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Yields of Promising Sugarcane Clones under Three Different Planting Arrangements

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ABSTRACT

A field experiment was conducted at Kediri, East Java, to examine the influence of row spacing on the yield of five promising clones from August 2018-June 2020. The investigation was of a Split-Plot design with three replications. The main plot consisted of three planting arrangements: SR, single row spacing at 110 cm, DR1, double rows spacing 50+135 cm, and DR2, double rows spacing 50+170 cm. Sub-plots consisted of five promising clones and one check variety: MLG 5, MLG 9, MLG 14, MLG 52, MLG 55, and PS 881. The results suggest no overall significant effect of planting arrangement on sugar yield, though clones may vary. There are significant differences in yield between some clones. Wider rows, DR2, show the highest yield in tonnes of cane per hectare (TCH) in PC (153.94 t/ha) with a slight decrease (14%) in RC-1 due to reduced plant population. Sugar yield in tonnes of sugar per hectare (TSH) in various planting arrangements ranges from 12.26-13.99 t/ha in PC and 10.68-11.93 t/ha in RC-1. MLG 9 can be released as a new variety with high cane and sugar yields.

INTRODUCTION

An increase in sugarcane yield in Indonesia is partly addressed by developing new high-yielding varieties. An increase in sugarcane yield is essential in filling the gap between national production and increased demand for sugar, which is in line with a growing Indonesian population. Increased sugar production can occur through genetic improvement obtained via breeding programs. Argentina's genetic modifications increase sugar production by 0.08 t/ha and 0.14 t/ha (Acreche et al., 2015). The ISFCRI breed five promising sugarcane clones exhibiting high sucrose content (early to early middle maturity types) (Supriyadi et al., 2018). In Brazil, sugarcane yield improvement is supported by genetic improvements and better farming systems. Genetic modification leads to varieties with high yields, resistance to pests and diseases, and adaptations to various weather conditions; sugarcane productivity has risen to 50% (Goes et al., 2011).

Optimum planting systems (row width, dual planting lines) can potentially vary for different clones and varieties. Therefore, it is considered essential to research the response of some example clones to varying planting systems. Keshavaiah & Devaraju (2015) studies the performance of sugarcane varieties to varying row spacings; wider row spacings may improve sugarcane yield and quality through the increased penetration of sunlight and air, allowing for intercropping, use of mechanization, and trash management.

Improved cultural practices may positively influence cane yield in plant crops and regrowth (ratoon) crops that develop after harvest. Commercial varieties must adapt to varying environmental conditions, which change every season. Soil conditions may also influence sugarcane yield (Marin et al., 2019). Plant management should optimize radiation capture, mainly as the crop develops and before the crop canopy has closed; this may be achieved by varying the planting system (Khandagave, 2010). Ferreira Junior et al. (2015) did not find differences in sugarcane productivity with differences in Brazil's single and combined (double row) planting systems. However, research has shown that planting system arrangements can better utilize environmental resources to increase sugarcane yields (Samiullah et al., 2015;Ullah et al., 2016).

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Conventionally, the selection of higher-yielding clones in Indonesia is generally undertaken using single-row plots with a row spacing of 110 cm. Djumali et al. (2016) shows an increase in sugar yield using double rows. Double (vs. single) row selection trials pose potentially two different planting systems for selecting new clones in Indonesia. Therefore, the research is necessary to determine if an alternative farming system should be adopted for clone selection. A study assessing the yield of promising sugarcane clones in three different planting arrangements is reported below.

MATERIALS AND METHODS

The field trial was carried out in Kediri, East Java, in 2018-2020; plant cane (PC) and ratoon cane (RC-1) were grown. The field site represented a typology of dry land with light-textured and well-drained soil. Supplemental irrigation was delivered from a nearby water source (as needed) when rainfall failed to provide sufficient water (especially during the dry season). The climate type was classified as C3, according to Oldeman. The sugarcane plots were planted in August 2018 and harvested in July 2019 (PC), with the first ratoon harvested in June 2020 (RC-1). The experiment grew bud chips from five promising clones, classified as early and early-middle maturity, with a check 'early maturity' variety. The treatments were arranged in a Split-Plot design with three replications. The main plot consisted of three planting systems: single row (SR) with a spacing of 110 cm, double rows (DR1) with spacing 50+135 cm, and double rows (DR2) with spacing 50+170 cm. The subplots consisted of five promising clones: MLG 5, MLG 9, MLG 14, MLG 52, MLG 55, with the check variety PS 881.

Each plot consisted of 6 planting furrows of 9 m in length. For single and double row plantings, the size of planting furrows per hectare was 8100 m and 9720 m, respectively. Organic fertilizer was applied in the planting furrow before planting, at a rate of 5 t/ha. Inorganic fertilizer was used at a 400 kg NPK compound fertilizer (Phonska)+600 kg ZA/ha for the single row treatment, and 560 kg Phonska+840 kg ZA/ha for the double row systems. All doses of Phonska fertilizer and 1/3 dose of ZA fertilizer were applied one month after planting (MAP) in PC or one month after harvest (MAH) in RC-1. The remaining ZA fertilizer was applied at three MAP or three MAH. Pest, disease, and weed management was undertaken according to the local sugar mill area (Jombang Baru Sugar Mill).

Plant populations per m row length was recorded 4-8 MAP/MAH and plant height at 4-10 MAP/MAH. Stalk diameter, length of the productive stalk, and stalk weight were measured before harvest using 10 sugarcane stalk samples per plot (selected at random). Cane juice extracted from six stalks from every plot was analyzed for sugar content using an automatic saccharimeter. Monthly rainfall data (2018-2020) were collected from the rain station nearby the experimental plot. The transpiration rate, photosynthetic rate, and stomatal conductance were observed at five MAH in RC-1, using a LC*pro*-SD Portable Photosynthesis System by ADC Bioscientific. Analysis of variance for each component was undertaken using the SAS program, followed by Duncan's 5% distance test analysis to check for statistical differences between the treatments.

RESULTS AND DISCUSSION

Growth of PC and RC-1 Sugarcane

Sugarcane shoot populations in PC and RC-1 in three planting arrangements with five promising clones are presented in Table 1. Statistical analysis shows no significant interaction between planting arrangements, promising clones (in PC and RC-1) and shoot populations. Shoot populations increased up to 4 MAP/4 MAH, then decreased from 4-6 MAP/4-5 MAH to a stable 6-8 MAP/5-6 MAH level. These shoot population changes were consistent with Zhou & Shoko's (2011) observation in Zimbabwe. Shoot populations contribute to sugarcane yield. The peak of the tiller population is strongly influenced by the interaction of varieties and seasons.

The stalk elongation phase is initiated 6 MAP or 5 MAH when the rate of tiller formation has decreased. Sugarcane stalks start to develop rapidly along with the peak formation of tillers (Allison et al., 2007). The final stalk number in PC at 8 MAP of DR2 50+170 cm (10.97 plants/m) is higher than the DR1 50+135 cm planting arrangement, while the stalk number in RC-1 of SR 110 cm is higher (10.78 plants/m) than those of DR1 and DR2 at 6 MAH. Stalk populations in PC and RC-1 are affected by the planting arrangements. Maintaining high stalk populations and increased stalk weight contributes significantly to improved yield (Bell & Garside, 2005). MLG 52 released as PSMLG-1 Agribun gives the highest final plant population (11.54 stalks/m in PC and 12.05 stalks/m in RC-1) compared to the other promising clones or the check variety at 6-8 MAP or 5-6 MAH. The stalk populations in RC-1 of the other good clones are not significantly different from the check variety.

Based on statistical analysis, plant height in PC and RC-1 is not affected by the interaction between planting arrangement and sugarcane clone. Fig. 1 shows that the RC-1 plant heights (324-328 cm) at 8 MAH were similar to those in PC at the same age. There is still an increase in plant height in PC at 8-10 MAP but shoot height in RC-1 slow 7-8 MAH in all clones, indicating that ratoon plants enter the maturity phase faster in all planting arrangements (Fig. 2). The stalk height in PC and RC-1 is affected by the clone. Harvest age in RC-1 is a month shorter than PC. The plant heights in PC at 10 MAP of all clones tested are not significantly different (321-338 cm) with the check variety (324 cm) except for MLG 5 (290 cm). The plant heights of all tested clones in RC-1 at 8 MAH are not significantly different (329-341 cm) and higher than the check variety (316 cm) except for MLG 5 (301 cm). Shoot heights in MLG 5 are shorter than the other promising clones and the check variety.

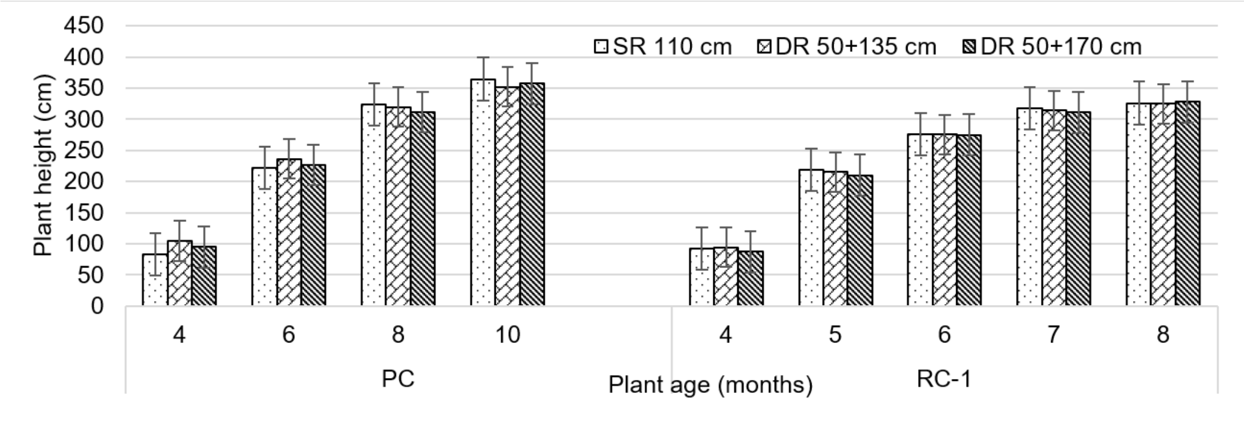


Fig. 1. Sugarcane plant height in PC and RC-1 at various plant ages and planting arrangements, ɪ shows the error bar. PC= Plant Cane; RC-1= Ratoon Cane-1.

Table 1. Sugarcane population per m in PC and RC-1 in different planting arrangements and promising clones

Treatments	Plant age in PC (MAP)			RC-1 (MAH)		
	4	6	8	4	5	6
Planting arrangements						
SR, 110 cm	16.87 b*	11.11 a	9.52 b	16.36 a	11.52 a	10.78 a
DR1, 50+135 cm	15.27 c	9.27 b	8.80 c	13.84 b	9.45 b	8.47 b
DR2, 50+170 cm	19.21 a	10.58 a	10.97 a	14.00 b	9.94 b	9.39 b
Promising clones						
MLG 5	15.43 c	10.62 b	9.81 b	10.48 c	9.47 a	8.48 b
MLG 9	17.86 ab	9.91 bc	9.31 bc	17.56 a	10.24 b	9.12 b
MLG 14	16.66 bc	10.11 bc	10.09 b	15.00 b	9.83 b	9.43 b
MLG 52	18.05 ab	12.21 a	11.54 a	15.66 b	13.00 a	12.05 a
MLG 55	19.82 a	9.61 c	9.21 bc	14.41 b	9.27 b	8.91 b
PS 881	14.89 c	9.47 c	8.62 c	15.29 b	9.98 b	9.32 b
CV (%)	13.20	8.62	10.63	12.43	11.51	11.94

Remarks: * Means within a column with different letters are significantly different at 5% probability level by Duncan's Multiple Range Test. MAP=Month after planting; MAH=Month after harvest PC=Plant Cane; RC-1=Ratoon Cane-1

The rainfall during the RC-1 season is 1296 mm from December 2019 to June 2020, slightly above the rain over the PC sugarcane season (1242 mm from November 2018 to May 2019) (Fig. 3). Riajaya et al. (2012) calculated the actual evapotranspiration of sugarcane in the semi-arid regions of East Java, which is in the range of 1274±157 mm. The total rainfall at the experimental site in the 2018/2019 and 2019/2020 seasons is sufficient to meet crop requirements, with supplemental irrigation at the initial crop establishment phase (PC and ratoon). The rainy season period in 2018/2019 is from November 2018 to April 2019, with a normal distribution and amount for East Java. During the PC growth period, there are five wet months with rainfall above 200 mm/month and two dry months with rainfall below 100 mm/month (according to Oldeman's classification). There are three wet and humid months with 100-200 mm/month rain in the ratoon growth period. RC-1 crops in the 2019 season received additional irrigation water during the early tillering phase.

Extreme and prolonged drought (seven dry months) from May-November 2019 resulted in a delay in the rainy season's onset, which does not start until December 2019. The long dry season affects the growth of new ratoon shoots and leads to a reduced ratoon shoot population, even though sugarcane plants receive some limited irrigation water. Little soil moisture after harvest can reduce root growth from the remaining sugarcane stalks near the soil surface, reducing new ratoon shoot growth after harvest, which is critical for stool survival to support further plant growth (Chumphu et al., 2019). The rainfall gradually increases in January 2020 with high rainfall that coincides with the stem elongation phase. The crop entered the maturity phase in May 2020; 159 mm of rain occurred in the early maturity period. The dry season started in June 2020, evidenced by reduced rainfall, when harvesting the RC-1 crop occurred. The rainfall distribution in PC and RC affects sugarcane yields (Acreche et al., 2015; Marin et al., 2019). This is where drought-resistant varieties are a potential strategy to address water stress caused by a long dry season, as Chandiposha (2013) suggested.

Results of previous tests of the promising clones used in this experiment show that MLG 5 and MLG 52 are susceptible (early maturity), MLG 9 and MLG 14 very tolerant (early maturity), MLG 55 moderate (early maturity), and PS 881 (early maturity) sensitive to drought (Riajaya et al., 2020). It is essential to have high sugar content in early maturing sugarcane to harvest early in the milling season (Terauchi et al., 2012). Varieties with early maturity quickly complete the growth phase of tillers and stem development and fill with sucrose to mature earlier than late-maturing varieties (Cardozo & Sentelhas, 2013). The nature of drought resistance will affect plant performance and sugarcane yield. Drought-resistant types can minimize yield losses caused by short periods of drought (Medeiros et al., 2013).

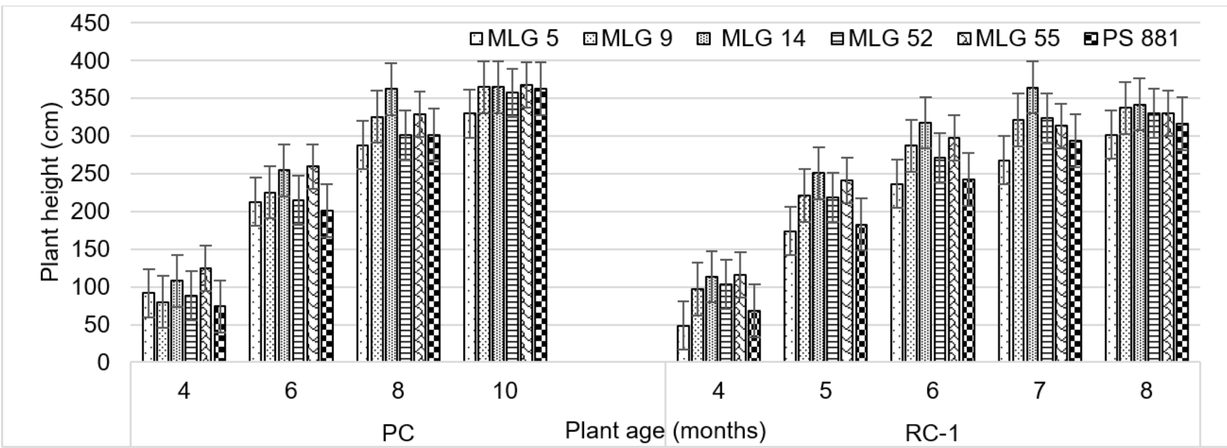


Fig. 2. Sugarcane plant heights in PC and RC-1 of promising clones at various ages, I shows the error bar. PC = Plant Cane; RC-1 = Ratoon Cane-1.

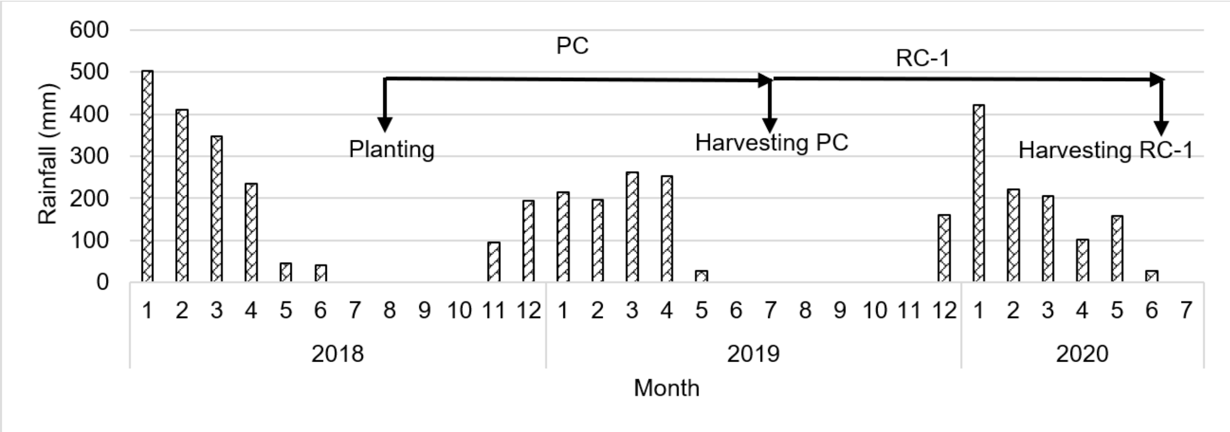


Fig. 3. The rainfall distribution during the growth of PC and RC-1 at the experimental site in 2018-2020. PC = Plant Cane; RC-1 = Ratoon Cane-1.

Table 2. Components of sugarcane yield in PC and RC-1 in different planting arrangements and promising clones

Treatments	PC				RC-1			
	Stalk length (cm)	Stalk weight (kg)	Number of internodes	Stalk Diameter (mm)	Stalk length (cm)	Stalk weight (kg)	Number of internodes	Stalk Diameter (mm)
Planting arrangements								
SR,110 cm	331.9 a*	1.74	25.25	24.57	319.0 ab	1.68 ab	25.51 b	25.01
DR1,50+135 cm	318.5 b	1.73	24.79	24.92	309.8 b	1.61 b	25.22 b	24.71
DR2,50+170 cm	316.4 b	1.75 ns	25.51 ns	25.02 ns	325.8 a	1.81 a	26.78 a	25.43 ns
Promising clones								
MLG 5	290.4 b	1.71 cd	25.23 b	26.32 a	296.4 d	1.71 ab	25.17 b	26.07 a
MLG 9	331.1 a	1.78 bc	23.09 c	25.54 a	325.9 b	1.89 a	23.55 b	26.06 a
MLG 14	338.9 a	1.47 e	22.92 c	22.07 c	343.6 a	1.34 c	24.87 b	20.89 c
MLG 52	321.2 a	1.56 de	28.23 a	23.34 b	313.8 bc	1.58 b	28.77 a	24.26 b
MLG 55	327.3 a	1.88 b	26.54 b	25.51 a	324.8 b	1.89 a	28.85 a	26.30 a
PS 881	324.6 a	2.04 a	25.08 b	26.24 a	304.4 cd	1.89 a	23.80 b	26.71 a
CV (%)	5.2	9.02	6.35	4.58	3.78	10,16	4.76	3.98

Remarks:* Means within a column with different letters are significantly different at 5% probability level by Duncan's Multiple Range Test. ns: not significant. PC = Plant Cane; RC-1 = Ratoon Cane-1.

Sugarcane Yield and Yield Components

The main sugarcane yield components consist of shoot populations, stalk length, and stalk weight, as presented in Table 1 and Table 2. Based on statistical analysis, there are no significant interactions between planting arrangements, promising clones, and sugarcane yield components. Sugarcane yield is strongly affected by the number, diameter, length, and weight of the stalks (Chumphu et al., 2019). The number of internodes is related to stalk length, and stalk diameter corresponds to stalk weight. The number of internodes in PC is in the ranges of 24-25 internodes, slightly lower than in RC-1 (25-26 internodes). Stalks length for single and double rows (DR1) in RC-1 are 319.0 and 309.8 cm, respectively, slightly decrease compared to PC. There is little difference in stalk diameter between PC and RC-1, so that stalk weight in RC-1 decreases compared to PC due to the reduction of stalk length. The planting arrangement with DR2 increases the productive stalk size in RC-1 and increases stalk weight (1.81 kg) compared to PC (1.75 kg). The importance of stalk is greatly influenced by the length and diameter of the stalk. Stalk lengths and weights in Table 2 vary among the clones in 290.4-338.9 cm and 1.47-1.88 kg in PC. Mohammed et al. (2019) also obtain differences among sugarcane clones in stalk length (152.9-211.9 cm) and single stalk weight (0.5-1.1 kg).

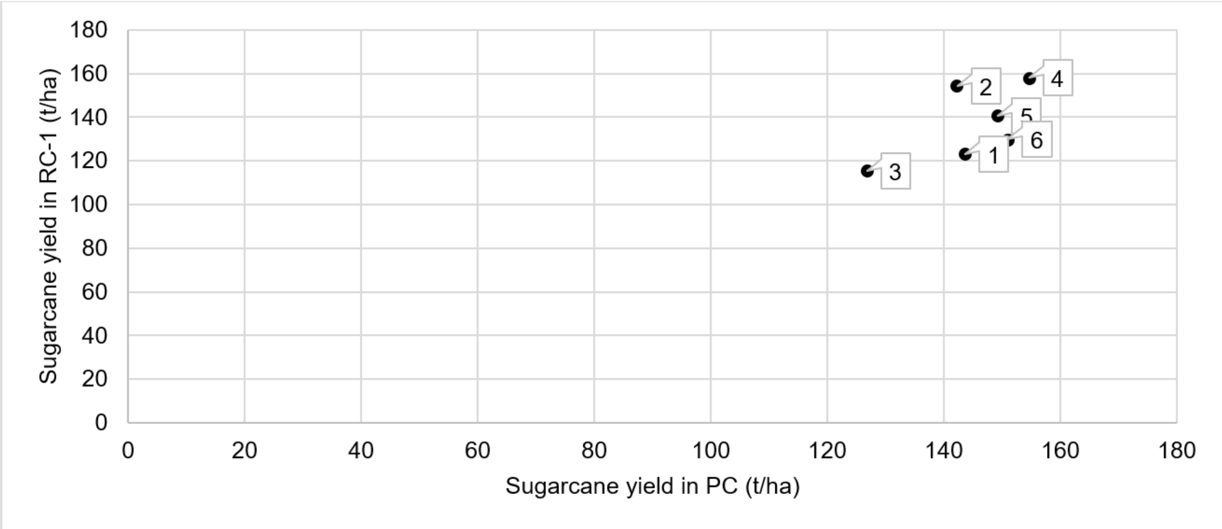
There is no response to stalking length in PC amongst the promising clones and the check variety, except for MLG 5. The most extended stalks were in MLG 14 in RC-1 (343.6 cm); however, the lower diameter (20.89 mm) resulted in a significantly decreased stalk weight (1.34 kg). The promising clones' stalk length and diameter do not differ between PC and RC-1. MLG 55 released as a new variety (PSMLG 2 Agribun) has the highest stalk weight among promising clones (1.88 kg) in PC and 1.89 kilograms in RC-1.

Stalk length, stalk diameter, and plant population is related to sugarcane yield (Table 3). The sugarcane yield in single rows increases by 14% from 133.79 t/ha (PC) to 146.26 t/ha (RC-1) due to an increase in shoot populations (13% increase from 9.52 stalks/m (PC) to 10.78 stalks/m (RC-1)). Dlamini & Olaleye (2019) obtained a significant increase in productivity by increasing plant density. Nuñez & Palomeque (2016) also increased PC sugarcane yield by 7-12% with dual rows than a single row planting in San Carlos, Ecuador. The decline in plant population by 14% in DR2 from 10.97 stalks/m (PC) to 9.39 stalks/m (RC-1) resulted in a decrease in the sugarcane yield (TCH) in RC-1 by 14% from 153.94 t/ha (PC) to 131.63 t/ha (RC-1). Gomathi et al. (2013) found a 17% decline in the average stalk population in the first ratoon in the tropical region of India, resulting in a 27.38% yield reduction. The shoot population strongly influences ratoon yield after harvest (Hassan et al., 2017) and stalk weight (Palachai et al., 2019). The lower result is associated with increasing the number of ratoons; this is related to a decrease in yield components (Hase, 2019; Masri & Amien, 2015).

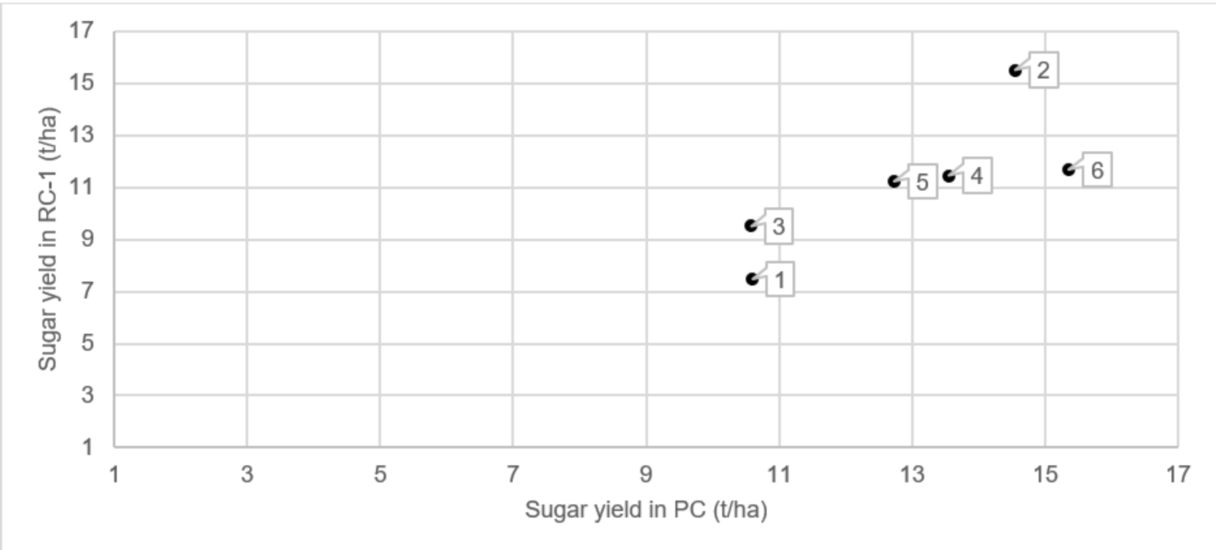
Rainfall that occurred at the beginning of the dry season in May 2020 decreased sugar content in RC-1 in some clones. Rain during the maturity phase reduces yield (Cardozo & Sentelhas, 2013). Sugar content (CCS) and sugar yield (TSH) are not significantly different in the three planting arrangements in PC and RC-1. Sugar yield in other planting arrangements ranged from 12.26-13.99 t/ha in PC and 10.68-11.93 t/ha in RC-1, lower than the sugar yield obtained by Maruthi et al. (2019) 14.2-15.2 t/ha planted in double rows in India. There are different yields (tonnes and sugar content) related to genotype in PC and RC-1. PS 881 (check variety) achieves the highest yield of 151.02 t/ha in PC; RC-1 yield is 129.86 t/ha, a decrease of 14%. This is the same rate of decline as for MLG 5 (143.60 t/ha (PC) to 123.02 t/ha (RC-1)). Yields in PC of all clones tested are in the range 142.26-154.56 t/ha, not significantly different from the check variety (151.02 t/ha) - except for MLG 14. MLG 9 and MLG 52 have higher sugarcane yields in RC-1 (140.46-158.07 t/ha) than the check variety (129.86 t/ha) in Fig. 4a. MLG 9 achieves the highest sugar yield in RC-1 (15.52 t/ha) in Fig. 4b. MLG 5 and MLG 14 have relatively low PC and RC-1 sugar yields (<10 t/ha) compared to the other promising clones.

MLG 9 has higher sugar content and sugarcane yield potential than the two released new varieties (MLG 52 and MLG 55) and PS881. MLG 9 is also very drought tolerant and is an early maturing clone. Further research is needed whether it is widely adaptable across growing environments, a feature of many commercially successful varieties (Dumont et al., 2019; Guerra et al., 2009; Luo et al., 2015). Sugar yield is the essential factor to consider from an economic perspective. Higher sugar yield results in greater sugar production for both the landholder and the sugar mills while simultaneously reducing production costs through reduced costs associated with harvesting (cutting), transportation, and milling (Dumont et al., 2019).

Further research is needed to strengthen the recommendations for the promising clones included in this work; high and stable yields have been attained in PC and RC-1. Cabral et al. (2017) suggested assessing the genotypes in several cuts or harvests, despite high results and stability in diverse environments. Varieties with early maturity, very tolerant of drought, accompanied by high cane and sugar yields, provide options for early planting in Indonesia. Further research is still needed to examine variety adaptation and consistent result in the different production environments in East Java.



(a)



(b)

Fig. 4. Relationship between (a) sugarcane yields in Plant Cane (PC) and Ratoon Cane-1 (RC-1) and (b) sugar yields in PC and RC-1 in promising clones (1) MLG 5, (2) MLG 9, (3) MLG 14, (4) MLG 52, (5) MLG 55, and (6) PS 881.

Table 3. Yields of sugarcane and sugar in different planting arrangements and promising clones

Treatments	PC			RC-1		
	Sugarcane yield (t/ha)	Sugar content (%)	Sugar yield (t/ha)	Sugarcane yield (t/ha)	Sugar content (%)	Sugar yield (t/ha)
Planting arrangements						
SR, 110 cm	133.79 b*	9.12	12.26	146.26 a	8.15	11.93
DR1, 50+135 cm	145.96 ab	8.57	12.42	132.61 b	8.02	10.83
DR2, 50+170 cm	153.94 a	8.98	13.99	131.63 b	7.99	10.68
		ns	ns		ns	ns
Promising clones						
MLG 5	143.60 ab	7.31 c	10.59 b	123.02 bc	6.02 e	7.48 d
MLG 9	142.26 ab	10.16 a	14.55 a	154.26 a	10.06 a	15.52 a
MLG 14	126.71 b	8.27 bc	10.57 b	115.34 c	8.16 c	9.51 c
MLG 52	154.56 a	8.77 b	13.55 a	158.07 a	7.23 d	11.46 b
MLG 55	149.22 ab	8.70 b	12.73 ab	140.46 ab	7.85 cd	11.24 b
PS 881	151.02 a	10.14 a	15.36 a	129.86 bc	10.06 a	11.69 b
CV (%)	15.14	12.72	20.53	10.54	8.13	11.16

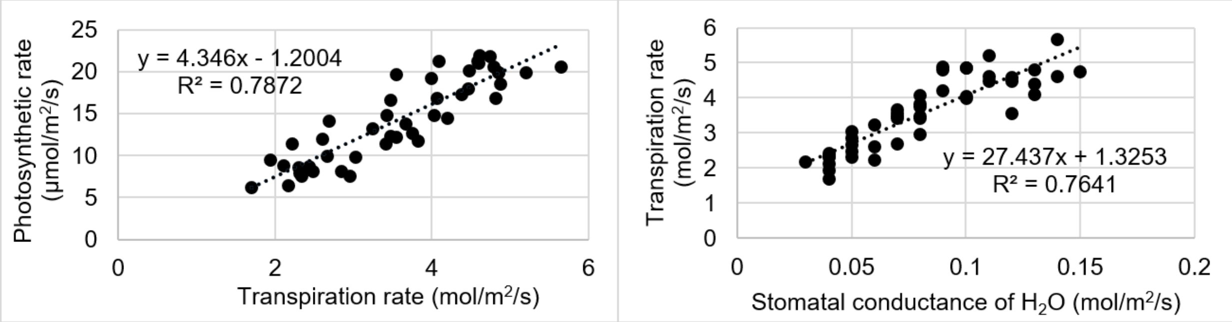
Remarks:* Means within a column with different letters are significantly different at 5% probability level by Duncan's Multiple Range Test. PC=Plant Cane; RC-1=ratoon Cane-1.

Physiological Characters of Promising Sugarcane Clones

The transpiration rate (x) is positively correlation with the photosynthetic rate (y) in the clones tested and is represented by the regression equation: y = 4.346x - 1.2004 (coefficient of determination: R^2 = 0.7872;correlation coefficient R = 0.89) (Fig. 5a). Therefore, an increased transpiration rate is related to an increase in the photosynthetic rate. The average transpiration rate of the clones tested is 3.59±1.03 mol/m^2/s, while the photosynthetic rate is 14.39±5.03 μmol/m^2/s. The average water use efficiency (the ratio of photosynthetic rate and transpiration rate) is 4.0 μmol of CO_2 fixed for photosynthesis per mole of H_2O. This ratio is lower than that obtained by Endres et al. (2010) in Brazil (4.4 μmol CO_2/mol H_2O depending on varieties). The transpiration rate (y) is strongly influenced by stomatal conduction (x) which is expressed by the linear regression equation y = 27.437x + 1.3253 (coefficient of determination R^2 = 0.7641; correlation coefficient R = 0.87) (Fig. 5b). Higher stomatal conductance is therefore associated with a higher transpiration rate. The mean stomatal conductance of promising clones is 0.08±0.03 mol/m^2/s. The rates of transpiration and photosynthesis are controlled by stomata (Jones, 1998).

The photosynthetic rate (A) of promising sugarcane clones follows the transpiration rate (E) in three planting systems (Fig. 6). The highest transpiration and photosynthetic rates in DR2 of MLG 52 are 5.17 mol/m^2/s and 17.27 μmol/m^2/s, respectively, followed by MLG 9 3.97 mol/m^2/s and 14.73 μmol/m^2/s. Furthermore, MLG 55 has the highest transpiration and photosynthetic rates of 3.87 mol/m^2/s and 15.68 μmol/m^2/s, respectively, followed by MLG 5 4.29 mol/m^2/s and 14.78 μmol/m^2/s, in DR1. PS881 (the check variety) has the highest transpiration and photosynthetic rates (SR, 4.68 mol/m^2/s, and 15.05 μmol/m^2/s, respectively).

Soil water availability during the fast-growing is essential to maintain the high photosynthetic rate. MLG 9 has a high photosynthetic capacity under dual planting lines leading to high sugar and sugarcane yields. This result suggests further research for its physiological character under different environments.



(a) (b)

Fig. 5. (a) The relationship between transpiration rate and photosynthetic rate and (b) stomatal conductance and transpiration rate of promising sugarcane clones

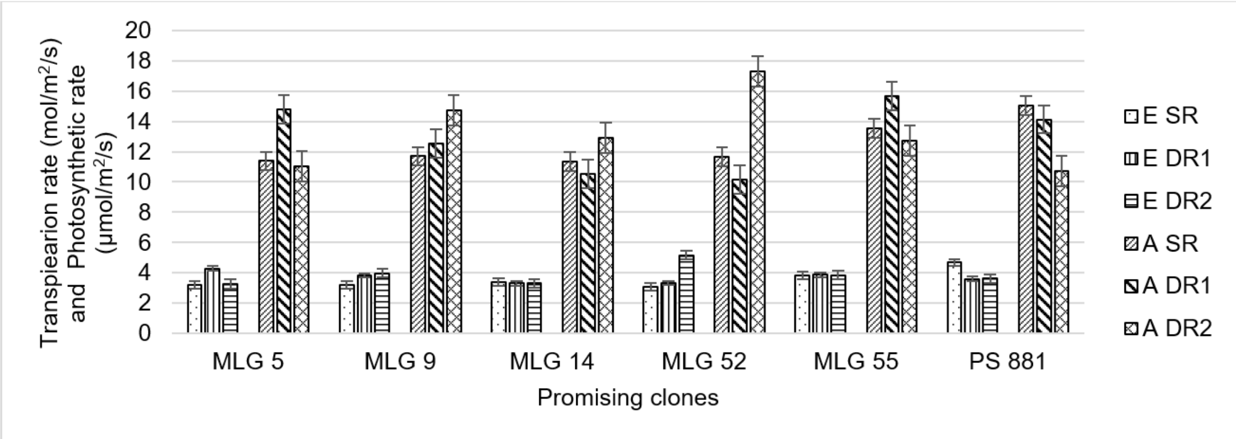


Fig. 6. Transpiration rate (E) and photosynthetic rate (A) of sugarcane promising clones in a single row (SR), double rows with spacing 50+135 cm (DR1), and double rows with spacing 50+170 cm (DR2), I show an error bar

CONCLUSION AND SUGGESTION

Planting arrangements do not significantly affect sugar yield, although clones vary. There are significant differences in yields between some clones. Wider rows (double rows spacing 50+170 cm) show the highest yield in tonnes of cane per hectare (TCH) in PC (153.94 t/ha) with a slight decrease (14%) in RC-1 due to reduced plant population. Sugar yield in tonnes of sugar per hectare (TSH) in various planting arrangements ranges from 12.26-13.99 t/ha in PC and 10.68-11.93 t/ha in RC-1. MLG 9 can be released as a new variety with high cane and sugar yields.

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