildew is a major disease in corn and cause yield losses up to 100% if it infects susceptible plants at the age of 10-15 days after planting [3, 6, 7]. Sweet corn that is attacked by *P. maydis* cannot produce ear [8]. The disease is caused by three types of fungi namely *Peronosclerospora maydis, P. philippinensis* which is the dominant type causing damage and *P. sorghi. P. maydis* is commonly found on the Java island while *P. philippinensis* in Sulawesi [9]. The pathogen infects corn plants at the age of 10-60 HST so the management is very important at that time [5].

Liman, mimba, betel, and lemongrass extracts are effective in suppressing downy mildew on maize sweet and *Seraiwangi* has the highest potential in suppressing downy mildew disease in sweet corn [10]. Plant Growth Promoting Rhizobakteri (PGPR) and asam salisilat can be used as elicitor and increased in resistance status of corn against Downy Mildew Disease [11]. *Bacillus* sp. and *Pseudomonas* sp. showed superior variety development of sweet corn that is resistant to downy mildew disease is needed to increase the productivity as an effort to fulfill national needed. Metallaxyl fungicide cannot control downy mildew if the variety does not have resistance to the disease [5]. This shows that the management of downy mildew on maize requires a combination of various disease management technologies such as resistant varieties, resistance induction, antagonistic biological agents, healthy cultivation techniques, and fungicides when needed.

Superior varieties can be obtained through plant breeding activities. One step in plant breeding activities is the expansion of genetic diversity through hybridization or crossing.

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Sweet corn is the result of a recessive mutation that occurs naturally in genes that control the conversion of sugar to starch in corn endosperm.

Sweet corn seeds can be distinguished from their stinging seeds, but it does not indicate what genes are responsible for the sweetness [12]. There are 13 genes that are responsible for increasing sugar in sweet corn. 3 of these 13 genes are considered to be most influential in maize sweetness and are recessive genes. These 3 genes are sugary genes (su) with 9-16% sugar content, sugary enhancer (se) have 14-22% sugar content, and shrunken (sh2) have 28-44% sugar content [13, 14].

The most common genes used in the hybridization of sweet corn varieties are the su2 and sh2 genes. The sugars given by the sh2 gene do not easily turn into starch so their sweetness lasts. Crossing is one of the efforts to increase genetic variability and obtain new superior genotype. The initial stage is a characterization to select prospective parent, and then the purification stage by self-pollinating to obtain a homozygote plant population. One type of crossing that is commonly held is diallel crossing. Dialel crossing is a crossing between all pairs of parents so that 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 [15].

METHODS

The field experiment was conducted at the Wedomartani Experimental Garden, Faculty of Agriculture, UPN Veteran Yogyakarta in August until October 2019. Sweet corn seeds: Bfa, Bfb, Bfc, Bfd, Bfe, Bff, and Bfg were obtained from the base population and used for the experiment. Nitrogen, phosphorus and potassium fertilizer 16:16:16, urea fertilizer, SP-36 fertilizer, manure, liquid supplementary fertilizers, and natural growth regulators were used for the plant nutrients. Drip tape, spray hose, sprinklers, pipes, timers, booster pumps, filters, and water reservoirs were used for the irrigation system. Fura& 3G and metarizium were used to control pest in the field.

This research was a field trial using a Completely Randomized Design with 3 replications. This study was a single factor experiment with sweet corn number as the treatment, which consists of 8 levels: Bfa, Bfb, Bfc, Bfd, Bfe, Bff, and Bfg. Therefore, the research model was written as follows:

$$Y_{ij} = \mu + \tau_i + \varepsilon_{ij} \quad (1)$$

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)

Further tests were carried out with Duncan's multiple range test at the real level $\alpha = 5\%$ [16]. Observation variables consisted of growth character, yield components and resistance to

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downy mildew. Observation of growth characters consisted of plant height, stem diameter, number of leaves. The yield component observed consisted of the number of ears, the length of the ear and the diameter of the ear. Resistance variables were disease incidence.

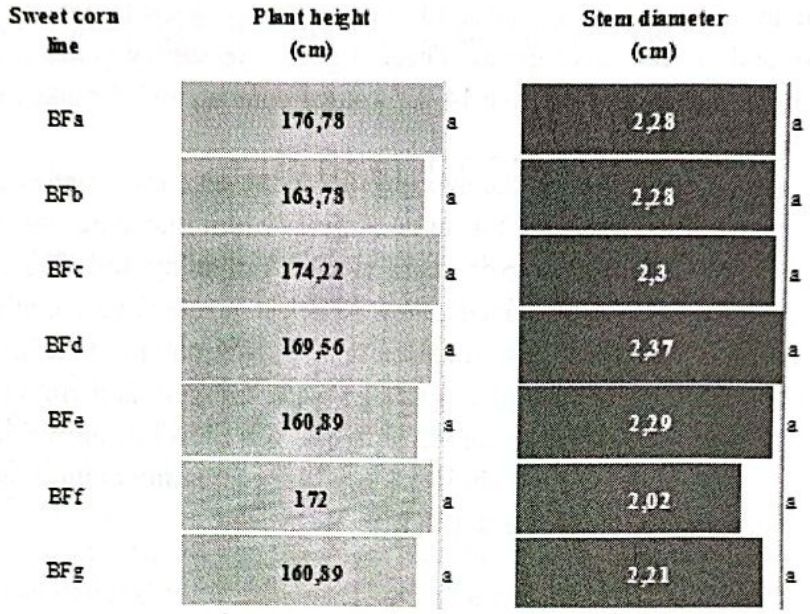

Figure 1. Plant height and stem diameter of various sweet corn lines. The mean followed by the same letter in each column is not significantly different in Duncan's multiple range test at the significance level =5%.

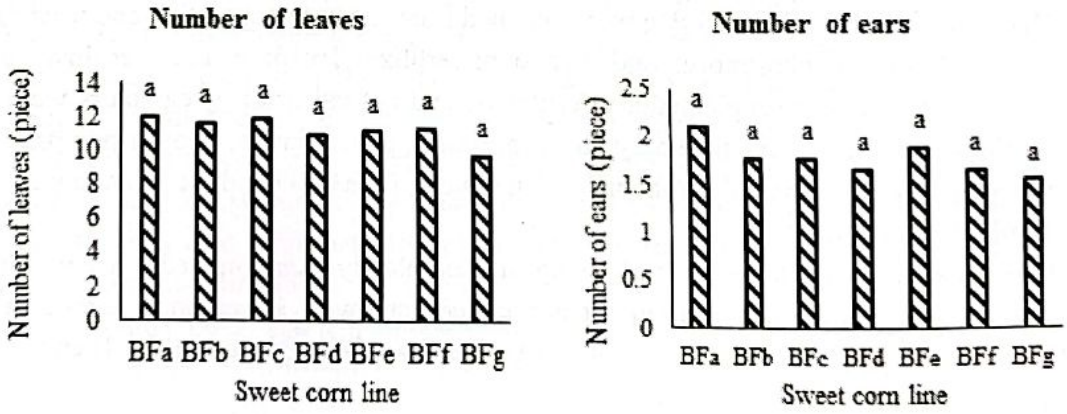

Figure 2. (left) Number of leaves of various sweet corn lines and (right) Number, Length and diameter of the ears of some sweet corn lines. The mean followed by the same letter in each column is not significantly different in Duncan's multiple range test at the significance level =5%.

RESULT AND DISCUSSION

Figure 1 and Figure 2 (left) show that plant height, stem diameter, and number of leaves were not significantly different. The morphological similarity of sweet corn number is more

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influenced by the presence of genotype factors than the growing environment. Plant height on sweet corn is growth related characteristic. Tall plant is expected has many internode and produce more plant. Higher number of leaves influence more on photosynthesis and better growth. The population used was S-3 generation, which will be selected for S-4 and expected to get superior line with high number of leaves and stem diameter.

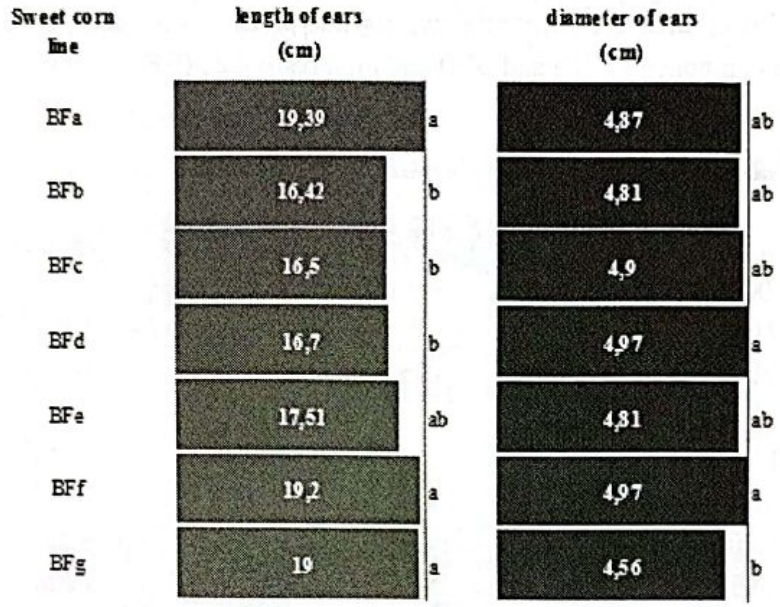

Figure 3. Number, length and diameter of the ears of some sweet corn lines. The mean followed by the same letter in each column is not significantly different in Duncan's multiple range test at the significance level =5%.

Figure 3 and Figure 2 (right) show that the number of ears produced by the seven numbers was not significantly different, whereas the length and diameter of ears was significantly different. Each sweet corn number has its own characteristics. Sweet corn BFa, BFf, and BFg produce significantly longer ears compared to BFb, BFc, and BFd, but not significantly different from BFe. Sweet corn BFd and BFf produce significantly larger ear diameter compared with BFg, but not significantly different from BFa and BFa, BFb, BFc, and BFe.

There is no significantly different between sweet corn line based on plant height, stem diameter, number of leaves, and number of ears. This is a consequence of the 3rd generation field test. All line has been selected before, so it has good and relatively similar characteristic. However, there are significantly different on the length and diameter of the eras. Length and diameter of the ears affect corn productivity. BFf has highest length and diameter of the ear although it was not significantly different with some other line. BFf, BFg, BFa, and BFa lines is potential line candidates because have good production. It was showed from the ear length. Sweet corn lines with long ears potentially have high number of seed. Productivity of a line is influenced by ear diameter and length.

Figure 4 shows that sweet corn BFf has highest disease incidence (43.6%). Sweet corn BFc and BFd have lowest disease incidence. The mean of number of plant BFd was significantly smallest than other line. The low disease incidence of BFd could be lead by the

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low number of plant. BFc is potential as resistance parent because it has low disease incidence and is followed by BFd, BFe, BFb, & BFg. Stomatal density is positively correlated with corn downy mildew disease incidence [17].

BFc, BFd, BFe, BFb, and BFg have resistance source gen of downy mildew. Selection will be carried out on these lines in the S-4 generation, so it is expected to get a higher level of resistance. The hybrid sweet corn plant breeding program is aimed to produce plants with high yields and resistance to downy mildew. For this purpose, crossing between lines which have high yield components (BFa and BFf) and high resistance (BFc & BFd).

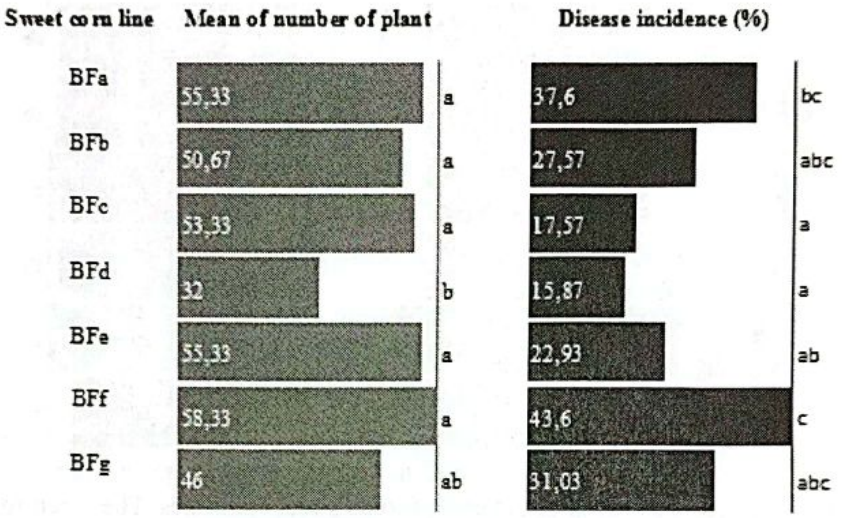

Figure 4. Mean of number of plant and disease incidence of various sweet corn lines. The mean followed by the same letter in each column is not significantly different in Duncan's multiple range test at the significance level =5%.

Sweet corn line BFf has better characteristic of growth and productivity but it looks susceptible against downy mildew. BFc has low disease incidence than other line although it did not significantly different with BFd, BFe, BFb, and BFg. BFd has lower disease incidence than BFc but it has low number of plant. It indicates that BFd has low survival.

CONCLUSION

The conclusion from the research is sweet corn Bfa, BFf, and BFg have better characteristic of growth and productivity and sweet corn BFc and Bfd has lowest downy mildew disease incidence. Both of the corn line can be used for further research to find high productivity and resistance corn line.

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