

## Potential Brix Levels of Mutant Sugarcane Plants at Different Altitudes

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**Abstract :** As ingredient raw Sugarcane industry is one \_ commodity plantations that have role strategic in economy in Indonesia. Availability varieties superior sugarcane is one \_ reason low production sugarcane national . However , the use of varieties superior could support enhancement production sugarcane in Indonesia. enhancement sugar production through varieties with yield tall more take precedence because could increase sugar yield without increase right capacity sugar factory . Mutation result from sugarcane varieties Bululawang (BL) was obtained three genotype potential have yield high . Brix can be made a reference for measure content yield sugarcane because the more tall degrees the brix so the more sweet solution that . Study this use method observation by directly each location . \_ Measurement degree brix done with using a refractometer, with take samples on each sugarcane mutants in every location . The results of the research M1 mutant sugarcane has Highest Brix content (19.5%) and capable of adapt with good at height place ± 62 masl . M3 mutant sugarcane has Highest Brix content (19%) and capable of adapt with good at height place ± 141 masl . M2 mutant sugarcane has highest Brix content (23.4%) and capable of adapt with good at height place ± 512 masl .

**Keywords:** Brix; Sugarcane Mutation; Altitude

### INTRODUCTION

Sugarcane is one of the plantation crop commodities in the agricultural sector which plays an important role in encouraging the economy in Indonesia. As a raw material for the sugar industry, Sugarcane is one of the plantation commodities that has a strategic role in the economy in Indonesia with an area of around 415.66 thousand hectares of Sugarcane in 2018 [1]. Indonesia as the world's main sugar producer has experienced a decline in production. Sugar needs reached 6.6 million tons [2] for household consumption by 51% and refined for the needs of the food and beverage industry by 47%, and for other consumption by 2%. Meanwhile, domestic sugar production is only 2.17 million tons with a sugarcane yield of 7.7 tons/ha which is supplied by 48 state-owned sugar factories and 17 private sugar factories [2]. Thus, in 2019 Indonesia imported 4090.1 tons of sugar.

The availability of superior sugarcane varieties is also the cause of the low national sugarcane production. In fact, the use of superior varieties can support the increase in sugarcane production in Indonesia. Superior variety is a plant breeding line that has one or more special characters such as having high yield potential and yield, ripening type, tolerance to environmental stresses, suitability to soil physicality, resistance to certain plant-disturbing organisms, and most importantly, adaptive sugarcane which suitable to be developed in each region [3]. In principle, the increase in sugar production can be carried out through expansion of planting area,

increasing sugarcane weight per hectare, and increasing yield. However, increasing sugar production through yield is preferred because it can increase sugar yield without increasing sugar factory capacity [4]

Brix is the amount of apparent solid dissolved (in g) per 100 g of solution. Brix is a dry solid dissolved in a solution which is calculated as sucrose. The brix unit is a unit used to indicate the amount of sugar dissolved in a solution. The higher the degree of brix, the sweeter the solution [4]. For example, in the case of juice processing, the brix value is an illustration of how much solids dissolved in the juice. The dissolved solids contain sugar and non-sugar components. As an illustration, if a brix value of 17% is obtained, then every 100 parts of sap consists of 17 parts of brix and 83 parts of water [4].

The mutation results from the Bululawang (BL) sugarcane variety obtained three genotypes that have the potential to have high yields. The three genotypes in the first generation had yields of 18.58%, 16.83% and 15.57%, while non-mutant BL sugarcane was only 10.81%. The three genotypes were obtained through induced mutations using *ethyl methane sulfonate* (EMS) with a concentration of 16 mM and a time of 5 hours (genotype having a yield of 18.58%) and a concentration of 16 mM and a time of 10 hours (a genotype having a yield of 16.83% and 15.57%) (Miswar et al., 2016; [5]). Therefore, it is necessary to observe the potential of brix content in mutated sugarcane in several locations with different altitudes so that the brix potential of each mutated sugarcane can be known on land with different altitudes.

## METHOD

The multi-location test study was carried out in December 2020 - June 2021 in three sub-districts spread over two districts. The agroecological specifications for each location are listed in Table 1.

Table 1 Agroecological Specifications for Each Location

Location (District)	City/ Regency	Position	Altitude (masl)	Soil Texture
Sukorambi	Jember	8°11'27.4"S 113°38'14.4"E	±62	clay
Arjasa	Jember	8°07'12.9"S 113°44'16.5"E	± 141	clay
Pakem	Bondowoso	7°51'51.6"S 113°44'49.5"E	± 512	clay

In detail the area and height of the area can be seen in table 3.2 and details of the slope of the land can be seen in table 2:

Table 2 Area by Altitude Classification

No	Height	Large	
		km <sup>2</sup>	%
1	0-100 meters	50.94	3.27
2	100-500 meters	766.23	49.11
3	500-1,000 meters	308,10	19.75
4	>1,000 meters	434.83	27.87
	<b>Amount</b>	<b>1,560,10</b>	<b>100.00</b>

Table 3 Land Slope

No	Slope Classification	Large	
		km <sup>2</sup>	%
1	Flat (0-2%)	190.83	12.23
2	Ramps (2-15%)	568.17	36.42
3	Slightly Steep (15-40%)	304.70	19.53
4	Very Steep (>40%)	496.40	31.82
<b>Amount</b>		<b>1,560,10</b>	<b>100.00</b>

Source: Bondowoso Regency in 2019 Figures

The altitude in Jember Regency is between 0-3,300 masl as detailed in Table 3.4, while the topography based on the slope of the land (elevation) is presented in Table 3.5.

Table 4 Details of the elevation of places in Jember Regency

No	Place Altitude (masl)	Percentage (%)	Information
1	0-25	17.95	Located in the southwest region of the Regency
2	25-100	20.70	City Area
3	100-500	37.75	City Area
4	500-1000	15,80	City Area
5	>1000	7.80	Located in the northeast (border of Bondowoso Regency) and southeast (border of Banyuwangi Regency)

Source: Jember Regency in Figures 2020

Table 5 Land Slope

No	Slope Classification	Large	
		km <sup>2</sup>	%
1	Flat (0-2%)	1,205.47	36,60
2	Ramps (2-15%)	673.76	20.46
3	Slightly Steep (15-40%)	384.03	11.66
4	Very Steep (>40%)	1,030.07	31.28
<b>Amount</b>		<b>3,293.34</b>	<b>100.00</b>

Source: Jember Regency in Figures 2020

This study uses the method of direct observation to each location. The brix degree measurement was carried out using a refractometer, by taking samples from each mutant sugarcane at each location. Then the data obtained was analyzed descriptively analytically to provide an overview of the object under study through the data that has been collected as it is without analyzing and making conclusions that apply to the public.

## RESULTS AND DISCUSSION

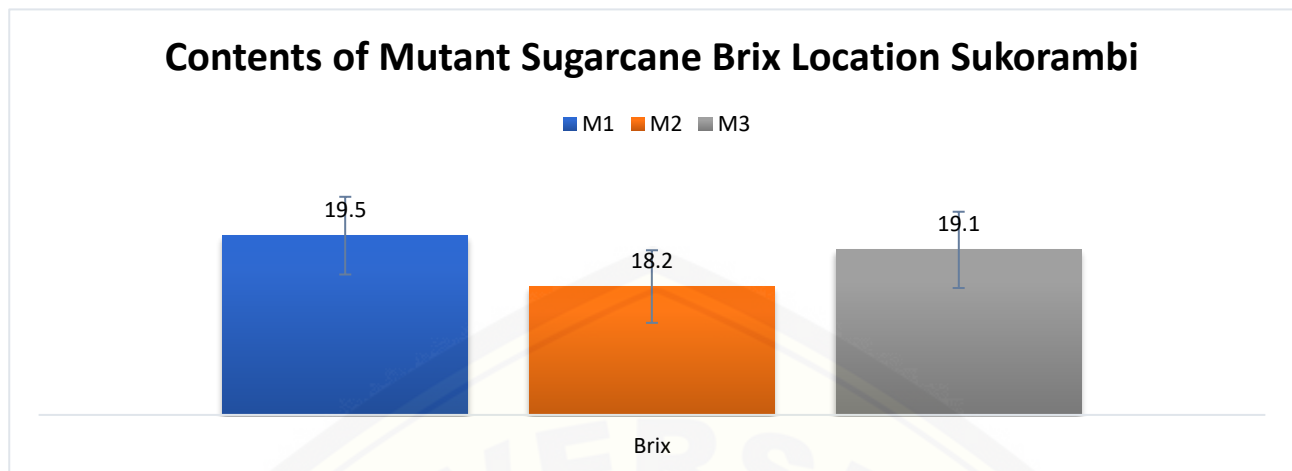


Figure 1 Graph of Brix Content of Mutant Sugarcane at Sukorambi Location

Based on Figure 1, it can be seen that the M1 mutant sugarcane has the highest Brix content than M2 and M3 mutant sugarcane, M3 mutant sugarcane has a greater Brix content than M2 mutant sugarcane but smaller than M1 mutant sugarcane, M2 mutant sugarcane has the smallest brix content compared to M1 mutant sugarcane. other mutant sugarcane. The location of Sukorambi has an altitude of  $\pm 62$  with a typology of rice fields with abundant water availability in every season. It is suspected that the M1 mutant sugarcane adapts well in locations with an altitude of  $\pm 62$  m above sea level with a tendency to have abundant water availability, while the M2 mutant Sugarcane cannot adapt well at an altitude of  $\pm 62$  m above sea level. These results are in line with the research results [6] in sugarcane, there were significant differences between three sugarcane clones in growth and Brix yield variables in each colon. According to [7], quality sap is produced from quality varieties. Sugarcane varieties that have the potential for high sugar content will affect the performance of the factory and the resulting product. Most of what is contained in brix is sucrose. [8], The higher the % brix content, the sucrose content in sugarcane has a high potential as well.

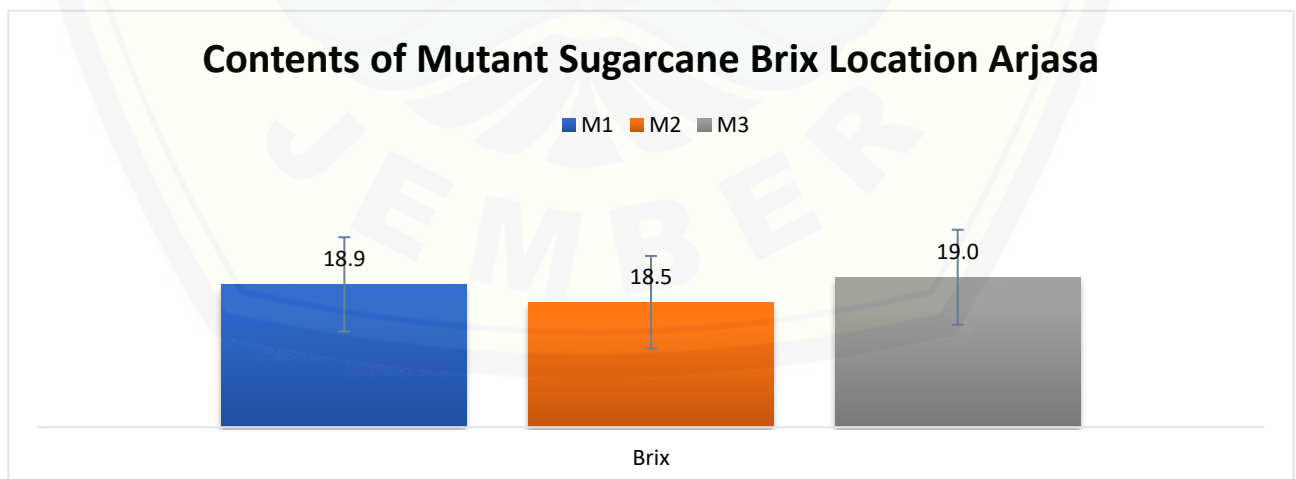


Figure 2 Graph of Brix Content of Mutant Sugarcane in Arjasa Location

Based on Figure 2, it can be seen that the M3 mutant sugarcane has the highest Brix content than M1 and M2 mutant sugarcane, M1 mutant sugarcane has a greater Brix content than M2 mutant sugarcane but smaller than M3 mutant sugarcane, M2 mutant Sugarcane has the smallest brix content compared to M3 mutant sugarcane. other mutant sugarcane. The location of Arjasa has an altitude of  $\pm 141$  with a typology of rice

fields with moderate water availability in every season. It is suspected that the M3 mutant sugarcane adapts well in locations with an altitude of  $\pm 141$  m above sea level with a moderate tendency to water availability, while the M2 mutant Sugarcane cannot adapt well at an altitude of  $\pm 141$  m above sea level. These results are in line with the research results [6] in sugarcane, there were significant differences between three sugarcane clones in growth and Brix yield variables in each colon. The amount of yield value is influenced by factors from sugarcane varieties, environment, cultivation, and manufacturing processes [9].

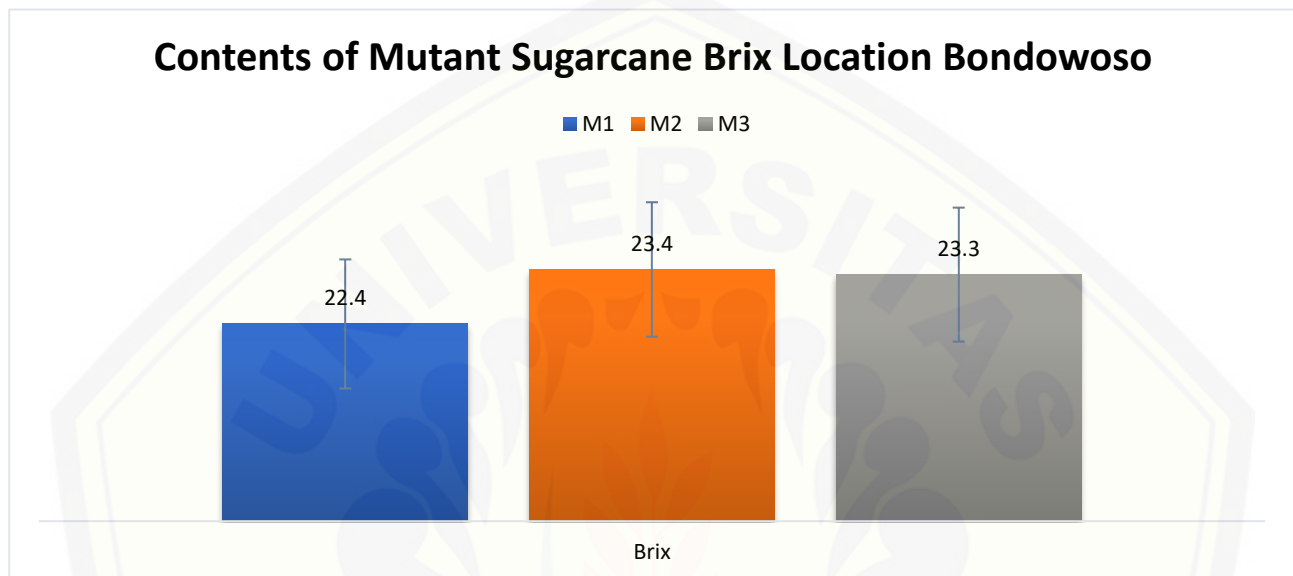


Figure 3 Graph of Brix Content of Mutant Sugarcane in Bondowoso Location

Based on Figure 3 it can be seen that the M2 mutant sugarcane has the highest Brix content than M1 and M3 mutant sugarcane, M3 mutant sugarcane has a greater Brix content than M1 mutant Sugarcane but smaller than M2 mutant sugarcane, M1 mutant sugarcane has the smallest brix content compared to M2 mutant sugarcane. other mutant sugarcane. The Bondowoso location has an altitude of  $\pm 512$  with a typology of upland land with low water availability in the dry season and moderate water availability during the rainy season (rainfed). It is suspected that the M2 mutant sugarcane adapts well in locations with an altitude of  $\pm 512$  mdpl with a tendency for low water availability during the dry season and moderate during the rainy season, while M1 mutant sugarcane cannot adapt well at an altitude of  $\pm 512$  mdpl. These results are in line with the research results [6] in sugarcane, there were significant differences between three sugarcane clones in growth and Brix yield variables in each colon. Based on the results of research [9] The location of sugarcane mooring has the potential for a greater brix value than the swah location. The amount of yield value is influenced by factors from sugarcane varieties, environment, cultivation, and manufacturing processes [9].

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## CONCLUSION

1. M1 mutant sugarcane has Highest Brix content (19.5%) and capable of adapt with good at height place  $\pm 62$  masl .
2. M3 mutant sugarcane has highest Brix content (19 %) and capable adapt with good at height place  $\pm 141$  masl .
3. M2 mutant sugarcane has highest Brix content (23.4%) and capable of adapt with good at height place  $\pm 512$  masl .

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