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Evaluation Of Superior Maize Genotypes On Growth Environment With Improved Cultivation Technology

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Abstract : *This study aimed to examine the yield potential capability of several maize genotypes on environmental conditions with improved cultivation technology. The research method used is experimental method with field experiment and farmer's active participation approach (on farm). The experiment was layed out according to Randomized Complete Block Design, with 10 genotype treatments: Superior Variety of Sukmaraga, Superior Variety of Lamuru, BISI 18 Hybrids, Pioner Hybrids, BISI Hybrids 2, Arjuna Superior Variety, NK 22 Hybrids, Seraye Local Cultivar, and Bima Local Cultivar. Each treatment was replicated 3 times to obtain 30 experimental units. The observed data were analyzed by the analysis of variance at the 5% significant level and posthoc tested by the least significant differences at the same significant level. The results showed that the highest yield of genotypes, in both hybrid and open-pollination varieties, was obtained by the Pioner hybrid. The yield potency of Pioner hybrid is higher and different with NK 22, BISI 18 and BISI 2; The yield of Sukmaraga is higher and different with Arjuna, Lamuru, Population C2, Seraye and Bima.*

Keywords: *superior maize genotypes; hybrid and open pollination varieties, growth environment, improved cultivation technology*

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I. Introduction

The discovery of high yielding paddy and maize varieties that have short life, responsive to fertilizer, drought tolerant and tolerant to pests and diseases has been able to dramatically increase productivity, production efficiency, the adequacy and affordability of food. To keep the sustainability, then the study of the technology package is always developed, especially maize crops.

In 2013, the yellow maize demand for animal feed reached 13.37 tons. These needs are met from domestic production and about 3.20 tons of imports (Musta'idah, 2013). In 2014, the demand increased to 14.70 tons and fulfill from imports of 3.0 tons. The increase in production was due to harvested area and increased productivity through improved cultivation technology (Balitsereal, 2014). According to animal feed and nutrition experts of Ciawi Bogor Livestock Research Center in the next five years, it is predicted that the feed mill needs to be doubled so that maize production needs to be improved.

The increased maize production can be done with intensification and extensification. Intensification has a greater chance because maize productivity is still far from the potential yield. Based on forecast figures, maize productivity of Indonesia in 2014 is 4,959 tons ha^{-1}; while the yield potential of maize reached 8 tons or more for composite superior varieties and 13 tons for hybrid varieties (Biro Pusat Statistik, 2013).

Maize harvested area of NTB in 2006 was 40,617 ha with productivity 2,56 ton ha^{-1} (BPS NTB, 2007). It was still lower than the average national productivity of 3.47 tons ha^{-1}. The results of the Cereals Research Institute which combines superior quality varieties, both open pollination and hybrid with the introduction of innovative technology can achieve productivity of 7-9 tons ha^{-1} (Saenong and Subandi, 2002). While the production obtained by farmers with the application of recommendation technology package can achieve yield of 5-6 tons ha^{-1} (Wahid., *et al*, 2001).

Therefore, plant breeding or related institutions are required to always be able to produce new superior varieties in order to increase the choice of cultivated varieties for farmers and at the same time to increase the genetic diversity in the field. High yielded varieties, short life, pest and disease resistant and stable to environmental diversity are the goals to be achieved. Sutresna (2007) reported that there has been a new population of maize crops (C2) that has high yielding and fresh biomass, short life and able to adapt to dry land in Lombok Island, but the actual yield potential is still not maximal yet because it has not got application of cultivation technology adequate. On the other hand the discovery of several types of hybrid maize, many of them are still intolerant to drought stress. Therefore, to get varieties or candidates of adaptive maize varieties with high yielding for dry land of NTB need to be trial. This is intended with site-specific genotypes can minimize loss of production due to incompatible agroecosystems (Harahap and Silitonga, 1989). Based on the explanation above, this research has been done. The purpose of this study is to assess the potential yield capability of some superior maize genotypes on environmental conditions with improved cultivation technology

II. Research Methods

This research used experimental method with field experiment and approach of active participation of farmer (On farm). The experiment was layed out using Randomized Complete Block Design with 10 superior maize genotypes as treatment: Sukmaraga Superior Variety (g1); Superior Variety of Lamuru (g2); BISI hybrid 18 (g3); Pioner hybrid (g4); BISI hybrid 2 (g5); Arjuna Superior Variety (g6); Hybrid NK 22 (g7); Seraye Local Cultivar (g8); Local Cultivar of Bima (g9); and Corn population C2 (g10).

Each genotype treatment was applied to the growing environment with improvement of cultivation technology, namely: Organic fertilizer 20 tons/ha + Urea 200 kg/ha + NPK Ponska 250 kg/ha + (35 cm x 35cm) x 70 cm Legowo row spacing, was replicated 3 times to obtain 30 experimental units. The experiment was conducted in Aik Ampat Village, Gerung District on semi-technical irrigation-farms during the dry season as a maize production center from July to October 2015

Before the seeds were planted, it was first treated with Saromyl 35 SD with a dose of 5 g / kg of seed. The treatments were done separately between varieties in order being not to mix with each other. The land used was plowed and dismantled one time and then leveled. Furthermore, 30 plots of each size 6 m x 10 m were made. which were grouped into 3 blocks, the distance between blocks 1 m and the distance between plots 0.5 m. Each genotype treatment was grown in a growing environment with adequate cultivation technology. Planting was done by *tugal* (doing a planting hole) approximately 5 cm in soil deep . Each hole was planted 2 seeds and at the age of 10-14 days done thinning by leaving 1 plant per hole that had better growth. Organic fertilization, before use, was firstly composted and given as a seed cover at the time of planting in accordance with the dosage. Urea and Ponska inorganic fertilizers were given at the time of planting as well. Urea fertilizer was given ½ part and the rest was given at 21 days after planting. Weeding and soil covering were done at 21 days after planting, while irrigation used the remaining water available at the previous planting.

Maize was harvested after 85% of them for each treatment had met the criteria of harvest, the leaves and cob had dried and if the seeds were pressed without leaving the sign of pressure. The maize, then peeled, dried and threshed.

Observations were made on the characters of: plant height (cm); diameter of maize stalks (cm); the weight of fresh biomass per plant (kg); diameter of cob (cm); cob length (cm); weight of 100 dry seeds (g); dry seed weight per plant (g).

The data then were analyzed by analysis of variance (Anova) and poshoc test of LSD at 5% significant level. Correlation analysis between observed variables was done as well. Riley (2001).

III. Results And Discussion

The results of the Anova in Table 1 show that there is a significant difference between the genotypes of maize crops. The differences were seen significantly in plant height, fresh biomass weight, weight of 100 dry seeds, length of cob, diameter of cob and weight of dry seeds per plant. It suggests that there is a difference in response between the ten genotypes of maize crops. The analysis of variance are presented in Table 1 and the yield of dry seeds is graphed in Figure 1.

Table 1. Genotype performances of the maize crops in the growing environment with adequate cultivation technology

Genotypes	Quantitative properties of maize plant genotypes*)						
	1	2	3	4	5	6	7
Sukmaraga	202.75a	773.25bc	31.52ab	4.28a	2.24ab	127.87ab	10.96
Lamuru	202.75a	774.50bc	30.07b	4.47a	2.15bcd	109.72bc	9.08
BISI 18	189.75ab	859.75ab	29.82b	4.18a	2.16bcd	138.91ab	11.91
Pioner	180.00bc	1015.75a	28.16b	4.30a	2.31a	153.01a	13.03
BISI 2	178.75bc	734.50bc	29.26b	4.28a	2.14cd	115.60b	9.03
Arjuna	177.50bc	555.00cd	24.34b	4.31a	2.13d	109.48bc	9.91
NK22	171.75bc	750.50bc	39.77a	4.25a	2.25abc	130.26ab	9.38
Seraye	159.75cd	417.25d	23.49a	3.45b	1.92e	60.49de	11.16
Bima	150.50d	402.00d	22.21b	3.36b	1.91e	47.56e	5.18
C2	149.75.d	465.25d	27.33b	3.36b	1.99e	81.63cd	6.99
$LSD_{0.05}$	12.72	14.75	29.82	0.17	0.05	18.65	-

Notes: Figures in the same column followed by different letters show significant differences in the significant level of 5% ($p < 0.05$)

*)1. Plant height (cm); 2. Fresh biomass weights (g); 3. Weight of 100 dry seeds (g); 4. Cob length (cm); 5. Cob Diameter (cm); 6. Weight of dry seeds per plant (g); 7. Equivalency to ton ha^{-1}

Different responses between the ten genotypes of maize plants were shown on the characteristics of plant height, diameter of stalks, diameter of cob, length of cob, weight of 100 dry seeds, and dry seed weight per plant. The highest plants are given by Lamuru and Sukmaraga varieties, whereas the weight of fresh biomass, the length of the cob, the diameter of the cob and the weight of the heaviest dry seed per plant are achieved by the Pioner.

Pioner hybrids can better adapt to a growing environment with adequate cultivation technology, which means it is more suitable to be cultivated in the growing environment with the average weight of the highest dry seed equivalent to 13.03 ton ha^{-1}, higher than others such as: BISI 18, NK22, Sukmaraga, BISI 2, Arjuna, Lamuru, Population C2, Seraye and Bima with average weight of dry seeds respectively (11,91,10,96,9,91,9 , 38, 9.08, 6.99, 5.18 and 4.07) ton ha^{-1}. (Figure 1). Contrast to Dwiani, *et al* (2009) reported that there is only the response to growth while not to yield. The addition of organic fertilizer (15-20) ton ha^{-1} along with the arrangement and variation of plant density from 20 cm x 70 cm to (35 cm x 35 cm) x 70 cm (Legowo row spacing) can improve plant height, fresh biomass weight, weight of 100 dry seeds, length of cob, cob diameter and weight of dry seeds per plant. The results agree with the research finding of Al-Kaisi and Yin (2003).

The addition of organic fertilizers can provide the availability of soil organic matter, improve soil physical and chemical properties and organism activity in the soil. This improvement will result in better supply of nutrients and water supply in the soil. Sudiana (2007). reported that the increase in plant population had a positive effect on growth and crop yield to certain point, due to the achievement of maximum use of light at the beginning of growth. The yield of the grain produced is not solely influenced by the plant spacing, but is also strongly influenced by the adaptive genotype used with the cultivation conditions. Each genotype applied is specific to both the macro and micro growing environment, therefore the selection of genotype is very important for the success of cultivation.

Such conditions can be well utilized by the Pioner genotype, which is certainly different from other hybrid genotypes such as BISI 18, NK22, Sukmaraga, BISI 2, Arjuna, Lamuru, Population C2, Seraye and Bima. For open pollination varieties even though C2 is lower than Sukmaraga, Lamuru and Arjuna and is higher than Local Bima and Seraye. This can be explained by the lack of water at the time of filling the seeds. While population C2 has been harvested earlier although the dry seed yield is lower, because genetically the yield potential is lower but it shows the feature of stay green with very short life (74) days compared with other genotype that is ranged between (85-94) days.

In addition to the genetic potential of the population is more dominant and there is a significant positive correlation ($p < 0.05$) between the weight of dry seeds with other properties such as plant height, fresh biomass weight, cob length, stalk diameter, and weight of 100 dry seeds with successive correlation coefficient (0.627, 0.875, 0.925, and 0.482). Thus, it can be said that with the increase of plant height, fresh weight, length of cob, stalk diameter, and weight of 100 dry seeds will increase the weight of dry seeds of maize. This is in accordance with the results of research reported by Sudika *et al*. (1998); Sutresna and Sudika (2005); and Sutresna, 2008. A strong positive correlation in some pairs of traits can be caused by two things, namely pleitropi and gene linkage.

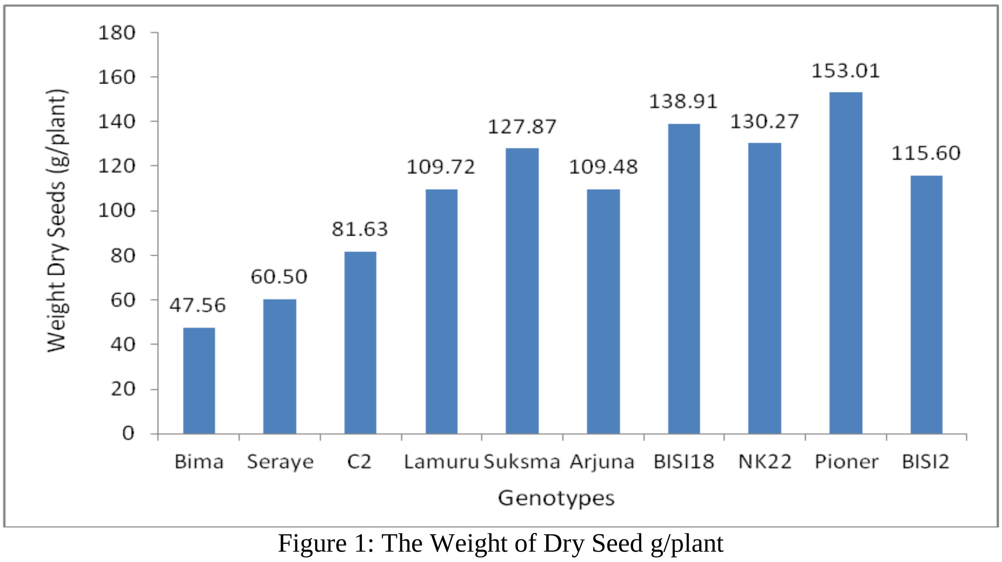

Figure 1: The Weight of Dry Seed g/plant

IV. Consclusions and Suggestions

4.1 Conclusions

1) Pioner hybrid has the highest yield among both hybrid and open pollination varieties with an equivalent dry seed weight of 13.03 tons ha^{-1}.
2) The yield capacity of hybrid Pioner is higher and significantly different compared with NK 22, BISI 18 and BISI 2, with equivalent dry seed weight are consicutively 13,03; 11,91; 11,16; and 9,91 ton ha^{-1}.
3) The yield of superior open pollination variety (Sukmaraga) is higher and significantly different compared with Arjuna, Lamuru, Population C2, Seraye and Bima; with the weight of dry seeds are each equal to 10,96; 9,38; 9,08; 6,99; 5 , 18 and 4.07 ton ha^{-1}.

4.2 Suggestions

Pioner hybrids or Sukmaraga open pollination varieties can be considered for cultivation in a growing environment with improved cultivation technology

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