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Growth and Production of Corn in Various Planting Distances Systems

AUTHORS INFO

Rusnadi Padjung
Hasanuddin University
Rusnadi2015@gmail.com

Muh Farid Bdr
Hasanuddin University
farid_deni@yahoo.co.id

Nasaruddin
Hasanuddin University
nnasaruddin@gmail.com

Ifayanti Ridwan
Hasanuddin University
ifayanti@unhas.ac.id

Muhammad Fuad Anshori
Hasanuddin University
fuad.pbt152@gmail.com

Andi Dwie Mochhammad Abduh T
Hasanuddin University
muhwiwin2@gmail.com

Ahrani Akbar Fachri
Hasanuddin University
Akhrani.akbar@gmail.com

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Abstract

Corn is one of the most important food commodities consumed by most people in various parts of the country. There is a real interaction between spacing varieties on the observed characters. There are one or more production chatacters that have a significant correlation with production. This research will be carried out at the Experimental Garden of the Bajeng Cereal Research Institute, Bajeng District, Gowa Regency, South Sulawesi, with a coordinate point of 5o18'21.5 "LS, 119o28'38.6" BT. The research was conducted from August to November 2020. This study used a separate plot experimental design. The main plot is a planting system legowo (S) which consists of 3 planting systems, namely the spacing of 75 x 20 cm = 66,667 pop / ha (J1), Legowo (50 + 100) x 20 cm = 66,667 population / ha (J2), and Legowo (50 + 100) x 18 cm = 74,074 population / ha (J3). Meanwhile, the subplots were maize varieties (V), namely NASA 29 (V1), Bisi 2 (V2), and Sinhas 1 (V3). From the research results, it can be concluded that the spacing has no effect on the character of the observation. the variety has a very significant effect on the observed character, except for rod diameter. As for the correlation, the observed characters that had an effect on production were ear length and weight of 1000 seeds

Keywords: varieties, characters, spacing, yield, correlation

A. Introduction

The carbohydrate content that is almost equivalent to rice makes corn an alternative to rice as a daily consumption. Suarni & Yasin (2008) The main nutritional content of corn is starch (72-73%), with a ratio of 25-30% amylose and amylopectin: 70-75%. Corn simple sugars (glucose, fructose, and sucrose) range from 1-3%. In addition to food, corn is also widely used in the livestock and fisheries industry, such as in the manufacture of nutritious and high value feed.

The increase in livestock population which continues to increase causes the need for feed needed to be higher and if it is not accompanied by an increase in corn production it will cause scarcity of feed ingredients. The worst impact of this is that it will drain the country's foreign exchange because Indonesia has to import corn to meet domestic corn needs. Corn Production Data of the Ministry of Agriculture (2020) for the last five years, namely in 2014, corn production was 19 million tons, in 2015 it increased to 19.6 million tons, in 2016 it increased to 23.6 million tons, in 2017 it experienced a significant increase. to 28.9 million tons and finally in 2018 increased to 30 million tons.

The Directorate General of Food Crops regarding the national production target (2016), the need for corn for the feed industry is 32% of total production while for food needs is 14% of total production. According to the Directorate General of Agro Industry, Ministry of Industry (2018), the total demand for corn for industry is 30 million tons with the following details: 1) the feed industry is (63%) or 18.9 million tons, 2) the sweetener corn starch industry is (6%)) or 1.8 million tons, 3) corn grits and corn flour industry (23%) or 6.9 million tons and 4) Snack industry (8%) or 2.4 million tons.

The application of cultivation technology is expected to improve the productivity of maize plants. One of the technologies that can be used to increase maize productivity and reduce production costs is through environmental engineering of maize through the legowo planting system (Mayadewi, 2007). The application of the legowo system prioritizes increasing the number of marginal row plant populations by utilizing empty rows. This is because the peripheral rows get more sunlight than the middle row plants so that their growth and development are very good.

Research by Syuryawati & Faesal (2015) suggests that the yield of corn kernels obtained in Pangkep from the usual planting method is 11.63 t / ha and the legowo method is 11.61 t / ha. Likewise, the average value of BWD, ear length, and weight of 1,000 seeds were relatively the same. The same thing also happened in Barru, that the regular planting method and legowo planting method gave relatively the same seed yields, respectively 10.10 t / ha and 10.12 t / ha, as well as ear diameter and weight of 1,000 seeds. Based on this description, it is very important to conduct research on the application of spacing to increase the productivity of maize plants.

B. Methodology

This research will be carried out at the Experimental Garden of the Research Institute for Cereals (KP) Bajeng, Bajeng District, Gowa Regency, South Sulawesi at an altitude of 27.2 m above sea level, with coordinates 5o18'21.5 "LS, 119o28'38.6" BT. The research was conducted from August to November 2020. This study used a separate plot experimental design. The main plot is a planting system legowo (S) which consists of 3 planting systems, namely the spacing of 75 x 20 cm = 66,667 pop / ha (J1), Legowo (50 + 100) x 20 cm = 66,667 pop / ha (J2), and Legowo (50 + 100) x 18 cm = 74,074 pop / ha (J3). Meanwhile, the subplots were maize varieties (V), namely NASA 29 (V1), Bisi 2 (V2), and Sinhas 1 (V3).

Soil processing using a tractor. The cultivated land is then made manually with a hoe. The size of each bed is 3 m x 5 m, with a distance between beds of 30 cm and a distance between replicates of 0.6 m. The seeds used were corn seeds, namely NASA 29, Bisi 2 and Sinhas 1 (Unhas Synthetic Corn released in October 2019. Each bed was made with a planting hole using a tugal with a spacing of 75 x 20 cm (J1), Legowo (50 + 100) x 20. cm (J2), and Legowo (50 + 100) x 18 cm (J3). Each hole is planted with 2 corn seeds, each planting hole is given furadan to avoid pests and then covered with soil.

Maintenance is carried out by fertilizing, weeding and weeding. Fertilizer is applied by sowing around the growing point of maize with Eco Farming Spraying. Watering is done by inundating the irrigated plots to the height of the beds. Meanwhile, weeding is done by cleaning the weeds around the corn plants.

Harvesting is done when it reaches physiological maturity and is done manually by taking the corn cobs on each plant by rotating the cobs with the husks or it can also be done by breaking the stalks of corn which are marked by the appearance of a black layer on the back of

the seeds and done manually on two rows The middle plants per number were then processed to observe yield and yield components.

C. Result and Discussion

The result of the analysis of variance in Table 1 showed that planting distance didn't affect the six morphology characters, especially to productivity. Otherwise, the varieties variance has a significant effect on almost all traits, except the steam diameter. As for the interaction of planting spacing and varieties has the same result with the planting distance variance.

Table 1. Analysis of varian of six morphology character between planting distance and varieties

Character	Source of diversity			CV (a)	CV(b)
	Planting distance (K)	Varieties (V)	K*V		
Plant height	0.2256	0.0000**	0.1997	2.98	3.81
Steam Diameter	0.5014	0.7746	0.3904	11.07	13.24
Ear Diameter	0.1970	0.0000**	0.7721	3.6	1.98
Ear Length	0.8824	0.0002**	0.4474	4.28	3.24
Weight of 1000 grains	0.7573	0.0400*	0.229	3.16	4.38
Productivity	0.4715	0.0028**	0.9184	7.58	19.73

The planting distance correlates with the population density among the plant. It has an effect on light reception, light use efficiency and the plant competition (Kurt, Bakal, Gullouglu, & Arioglu, 2017; Ximenes, Mayun, & Pradnyawathi, 2018). The short distance can induce the over population density so that the plant gets low light reception and has tight plant competition (Huang, Domec, Ward, Duman, Manoli, Parolari, & Katul, 2017; Fromme, Spivey, & Grichar, 2019). It can induce the low morphology trait, especially in corn as the C4 plant (Portes & Melo 2014). However, in this study, the planting distance has not the effect on all morphology traits. It due to some other factor effect on this study like pest attack and drought stress. This result is different from the report of Huang et al. (2017) and Portes & Melo (2014) showed significant differences among the plant density treatments. The phenomena in this study due to caterpillars and disease attack the plant when the plant age is one month after planting. Besides that, the low precipitation and high temperature in the field also have an impact this study. According to Dresselhaus & Hückelhoven (2018) , the stress can inhibit the morphology and yield responses. Its also means that the response potential of plant culture technology could be inhibited by biotic stress . Therefore, the response of planting distance effect and its interaction with varieties are not significant in this study. Otherwise, the varieties effect still significant although the biotic and abiotic stress has effected on this study.

The varieties in this study have a significant impact on the plant height, ear diameter, ear length, weight of 1000 grains and productivity (Table 2). In this study, the SINHAS 1 has lower morphology traits, especially in plant height, ear diameter, length diameter and productivity. On other hand, the SINHAS1 has high the weight of 1000 grains. As for, NASA 9 and BISI 2 relatively have the same morphology response pattern on all traits. Based on kind of variety, the NASA 9 and BISI 2 are the hybrid variety, meanwhile, the SINHAS 1 is the open-pollinated variety. The different kind has a different response on the morphology traits. The hybrid variety use over dominant concept in developing this variety. The over dominant effect can increase the hybrid vigor on the cross-pollinated plant, such as corn (Birchler, Yao, Chudalayandi, Vaiman, & Veitiac, 2010; Blum, 2013; Fromme et al. 2019). Therefore, the varieties effect still significant in this study and NASA 9 and BISI 2 have the good response on almost all morphology characters.

Table. 2. Morphology Characters between planting distance and varieties

Variety	Morphology Characters				
	Plant Height	Ear Diameter	Ear Length	Weight of 1000 grains	Productivity
NASA 9	208.02b	43.62a	18.15a	39.42b	15.16a
BISI 2	227.35a	43.68a	17.71a	41.00ab	17.01a
Sinhas 1	165.11c	40.87b	16.58b	41.84a	11.14b
$LSD_{0,05}$	7.83	0.87	0.58	1.83	2.93

The correlation in Table 3 showed that productivity has a significant correlation with ear diameter plant height and ear length. In general, the ear length and ear diameter are yield

component determined the productivity. It also has been stated by Fromme et al. (2019), so that the increase these characters can influence corn productivity. The plant height does not include the yield component. However, this character is the commonly vegetative variable use in detecting the plant condition. If the plant has small, it could correlate with low corn productivity. Based on this study, the hybrid corn that higher than SINHAS 1 plant height also showed higher productivity than SINHAS 1. Therefore, based on all, the plant height, ear diameter, ear length could be as the selection characters to corn productivity.

Table 3 Observation correlation between productivity

Characters	P	W1000	ED	PH	SD	EL
Productivity (P)	1					
Weight of 1000 grains (W1000)	-0.06	1.00				
Ear Diameter (ED)	0.42**	-0.40*	1.00			
Plant height (PH)	0.70**	-0.29	0.63**	1.00		
Steam Diameter (SD)	0.00	-0.20	0.05	0.03	1.00	
Ear Length (EL)	0.47**	-0.40*	0.54**	0.63**	0.18	1.00

D. Conclusion

From the research results, it can be concluded that the spacing has no effect on the character of the observation. the variety has a very significant effect on the observed character, except for rod diameter. As for the correlation, the observed characters that had an effect on production were ear diameter, plant height, and ear length.

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