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Research Article

Interaction of Genetic and Cultivation Technology in Maize Prolific and Productivity Increase

[1]A. Dwie Mochammad Abduh, [2]Rusnadi Padjung, [2]Muh Farid, [2]Abd Haris Bahrun, [2]Muhammad Fuad Anshori, [2]Nasaruddin, [2]Ifayanti Ridwan, [3]Amin Nur and [4]Muh Taufik

[1]Agriculture System Study Program, Graduate School, Hasanuddin University, Makassar, South Sulawesi, 90245, Indonesia
[2]Department of Agronomy, Faculty of Agriculture, Hasanuddin University, Perintis Kemerdekaan Street Km 10, Makassar, South Sulawesi, 90245, Indonesia
[3]Assessment Institute for Agriculture Technology of Gorontalo, Gorontalo, 96583, Indonesia
[4]Agriculture Technology Assessment Center South Sulawesi. Jl. Perintis Kemerdekaan No. Km 17,5, Pai, Makassar 90242, South Sulawesi, Indonesia

Abstract

Background and Objective: Maize cultivation technology package development is a solution in increasing maize production, especially prolific maize. However, technology package evaluation has to be evaluated with interaction towards crop genetics. The purpose of this research is to discover the interaction between maize variety towards cultivation technology (plant fertilization and spacing) and to find information about secondary production characters in cultivation technique optimization. **Materials and Methods:** This research used a split-split-plot design. The main plot was planting system (S) consisted of three planting systems. Sub Plot (SP) was fertilizing plans ha^{-1} (P) consisted of four plans. Whereas Sub-Sub Plot (SSP) were (V): NASA 29 (V_1), Bisi 2 (V_2) and Sinha's 1 (V_3). There were 15 characters observed. **Results:** The results prolific potential is very dynamic which is determined by genetic potential, cultivation technology and genetic-cultivation technology interactions. The increase in the prolific potential will have a direct effect on increasing maize productivity. In general, the use of legowo lines and Eco-farming (biofertilizer) can increase prolific potential and productivity. **Conclusion:** According to this research, the prolific potential is highly dynamic which is determined by genetic potential, cultivation technology and genetic-cultivation interaction. Technology considered in increasing maize productivity is Legowo plant spacing (50+100)×20 cm combined with N:P:K = 200:100:50+KNO_3 25 kg ha^{-1}+Eco farming 5 cc L^{-1}. This technique combination is recommended in maize productivity increase.

Key words: Fertilizer, maize, plant spacing, prolific, technology package, eco farming, genetic-cultivation, planting system

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Corresponding Author: Muh. Farid Bdr, Department of Agronomy, Faculty of Agriculture, Hasanuddin University, Perintis Kemerdekaan Street Km 10, Makassar, South Sulawesi, 90245, Indonesia

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Maize is one of the staple commodities that have been widely consumed by nations. Maize is commonly used in the cattle and fishery industry in producing valuable and nutritious feeds aside from staple needs. Increasing cattle production parallels their feed demands and will face scarcity if not being accompanied by maize production[1]. Mallory *et al.*[2], stated that the worst impact it can cause is a decrease of foreign exchange value due to maize imports to fulfill the country's maize needs and demands. Stated that one of the efforts to increase maize production is to increase its genetic potential, one of them namely prolific maize or maize that can produce more than one ear in a single plant[3].

Prolific genetic potential is commonly possessed by local maize types Wills *et al.*[4], yet with low productivity, potential ranged 3-4 kg ha^{-1}. This case is inversely proportional with commercial maize varieties that generally produce one ear in a plant, however, with potential productivity up to 10-12 kg ha^{-1}. This phenomenon is caused by responsive trait from both local and commercial maize towards their growing environment. Commercial maizes have a relative tendency to be more responsive in their growing environment compared to local ones. According to Muchtar *et al.*[5], superior varieties have more benefits in terms of production and pest and disease resilience as well as response towards fertilizer application compared to local varieties, resulting in better production in both quality and quantity. Despite the fact, commercial maize has to be potentially drawn into prolific traits for maize production increase. Therefore, prolific trait optimization is important in maize crops.

The application of cultivation technology is expected can improve maize prolific characters. The same was also quoted by Kwabiah[6] and Chozin and Sudjatmiko[7], that one of the technologies that can be used in maize productivity are through maize crop environmental engineering. Previous researches have reported many cultivation technologies were able to increase maize productivity, such as plant spacing and fertilizing. In the research conducted by Alimuddin *et al.*[8], N fertilizer dosage of 400 kg ha^{-1} with yield 11036.27 g plot^{-1} or 10.05 kg ha^{-1} towards dry peeled kernel weight per plot and hectare. Fertilizing is a technique that has been widely researched for environment optimization suitable for maize crops[9-11]. According to Bradley *et al.*[12], nutrient insufficiency throughout the multiple eared maize life periods can affect their growth and yield. Hence, fertilizing technique engineering is important in maize prolific trait optimization.

Spacing is considered a method in crop productivity and prolific potential optimization. As shown in various researches, plant density in a population can also influence prolific and productivity[13,14]. According to Alimuddin *et al.*[8], legowo plant spacing system can increase the maize yield compared to the one-row system. The application of this system has become a solution in mending maize characteristics by adopting the concept of border row plants. Legowo system will supply enough sunlight and less competition, resulting in more optimal utilization of plant's environment[15,16]. This will correlate with prolific and productivity. Based on this concept, fertilizing technique and population density can increase productivity and prolific potential. However, prolific traits cannot be separated from genetic traits. Hybrid maizes exhibit different potential from the open-pollinated ones Fromme *et al.*[17]. Therefore, this research regarding interaction of cultivation technique and genetic in maize productivity increase is important to be conducted.

The purpose of this research is to discover the interaction between maize variety towards cultivation technology (plant fertilizing and spacing) and to find information about secondary production characters in cultivation technique optimization.

MATERIALS AND METHODS

Place and time research: This research was conducted in Cereal Crops Research Center Bajeng (Balai Penelitian Tanaman Serealia (KP) Bajeng), District Bajeng, Gowa Regency, South Sulawesi, Indonesia in altitude of 27,2 m asl and longitude 5°18'21.5"LS, 119°28'38.6"BT. This research was carried out from August-November, 2020.

Experimental design: This research used split-split-plot design. Main Plot (MP) was legowo planting system (S) consisted of three planting systems: 75×20 cm = 66.667 pop ha^{-1} (PS_1), Legowo (50+100)×20 cm = 66.667 pop ha^{-1} (PS_2) and Legowo (50+100)×18 cm = 74.074 pop ha^{-1} (PS3). Sub Plot (SP) was fertilizing plans ha^{-1} (P) consisted of four plans: N:P:K = 225:100:75 (F_1), N:P:K = 200:100:60+KNO_3 25 kg ha^{-1} (F_2), N:P:K = 225:100:75+Eco-farming 5cc L^{-1} (F_3) and N:P:K = 200:100:50+KNO_3 25 kg ha^{-1}+Eco-farming 5 cc L^{-1} (F_4). Whereas Sub-Sub Plot (SSP) were (V): NASA 29 (V_1), Bisi 2 (V_2) and Sinhas 1 (V_3).

Research methods: Soil tillage using a tractor with 3 m×5 m bed sizes and 30 cm spacing for each bed and 0.6 m space for each replication. Holes were made in the bed using a wood stick with 75×20 cm plant spacing (J_1), Legowo (50+100)× 20 cm (J_2) and Legowo (50+100)×18 cm (J_3). Two maize seeds were planted in each hole with additional furadan application to avoid pest before closing them with soil. Fertilizing was done through spreading around the growth area with six times Eco-farming application; on 10, 20, 30, 40, 50 and 60 Days After Planting (DAP). KNO_3 was applied twice on 15 and 35 DAP and Urea was applied twice on 35 and 50 DAP except for NPK Ponska and SP36 which were applied only once on 10 DAP. Crop maintenance included irrigating, weeding, covering and thinning. The crop was harvested on the plant physiology maturity and was done manually through rotating the ear and cob altogether or breaking the ear that can be indicated by the appearance of the black layer behind the seeds and done manually on two mid plant rows per number then processed for yield and yield components observation.

Observation of parameters: Plant height (cm), Number of leaves, Number of Stomata, Days of Male Flowering (DMF), Days of Female Flowering (DFF), ear height (cm), Chlorophyll index, Ear diameter (mm), Ear length (cm), Length of the seeded ear (cm), Seed Rendement (%),1000 seed weight (g), leaf width index (mm^2), prolific percentage (%) and productivity (kg ha^{-1}).

Data analysis: Data obtained from observation were analyzed by analysis of variance (ANOVA), correlation, path analysis and Least-Squares Distance (LSD) test at 5% error. The ANOVA and LSD test used STAR 2.1 software. Meanwhile, correlation and path analysis used the RStudio 3.6.1 software with the Agricolae package.

RESULTS

Based on Table 1, the Plant Spacing has not significantly affected all characters. Days of Male flowering (DMF) and Days of Female flowering (DFF), whereas Ear Diameter (ED), Number of Leaves (NL), Leaf Width Index (LWI), Stomata (NS), Productivity (Pro), Prolific Percentage (PP) have significance effected by fertilizer. Meanwhile, the various treatment has significantly effected to almost characters, except DMF, DFF and Seed Rendement (SR). Based on the interaction effect in Table 1, Prolific was the only character that has a significant interaction effect among fertilizing, plant spacing and variety. As for, productivity only has been significant affected by the interaction of plant spacing and fertilizer.

Correlation analysis is shown in Table 2. Correlation is focused on two main characters; productivity and prolific. According to correlation with production, Ear Length (0.59), Ear Height (0.40), Number of Leaves (0.51), Plant Height (0.48), Ear Diameter (0.54), Leaf Width Index (0.46) and Prolific Percentage (0.62) were significantly positive correlated. On Prolific Percentage, Ear Diameter (0.34) and Leaf Width Index (0.36) has a significant positive correlation.

Path analysis on production shown that ear length, number of leaves, plant height, ear diameter and prolific have a positive direct effect on production. However, ear length and (0.36) and prolific (0.43) were the only significant characters. This indicated that ear length and prolific were characters that supporting production potential in Table 3.

The LSD test based on a single effect on prolific is shown in Table 4. According to the table, the NASA 29 (V_1) fertilizer has the best prolific percentage (64.76%). Based on Fertilizer

Table 1: Analysis of variance on plant spacing, fertilizing and varieties

Characters	Plant spacing (PS)	Fertilizer (F)	PS×F	Variety (V)	PS×V	F×V	PS×F×V
DMF	5.36	14.05**	2.85	1.02	1.38	0.70	1.19
DFF	7.56	24.52**	0.97	0.39	2.21	1.32	0.97
CI	4.34	2.64	23.01	324.50**	7.35	8.12	3.76
1000SW	1.98	0.81	4.33	54.27**	20.87	22.89	9.34
ED	23.68	107.19**	7.09	92.81**	1.28	2.46	2.11
PH	315.08	378.16	51.27	36533.33**	411.36	56.81	85.55
NL	0.65	4.61**	0.66	4.69**	0.35	0.31	0.47
EH	600.74	92.10	92.75	9940.45**	119.58*	33.24	76.31
EL	0.12	0.90	0.67	13.08**	0.78	1.03	1.22
SD	0.28	0.71	1.00	23.33**	1.26	0.73	1.45
NS	2.23	16.45*	3.87	23.23*	8.43	1.05	7.04
LWI	48.57	262.76**	38.09	159.97**	3.78	3.41	2.40
Pro	6.73	9.07*	6.49*	62.02**	3.45	3.27	1.65
PP	166.88	337.28**	192.19**	535.18**	436.09**	142.36**	200.23**
SR	13.16	28.49	26.35	101.22	19.36	31.61	21.73

**Significant effect at 1% level, *Significant effect at 5% level, DMF: Days of male flowering, DFF: Days of female flowering, CI: Chlorophyll, 1000SW: 1000 seed weight, ED: Ear diameter, PH: Plant height, NL: Number of leaves, EH: Ear height, EL: Ear length, SD: Stem diameter, NS: Number of stomata, LWI: Leaf width index, Pro: Productivity, PP: Prolific percentage and SR: Seed rendement

Table 2: Correlation analysis of several corn characters on the use of the corn technology combination

	1000SW	DFF	DMF	SR	EL	EH	SD	NL	PH	ED	LWI	CI	NS	PP
DFF	-0.03													
DMF	-0.1	0.9												
SR	0.17	-0.3	-0.21											
EL	-0.36	-0.13	-0.13	-0.07										
EH	-0.27	-0.19	-0.26	0.36	0.54									
SD	-0.14	0.18	0.14	-0.42	0.16	0.08								
NL	-0.11	-0.45	-0.43	0.25	0.42	0.54	0.18							
PH	-0.21	-0.15	-0.21	0.41	0.51	0.91	0	0.5						
ED	-0.26	-0.68	-0.66	0.39	0.39	0.59	-0.22	0.55	0.59					
LWI	-0.18	-0.73	-0.7	0.3	0.34	0.54	-0.12	0.58	0.52	0.79				
CI	0.01	-0.15	-0.2	-0.04	0.03	-0.09	-0.15	-0.27	-0.05	0.22	0.09			
NS	0.17	-0.29	-0.32	0.22	0.33	0.38	0.12	0.42	0.4	0.4	0.33	0.02		
PP	-0.21	-0.24	-0.08	0.22	0.25	0.16	-0.2	0.18	0.26	0.34*	0.36*	-0.07	0.16	
Pro	-0.28	-0.29	-0.25	0.18	0.59**	0.4[illegible]	-0.16	0.51**	0.48**	0.54**	0.46**	0	0.23	0.62**

**Significant correlated at 1% level, *Significant correlated at 5% level, DMF: Days of male flowering, DFF: Days of female flowering, CI: Chlorophyll index, 1000SW: 1000 seed weight, ED: Ear diameter, PH: Plant height, NL: Number of leaves, EH: Ear height, EL: Ear length, NS: Number of stomata, LWI: Leaf width index, Pro: Productivity, PP: Prolific percentage, SD: Stem diameter and SR: Seed rendement

Table 3: A path analysis of several characters to the productivity

		Indirect effect							
Characters	Direct effect	EE	EH	NL	PH	ED	LWI	Prolific	Residual
EL	0.36*		-0.18	0.11	0.15	0.09	-0.04	0.11	0.32
EH	-0.34	0.19		0.14	0.26	0.14	-0.07	0.07	0.32
NL	0.26	0.15	-0.18		0.14	0.13	-0.07	0.08	0.32
PH	0.29	0.18	-0.31	0.13		0.14	-0.06	0.11	0.32
ED	0.24	0.14	-0.20	0.14	0.17		-0.10	0.14	0.32
LWI	-0.12	0.12	-0.18	0.15	0.15	0.19		0.15	0.32
PP	0.43*	0.09	-0.05	0.05	0.07	0.08	-0.04		0.32

*Significant at 5% error, ED: Ear diameter, PH: Plant height, NL: Number of leaves, EH: Ear height, EL: Ear length, LWI: Leaf width index, PP: Prolific percentage

treatment, F_2 was the best fertilizing technique at 64.82%. However, it was not a significant difference between F_3 and F_4. On other hand, F_1 has the lowest prolific percentage at 48.93%. Based on the combination between variety and fertilizer, for Nasa 29 (V1), the best fertilization has been by F_2 (72.13%), but it was not significantly different to F_3. For BISI2 (V_2), F_2 was the best combination for prolific percentage, even though this combination was not significantly different to all fertilizer treatment. As for Sinha's 1 (V_3), the best combination has been by F_2 (68.32%), but this fertilization was not different from F_4. The combination V_1-F_2 (72.13%) was the best combination of prolific percentage toward all combination.

The LSD test based on the interaction of variety, plant spacing and fertilizer variance to prolific percentage is shown in Table 5. For NASA 29 (V_1), the combination of PS_2 and F_4 has the best prolific percentage (73.36%), while the combination of PS_1 and F_1 (42.08%) has the lowest prolific percentage. For Bisi 2 (V_2), the best combination of prolific percentage has been by PS_2-F_1 (72.32%), while the combination of PS_3-F_1 (49.67%) was the lowest combination of prolific percentage. As for Sinha's 1 (V_3), the combination of PS_1-F_3 (70.52%) has the best prolific percentage, while a combination of PS_3-F_1 (39.09%) was the lowest prolific percentage.

The LSD test based on productivity is shown in Table 6 and 7. Based on the variety of influence on productivity (Table 6), V_1 (10.56) has the highest productivity. On the other hand, V_3 (7.94 t ha^{-1}) presented the lowest productivity (Table 6). Based on fertilizing technology, F_4 (9.91 t ha^{-1}) as the best combination, but it was not significant toward F_3 (9.51), while F_1 (8.53 t ha^{-1}) has the lowest combination of productivity.

Based on the interaction between plant spacing and fertilizing (Table 7), for PS_1, the best fertilization has been by F_3 (9.84 t ha^{-1}), however, it was not significantly different toward F_1 and F_4. For PS_2, F_4 (10.43 t ha^{-1}) was the best combination for productivity, but this combination was not significantly different toward all fertilizations. Meanwhile, for PS_3, the best combination has been by F_4 (10.25 t ha^{-1}), but, this combination was not significantly different toward F_2 and F_3. The combination PS_2-F_4 (10.43 t ha^{-1}) was the best combination of prolific percentage toward all combination.

Table 4: Single effect variety and fertilizer variance to the prolific percentage (%)

Variety	Fertilizer F_1	F_2	F_3	F_4	Means
V_1	58.05^{c}	72.13^{a}	66.86^{ab}	62.00^{bc}	64.76^{a}
V_2	49.67^{a}	54.03^{a}	53.72^{a}	53.74^{a}	52.79^{b}
V_3	39.09^{c}	68.32^{a}	54.92^{b}	62.40^{a}	56.18^{b}
Means	48.93^{b}	64.82^{a}	58.50^{a}	59.38^{a}	

Same superscripted letters in one row indicate insignificant differences, V: Variety, F: Fertilizer

Table 5: Interaction effect variety, plant spacing and fertilizer variance to prolific percentage

V	PS	Fertilizer 1	2	3	4
V_1	PS_1	42.08^{b}	60.30^{a}	69.08^{a}	56.10^{a}
V_1	PS_2	67.65^{a}	68.31^{a}	66.47^{a}	73.36^{a}
V_1	PS_3	58.05^{ab}	72.13^{a}	66.86^{a}	62.00^{a}
V_2	PS_1	63.08^{ab}	70.15^{a}	66.07^{a}	62.51^{a}
V_2	PS_2	72.32^{a}	60.03^{a}	62.13^{a}	59.67^{a}
V_2	PS_3	49.67^{b}	54.04^{a}	53.72^{a}	53.74^{a}
V_3	PS_1	60.76^{a}	40.49^{b}	70.52^{a}	57.51^{a}
V_3	PS_2	42.92^{ab}	56.44^{ab}	61.07^{a}	56.21^{a}
V_3	PS_3	39.09^{b}	68.32^{a}	54.93^{a}	62.4^{0a}

Same superscripted letters in one row-column in each variety treatment indicate insignificant differences, V: Variety, F: Fertilizer, PS: Plant spacing

Table 6: Single effect variety and fertilizer variance to the productivity (t ha^{-1})

	F_1	F_2	F_3	F_4	Average
V_1	9.73	11.03	10.85	10.64	10.56^{a}
V_2	8.90	9.30	9.81	9.56	9.39^{b}
V_3					
6.97	7.39	7.88	9.53	7.94^{c}	
Rata-rata	8.53^{b}	9.24^{b}	9.51^{a}	9.91^{a}	

Same superscripted letters in one row indicate insignificant differences, V: Variety, F: Fertilizer, PS: Plant spacing

Table 7: Interaction effect of plant spacing and fertilizer variance to the productivity (t ha^{-1})

	F_1	F_2	F_3	F_4	Average
PS_1	9.05^{ab}	8.09^{b}	9.84^{a}	9.05^{ab}	9.01
PS_2	9.29^{a}	9.87^{a}	9.61^{a}	10.43^{a}	9.8
PS_3	7.27^{b}	9.76^{a}	9.09^{a}	10.25^{a}	9.09

Same superscripted letters in one row indicate insignificant differences, V: Variety, F: Fertilizer

DISCUSSION

Based on this research, three varieties were included in these two groups which were hybrid (NASA 29 and BISI 2) and synthetic (Sinha's 1). NASA 29 was the best variety in this study based on productivity and prolific percentage. Meanwhile, Sinha's 1 has the lowest performance based on productivity, even though its prolific percentage was not different from BISI 2 as the hybrid variety. It could indicate that the cultivation technology could increase the agronomic potential of hybrid variety than the synthetic variety. In general, the various treatment is closely linked with the genetic potential of a crop. Different varieties will exhibit varied response patterns of cultivation technology. This was also reported by Dalovic *et al.*[18], which presented significant interaction of many maize varieties and fertilizing technology on maize growth character. Generally, the potential of a plant is highly dependant on genetic, environmental and interaction between genetic and environment[19]. Hybrid varieties implement the overdominant concept between two parents[20], thus having better even multiplied growth potential compared to the parents Fromme *et al.*[17]. This potential is different from the synthetic variety which mainly focuses on population gene frequency[21]. Therefore, it is important to know about variety interaction towards cultivation technology in optimizing the genetic potential of respective varieties.

Population treatment in this experiment showed no significant effect on all characters. It is different from other reports that showed the significant effect of the planting system on the growth and reproductive characters[14,17]. In general, the planting system correlates with plant density induced plant competition, light reception and light use efficiency. The tighter population density could induce high plant competition in using a resource like water and nutrition. Otherwise, it was affected by a poor light reception, so that the photosynthesis could not optimally occur[15,16]. Nevertheless, in this study, this theory could not be applied. It due to the effect of plant spacing indicated the least significance towards productivity, making it not a primary factor compared to fertilizing and genetic in this experiment.

Based on this study, a combination of fertilization with KNO_3 and Eco-farming could increase the agronomic characters like prolific percentage and productivity. This result indicates that a combination of some fertilizer kinds could optimize the potential of agronomic characters. In general, fertilizing relatively influence maize growth potential. The difference and combination of the fertilizers will give a different response to maize growth. Commonly, an organic fertilizer will influence maize production potential[9,10]. Yet, organic fertilizer is considered crucial in supporting maize productivity. Mahmood *et al.*[22], stated that organic fertilizer not only influencing plant nutrition, but also the physical characteristics of the soil which correlates to the growth characteristics of maize. Added that biofertilizer application can minimize destructing damage of organic fertilizer to the environment. Hence, fertilizing technology in this research also presented a significant effect on almost all growth characters, making it crucial in regulating crop productivity[11,23,24].

According to interaction effects, prolific is a consistent character affected by both two and three character interactions. Maize prolific is highly determined by the genetic traits it has[13,25]. This trait is shown only under an optimum environment. The more cultivation technology used, the more varied prolific traits will have resulted. This was also discussed by Chozin and Sudjatmiko[7] and Al-Naggar *et al.*[13], that prolific is significantly affected by the relationship of environments, along with the density of the crop. Therefore, all three combinations can be implemented in maize prolific increase. Productivity was only influenced by the interaction of plant spacing and population, although in general variety posed a single effect on productivity. This indicates the vast difference between hybrid and synthetic varieties. However, from this research, cultivation technology will increase productivity from maize, both hybrid and synthetic varieties.

Based on the correlation analysis, the productivity has correlated significantly to many characters than the prolific percentage (towards ear diameter and leaf width index). It indicates the productivity is more complex than prolific percentage. The complexity of productivity also has been reported by Fromme *et al.*[17] and Anshori *et al.*[26]. Besides that, according to Ngosong *et al.*[27], the prolific percentage determined by 1 major gene and 2 minor genes, However. Based on this, Fellahi *et al.*[28] and Anshori *et al.*[29], stated that selection towards productivity must pay attention to secondary characters that can affect productivity. Therefore, the determination of the main secondary character in productivity is important. This was also reported by Fadhli *et al.*[30], regarding the evaluation of maize hybrids under drought stress. However, correlation use in determining secondary characters was considered rough[29,30], hence making path analysis a viable approach.

According to the path analysis result (Table 3), prolific and ear length are significant characters that can affect productivity in this research. Path analysis is one of the analyses that separate direct effects from indirect effects from a correlation[31]. This is highly important in knowing the main secondary character on productivity[32]. Even though, according to Table 1, cob length was only influenced by varieties, making this character not effective in maize cultivation technique evaluation. This strengthens the indication that prolific has a major role in maize productivity. Therefore, effectivity evaluation of cultivation technology was only focused on prolific and productivity.

Interaction results of three factors towards prolific shown that there were specific interactions between each variety. This solidifies the previous statement, where prolific is highly dynamic and specific. Yet in general, hybrid varieties tend to perform well with legowo (50+100)×20 cm spacing. This spacing is considered potential in optimizing light intake and plant competition rather than common plant spacing (P_1) and legowo with 18 cm spacing per row. On the other hand, Sinha's exhibited better potential in P_1. This was supported by its potential as a synthetic crop adaptive to competition. The potential of varieties is closely related to genetic factors. Jaradat *et al.*[33], stated that composite maize has a broader genetic background, making it more adaptable compared to hybrids, including in low lands. Wolde *et al.*[34], commented that composites are more adaptive in low productivity environment, whilst hybrids are more suitable in highly productive environments. Folloni *et al.*[35], noted that composite maize can be found in the form of synthetic or open-pollinated. Synthetic varieties were formed through inbred/line recombination with good GCA and are proceeded with selection, while open-pollinated varieties are made from recombination, inbreeding, population and selection.

Eco farming as organic fertilizer is commonly considered will increase prolific potential despite its specified on the varieties used. Biofertilizer application on maize production on the research conducted by Essam *et al.*[36], 8.75-ton dry peeling/hectare were obtained. Biofertilizer application will optimize nutrient availability and mobility, making maize prolific chances high. Microbes present in applied biofertilizer can bind nitrogen from the air, dissolve phosphates bound in the soil, breaking complex organic compounds and accelerating plant growth. Based on this research, prolific potential can be optimized through plant spacing and biofertilizer[37].

Productivity is a pivotal parameter of an experiment's success. Table 6 shows that in general, hybrid varieties (NASA 9 dan BISI 2) have better production potential compared to Sinha's 1. This strengthens the assumption of heterosis and overdominance of hybrids towards synthetics. Based on fertilizing, Eco-farming is considered able to increase the productivity of maize. This is also related to prolific characteristics that are affected by Eco-farming applications. Legowo plant spacing with NPK, biofertilizer and KNO_3 is considered as the best approach in increasing maize productivity[11,23,24]. This also applies to all varieties which were signified by the least significant interaction between plant spacing, fertilizing and variety. Therefore, this technique is recommended for maize productivity potential. As for, a technology considered in increasing maize productivity is Legowo plant spacing (50+100)×20 cm combined with N:P:K = 200:100:50+KNO_3 25 kg ha^{-1}+Eco-farming 5 cc L^{-1}. This technique combination is recommended in maize productivity increase.

CONCLUSION

In conclusion, the prolific potential is very dynamic which is determined by genetic potential, cultivation technology and genetic-cultivation technology interactions. The increase in the prolific potential will have a direct effect on increasing maize productivity. In general, the use of legowo lines and Eco-farming (biofertilizer) can increase prolific potential and productivity. Good technology in increasing maize productivity is the use of legowo row (50+100)×20 cm combined with N:P:K = 200: 100: 50+KNO_3 25 kg ha^{-1}+Eco-farming 5 cc L^{-1}. This technology combination is recommended in increasing maize productivity.

SIGNIFICANCE STATEMENT

This study discovers the prolific potential is highly dynamic which is determined by genetic potential, cultivation technology and genetic-cultivation interaction. Technology considered in increasing maize productivity is Legowo plant spacing (50+100)×20 cm combined with N:P:K (200:100:50) kg ha^{-1}+KNO_3 25 kg ha^{-1}+Eco-farming 5 cc L^{-1} to all corn genotypes (hybrid and open-pollinated). Thus, this technique combination is recommended to farmers in maize productivity increase.

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