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Research Article

Growth-yield performances and partial economic analysis of sugarcane under different planting methods

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Abstract

Sugarcane (*Saccharum spp.*) is an important tropical crop around the world, involving in Indonesia, however low productivity is still problem for it. The study was aimed to investigate effect of different planting methods on improving cane growth-yield performances and their partial economic analysis. The study was conducted at Gedangdowo, Jepon, Blora District, Central Java, Indonesia from 2015-2017 at initial planting (IP) to sugarcane ratoon SR-1 and SR-2. Material used was qualified seeds of PS.862 variety. Three planting methods were tested: 1) double trench system (DTS) with 50 cm distance between trench and 135 cm distance between double trenches; 2) single trench system (STS) with 120 cm distance of canter to center (CTC) and 3) STS with 110 cm distance of CTC. The experiment was arranged in randomized complete block design (RCBD) with 6 replications. Results of the study revealed that DTS 50/135 was the most appropriate planting method inducing higher cane productivity up to 129.12 t/ha in IP, then increased up to 134.1 t/ha in SR-1 and declined down to 114.1 t/ha in SR-2. Percentage of cane productivity in DTS 50/135 increased up to 40.8% in IP, 51.1% in SR-1 and 64.6% in SR-2. Higher R/C ratio up to 1.99 and 1.94 was performed by STS 120 followed by DTS 50/135. Increasing R/C ratio noted in STS 120 and DTS 50/135 was 18.3 and 21.3%, respectively on SR-1 compared to STS 110. The planting method can be applied to improve sugarcane productivity and its R/C ratio for other varieties.

Keywords: economic analysis; growth; planting method; sugarcane; yield

Introduction

Sugarcane (*Saccharum* spp.) is one of important tropical crops around the world. The crop is important mainly due to the production of sugar and alcohol (Casaroli *et al.*, 2019) and a great energy production capacity due to the burning of its dry matter (De Silva *et al.*, 2019). In Indonesia, the sugarcane is also one of important crop estates after palm oil, rubber, coconut, coffee, cocoa, and cashew. The plants were widely developed and cultivated in several provinces with East Java, Lampung and Central Java as the main sugarcane areas (Zuraina

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et al., 2018; Directorate General of Estate, 2020a). Total harvest areas of sugarcane were 458,432 ha; 2.4 million tons of total production and 5.5 t/ha its productivity in 2020 (Zuraina *et al.*, 2018; Directorate General of Estate, 2020b, c). Revenue/Cost (R/C) ratio of the sugarcane agribusiness was between 1.10 to 2.9 (Hajar *et al.*, 2019; Pokharel *et al.*, 2019; Zaky *et al.*, 2019). Sugar as the main product were sold from Rp. 12,000 – 20,000-/kg (Society Relation Department, 2020). The information gives evident that sugarcane is important and has high economical estate plants in Indonesia, however development of the plant in commercial scales was constrained by low plant productivity.

In Indonesia, sugarcane productivity was still low and generally under its variety potential. On farm site, sugarcane productivity in Indonesia was only 68.29 t/ha in 2017 (Zuraina *et al.*, 2018). The productivity decreased down to 52.2 t/ha in 2020 (Indonesian Trading Ministry, 2020). The productivity was lower than other sugarcane production countries as Brazil and China with 74.37 and 79.68 t/ha, respectively. While in off farm site, sugarcane yield was only 7.50% and lower than in Philippine, Thailand and Australia with 9.20, 10.70 and 14.12%, respectively. To increase sugarcane productivity in Indonesia, several strategies were carried out such as optimizing cultivation by utilizing qualified seeds, productive varieties, optimizing land processing, managing planting system, seedling embroidering, fertilizing and root managing (Diana *et al.*, 2016; Kadarwati, 2019; Sudarto *et al.*, 2020); source-sink approaching (Cholid, 2013); applying organic matter and land synthetic moisturizer (Tando, 2017). The such strategies, in fact, were also done in other countries to increase sugarcane productivity (Srivastava and Rai, 2012; Bikila *et al.*, 2014; Bokthiar *et al.*, 2015; Lemos dos Santos *et al.*, 2018; Singh *et al.*, 2019). While improving sugarcane productivity under treatment of planting method published internationally is still few.

Planting method is one of important aspects that can be carried out to increase sugarcane growth and yield performances. The method is closely related to (1) seed sizes such as bud chips (Mishra, 2019), single bud seeds (Muttaqin *et al.*, 2016; Ngatinem *et al.*, 2019) and long stalk with several buds (Majid, 2014; Prem *et al.*, 2017) and (2) planting system *viz*, single and double trenches with varied sizes (Majid, 2014; Gulati *et al.*, 2015; Djumali *et al.*, 2016). The bud chips were successfully applied to increase sugarcane yield up to 37.3% than conventional method (Mishra, 2019); single bud seeds with 140 × 30 cm improved the highest sugarcane productivity up to 36.7% compared to other treatments (Ngatinem *et al.*, 2019); and the long stalk in 1.8 m planted in narrow row of 1.25 m successfully increased sugarcane stalk number and its productivity up to 49.4% compared to other sizes (Majid, 2014). Furthermore, small pit method of planting (120 × 60 cm spacing with 3 settlings per pit) increased productivity up to 16.2% compared to conventional one (15 cm width 15 cm depth with 12 settlings per pit) of planting (Gulati *et al.*, 2015). Paired row trench plantation stimulated slightly improvement of sugarcane productivity up to 6.4% compared to conventional planting (Prem *et al.*, 2017). Trench planting method with 120 cm increased sugarcane yield up to 55.2% and better than other methods (Nadeem *et al.*, 2020). In Indonesia, double trench system (DTS) for improving sugarcane growth and yield performances was established since 2012 (Hendayana *et al.*, 2014), however transfer and adoption of the technology in farmer level was still low. To improve interest and attractiveness of farmers to the DTS, frequent researches dealing with application of the technology nearby farmer location and partial economic analysis are importantly addressed.

New and reliable research results derived from exploring the DTS on sugarcane growth and yield performances and its farming economic analysis were successfully revealed. New findings of the research were discussed in detail in the paper.

Materials and Methods

Study site

Field experiment was carried out on 3 ha farmer land at Gedangdowo village, Japon Subdistrict, Blora District, Central Java-Indonesia on ± 103 m altitude above see level, 6°56'55.3" in South latitute, 111°27'46.5" in East longitute at inceptisol soil type from September 2014 to August 2017. Number of raindays in 2015 was 0-22 days per month and 8.8 days in average with 0-176 mm rainfalls per month and 64.2 mm in average (Blora Statistic, 2015); 0-11 days and 5.6 days in average with 0-317 mm and 122.8 mm in 2016 (Blora Statistic, 2016); 2-20 days and 8.8 days with 12-410 mm and 146.3 mm (Blora Statistic, 2017). Materials used in the study were qualified seeds of PS. 862 cane variety, Phonska compound fertilizer, ZA, manure, insecticides with carbofuran as active ingredient, and fungicide. Hand tractor, sprayer, caliper, stick meter, refractometer and other supporting tools were used in the experiment.

Experiment preparation

Cane cultivation lands were prepared by soil tilling using hand tractor for four times with different purposes. First and second soil tilling was aimed to reverse soil ground 25 cm in depth and to clean land from rests of other vegatations that can inhibit sugarcane growth vegetatively. After the second soil tilling, the lands were harrowed to make soil become friable and finally the land plottings were settled based on planting methods tested.

Basic fertilizer, i.e. 5 tons/ha of organic manures was applied during soil harrowing. Fertilizing during in the initial planting was carried out using Phonska, ZA and organic manure and applied 4 weeks after planting (WAP) and 12 WAP. Phonska in 600 kg/ha, 400 kg/ha and 5 t/ha organic manure were applied for double trench system (DTS) with 50 cm distance between trench and 135 cm distance between double trenches; 550 kg/ha Phonska, 350 kg/ha Za and 5 t/ha for single trench system (STS) with 120 cm distance of canter to center (CTC) and 500 kg/ha Phonska, 350 kg/ha Za and 2.5 t/ha for STS with 110 cm distance of CTC. The fertilizers were applied by preparing long trench 10 cm distance from bottom stalk parts following plant trench length. The fertilizers were poured in the long trench prepared equally then covered again using soil nearby the trench.

Fertilizing at the first and second sugarcane ratoon (SR-1) was carried out using similar fertilizers and ZA and applied 1 month after ratoon (MAR) and 3 MAR. Phonska in 600 kg/ha, 400 kg/ha and 5 t/ha organic manure were applied for DTS 50/135; 550 kg/ha Phonska, 350 kg/ha Za and 5 t/ha for STS 120 and 500 kg/ha Phonska, 350 kg/ha Za and 2.5 t/ha for STS 110. Similar application methods as initial planting (IP) was applied in the SR-1 and SR-2.

Qualified seeds were prepared by selecting qualified cane stalks derived from 8 months of sugarcane plants from stock seeds having vigor and healthy growth, and no pest and disease symptoms used as seed sources. Sugarcane stalk with two buds derived from nodes in the middle stalk of PS.862 were selected and cut using sterile sharp knifes. Selected seeds generally had > 90% grow rate, fresh, vigor, and healthy; 15-20 cm in length with ± 2 cm in diameter; bud and root primordia in dormant condition; and disease free. The seeds were planted in trenches prepared in two rows in overlapping position in which the buds were position laterally and then covered by media till all the seeds covered perfectly. Total seeds used per ha were 60-80 kwintal or 10 grow buds per m trench.

The cane plants were maintained from initial growth till harvest time by (1) watering applied fit with growth steps of plants; (2) soil heaping up carried out three times, first at the first fertilizing, second at 3-3.5 months after planting (MAP) and third at 4.5-5.0 MAP; (3) tiller and leaf removing, especially tillers with un-optimal growth and the old leaves aiming to improve and strengthen cane stalk growth, to suppress growth of stalk buds, to prevent stalk collapsed and plant fire. The tiller and leaf removing was carried out three times, first at 4-5 MAP, second at 7-8 MAP and third at 1-2 months before harvest time; (4) seed tatting carried out to replace fail grow of planted stalks using similar seedlings and age. The seed tatting was conducted at 3-4 MAP; (5) tiller managing carried out to control number of tillers supporting cane optimal growth. Total number of tillers maintained till harvest period were 10 tillers, when more than 10 tillers, other tillers were removed; and (6) pest and disease controlling done by applying pesticides that fit with pests and diseases attacking in suggested dosages.

Sampling design

In the study, three planting methods tested were (1) double trench system (DTS) with 50 cm distance between trench and 135 cm distance between double trenches; (2) single trench system (STS) with 120 cm distance of canter to center (CTC) and (3). STS with 110 cm distance of CTC. The experiment was arranged in randomized complete block design (RCBD) with 6 replications. The experiment was conducted three years from 2015 to 2017 from IP to SR-1 and SR-2. Each treatment consisted ot 30 experimental plots. Each plot was 12 × 24 m with 1.5 m distance between plot. Each plot contained 21,216 seeds for DTS 50/135; 16,300 seeds for STS 120 and 17,136 seeds for STS 110 with 1,724,424 total of seeds planted. Total experimental samples were 20 plants that were established randomly.

Variables observed in the study were (1) plant height (cm), (2) stalk length (cm), (3) stalk diameter (cm), (4),number of nodes per plant, (5) number of productive tillers per plant (6) percentage of Brix (%), (7) fresh stalk weight (kg/stalk), (8) cane yield (%), (9) number of stalks per m trench and (10) sugarcane productivity (t/ha). Periodical observation was carried out to reveal growth response of cane from initial planting till harvest period. The variables were observed and measured 10 months after planting (MAP). While partial economic analysis of three planting methods tested in the study was carried out by comparing input and output variable costs, especially to establish revenue cost ratio (R/C ratio) (Hajar *et al.*, 2019).

Statistical procedures

Quantitative data in the experiments were analyzed using analysis of variance (ANOVA). Significant differences between means were assessed by Tukey test, $p = 0.05$ (Mattjik and Sumertajaya, 2006).

Results and Discussion

Based on periodical observation it was known that initial bud germination was occurred 13-17 days after planting (DAP) with 24.7 to 35.2% germination rate and 15 to 20 cm height of plants. The shoots continually grew and developed in the further observation. Shoots with 50 – 65 cm height and 3 – 5 leaves were noted at 30 DAP. Initial tillers were recorded 25 – 30 DAP, 90% germination rate 2 MAP with optimal number of tillers up to 14 tillers per plants recorded at 4 MAP. From 7-14 tillers noted per plants, the productive tillers were 53.4 – 71.2% while 28.8 – 46.6% of tillers were removed due to their un-qualified and un-optimal growth (Data not shown). In the harvest period, the plant height was varied from 237 - 423 cm with 161 – 249 cm stalk length, 2.4 - 2.7 cm stalk diameter, 15 – 24 nodes per plant, 4.5 – 6.7 productive tillers, 19.5 – 21.7% of Brix, 1.2 – 2.7 kg fresh stalk weight, 7.7 – 8.9% cane yield, 8 – 15 stalks per m trench and 69.4 – 134.2 t/ha sugarcane productivity in which sugarcane growth and yield performances were significantly observed on DTS 50/135 planting method.

Different planting methods investigated in the three years of study, it was successfully revealed that the different planting methods gave significant effect on growth and yield performances of sugarcane PS.862 variety, statistically. DTS 50/135 was the most suitable planting methods applied to increase and improve sugarcane growth and plant productivity. The method stimulated optimal plant growth with 6 productive tillers, 21.7% of Brix, 1.72 kg fresh stalk weight, 8.86% cane yield, 14 stalks per m trench and 129.12 t/ha cane yield in the IP (Table 1). The highest improvement of sugarcane growth and yield performances was significantly noted in the SR-1 under the similar method. Higher results in the treatment were 6 productive tillers, 15 stalks per m trench and 134.2 t/ha, respectively (Table 2). While in the SR-2, higher plant height up to 393 cm, 287 cm stalk length, 2.76 cm stalk diameter, 24 nodes per plant, 6.7 productive tillers, 1.62 kg fresh stalk weight, 13 stalks per m trench and 114.2 t/ha cane productivity was recorded on DTS 50/135 (Table 3). While second best planting method was STS 120. The planting method also successfully improved sugarcane growth and yield performances compared to STS 110 planting method.

Table 1. Cane growth and yield performances under different planting methods in the initial planting

Planting method	Plant height (cm)	Stalk length (cm)	Stalk diameter (cm)	Number of nodes per plant	Number of productive tillers per plant	Percentage of Brix (%)	Fresh stalk weight (kg/stalk)	Sugar cane yield (%)	Number of stalks per m trench	Sugarcane productivity (t/ha)
DTS 50/135	296.5 a	218.8 a	2.67 a	16.2 b	6.0 a	21.7 a	1.72 a	8.86 a	14.0 a	129.12 a
STS 120	297.3 a	227.2 a	2.69 a	18.2 a	5.0 b	20.1 a	1.60 a	8.04 a	12.2 a	111.82 b
STS 110 (control)	236.8 b	161.2 b	2.62 a	14.8 b	4.5 b	19.5 a	1.18 b	7.74 a	10.0 b	91.78 c
Coefficient of variation (CV)	3.83	5.82	8.74	7.10	11.72	8.93	10.74 a	11.08	10.46	2.02

Note: DTS 50/135 - double trench system (DTS) with 50 cm distance between trench and 135 cm distance between double trenches; (2) single trench system (STS) with 120 cm distance of canter to center (CTC) and (3). STS with 110 cm distance of CTC, Means followed by the same letter in the same column are not significantly different based on Tukey test, *p=0.05*

Table 2. Sugarcane growth and yield performances under different planting methods in SR-1

Planting method	Plant height (cm)	Stalk length (cm)	Stalk diameter (cm)	Number of nodes per plant	Number of productive tillers per plant	Percentage of Brix (%)	Fresh stalk weight (kg/stalk)	Sugarcane yield (%)	Number of stalks per m trench	Sugarcane productivity (t/ha)
DTS 50/135	412.0 a	248.0 a	2.76 a	21.0 a	6.0 a	20.9 a	1.56 a	8.47 a	15.0 a	134.20 a
STS 120	423.0 a	249.0 a	2.70 a	21.0 a	5.5 a	19.9 b	1.64 a	7.96 b	12.0 b	129.85 b
STS 110 (control)	374.0 b	223.0 b	2.72 a	19.0 b	4.8 a	21.4 a	1.38 a	8.72 a	9.0 c	89.43 c
Coefficient of variation (CV)	3.19	5.45	5.47	5.08	16.31	2.61	12.17	3.23	7.76	2.17

Means followed by the same letter in the same column are not significantly different based on Tukey test, p=0.05

Table 3. Sugarcane growth and yield performances under different planting methods in SR-2

Planting method	Plant height (cm)	Stalk length (cm)	Stalk diameter (cm)	Number of nodes per plant	Number of productive tillers per plant	Percentage of Brix (%)	Fresh stalk weight (kg/stalk)	Sugarcane yield (%)	Number of stalks per m trench	Sugarcane productivity (t/ha)
DTS 50/135	393.0 a	287.0 a	2.76 a	24.0 a	6.7 a	20.8 a	1.62 a	8.41 a	13.0 a	114.2 a
STS 120	287.0 c	245.0 b	2.40 b	21.0 b	5.8 ab	21.5 a	1.45 b	8.75 a	11.0 b	98.8 b
STS 110 (control)	307.0 b	247.0 b	2.47 b	19.0 b	5.2 b	21.4 a	1.28 c	8.72 a	8.0 c	69.4 c
Coefficient of variation (CV)	3.18	5.47	5.39	7.36	12.27	2.70	6.12	3.33	7.65	2.92

Means followed by the same letter in the same column are not significantly different based on Tukey test, *p=0.0*

Furthermore, based on sugarcane productivity in each year cultivation, there were significant cane productivity improvement up to 40.8, 51.1 and 64.6%, respectively in IP, SR-1 and SR-2 affected by application of DTS 50/135 (Table 4). Lower improvement was noted on STS 120 compared to STS 110. Whereas based on cane productivity pattern from IP to SR-2, application of DTS 50/135 and STS 120 improved sugarcane productivity in SR-1 and reduced thereafter in the SR-2. Results of the study carried out from 2015 to 2017 were successfully revealed that DTS 50/135 was the most suitable planting method applied to improved growth and yield performances on PS.862 variety. High quality and productivivy of the sugarcane variety could be maintained up to SR-1 and declined with almost similar results in SR-2 compared to IP. The results also gave evident that sugarcane planting cyclus was only maintained for three years from IP to SR-2 and the sugarcane cultivation shall be initiated from the IP again.

Table 4. Percentage of sugarcane productivity improvement in IP, SR-1 and SR-2 (%)

Planting method	Improvement of sugarcane productivity on IP to SR-1 and SR-2 (%)		
	IP	SR-1	SR-2
DTS 50/135	40.8	51.1	64.6
STS 120	21.8	45.2	42.4
STS 110 (control)	0	0	0

Sugarcane farming economic analysis carried out it was also revealed that different planting methods gave significant different revenue-cost (R/C) ratios. Application of DTS 50/135 and STS 120 stimulated higher R/C than STS 110 in IP, SR-1 and SR-2. The both treatments had R/C ratio from 1.16 and 1.18 in IP than increased up to 1.94 and 1.99 in CR-1 and reduced thereafter down to 1.53 and 1.52, respectively (Table 5). Improvement of R/C ratio on IP was only 11.5% on DTS 50/135 and 13.5% on STS 120 compared to STS 110, however significant enhancement was noted on CR-1 with 18.3 and 21.3% then reduced with 10.1 and 9.4%, respectively (Table 5). Though the DTS 50/135 had lower R/C ratio than STS 120, total sugarcane productivity of DTS 50/135 was higher than STS 120. Results of the study indicated that application of DTS 50/135 and STS 120 improved farmer profit on sugarcane farming. The results can also make sure to cane farmers in applying the DTS 50/135 or STS 120 in increasing their profits.

Tabel 5. Partial farming economic analysis of sugarcane under different planting methods of DTS 50/135, STS 120 and STS 110 for PS.862 variety

Planting method	Total farming economic cost (Rp.000,-/ha^{-1})			Income (Rp.000,-/ha^{-1})			Profit (Rp.000,-/ha^{-1})			R/C ratio		
	PC	SR-1	SR-2	IP	SR-1	SR-2	IP	SR-1	SR-2	IP	SR-1	SR-2
DTS 50/135	55,642	44,278	44,622	64,563	85,894	68,400	8,920	41,616	23,778	1.16	1.94	1.53
STS 120	47,284	41,742	39,273	55,905	82,995	59,880	8,621	41,253	20,607	1.18	1.99	1.52
STS 110	22,820	15,464	15,464	23,660	25,420	21,514	840	9,956	6,050	1.04	1.64	1.39

Entirely from the study, it was successfully revealed that application of different planting methods from the existing planting method usually applid by farmers in Gedangdowo village, Jepon Subdistrict, Blora District, Central Java-Indonesia gave significant effect on growth and yield of PS.862 variety and farmer profits. From the study, it was importantly proved that DTS 50/135 was the best planting method significantly increased sugarcane productivity up to 129.12 t/ha in IP, 134.2 t/ha in SR-1 and 114.2 t/ha in SR-2 primarily due to higher productive tillers and number of stalks per m trench. Other studies revealed that the sugarcane yield of 87A298 variety in conventional planting method was 128.7 t/ha and increased up to 149.5 t/ha using trench method (spacing-30 cm width x 30 cm depth, 12 settlings with paired systems of planting) mainly affected by number of millable sugarcanes and number of shoots/ha (Gulati *et al.*, 2015), a double row CTC 50/170 cm + double seeds planting arrangement produced the highest sugarcane productivity of Bululawang variety and sugar yield up to 191.02 t/ha and 15.33 t/ha, respectively (Djumali *et al.*, 2016), the cane yield of CoS-8436 variety in conventional planting system produced 77.53 t/ ha and increased up to 82.50 tons/ha using paired row trench plantation technique primarily influenced by number of millable sugarcanes, sugarcane length and weight (Prem *et al.*, 2017), the maximum stripped sugarcane yields of 154.36 t/ha and 130.28 t/ha of CPF-247 variety mainly affected by number of millable sugarcanes and plant height in initial plant and ratoon crop, respectively were obtained from sugarcane planted at 120 cm trench planting both as sole as well as lentil intercropped (Nadeem *et al.*, 2020). Based on the results of the study and other researches it was clearly proved that application of double trench planting system that increased in number of productive tillers and millable sugarcanes successfully increased sugarcane productivity.

Application of new planting methods for improving sugarcane growth and yield performances that lead to increasing profits can give high effect to farmers in adopting and applying the proved planting method in their sugarcane farming activities. Improvement of sugarcane productivity due to applying the new planting methods were varied from low to high percentage productivity. In the study, application of DTS 50/135 planting method enhanced sugarcane productivity of PS.862 variety up to 40.8, 51.1 and 64.6%, respectively in IP, SR-1 and SR-2. In other results, percentage of sugarcane productivity improvement was noted up to 16.2% for 87A298 variety (Gulati *et al.*, 2015), 12.3% for Bululawang variety (Djumali et al., 2016), 6.4% for CoS-8436 variety (Prem *et al.*, 2017), 60.6% for CPF-247 variety. The percentage of improvement values gave evident that the new planting methods had high potential applied for further sugarcane farming activities by farmers.

High preferences of farmers to continue on applying new techniques for their sugarcane farmings are significantly affected by the existence of as high as profits they get in their final farming activities. From the previous studies, it was successfully revealed that application of new planting methods, especially paired or double trench system, increased varied-R/C ratio from 4 – 30%. Djumali *et al.* (2016) found that double row CTC 50/170 planting method induced R/C ratio up to 1.62 with 13.3% improvement compared to STS 110 in SR-1, the double rows cropping system led to additional revenue of Rp 4.67 million per hectare with marginal benefit cost ratio (MBCR) value of 1.79 with 4.4% improvement compared to conventional system (Hutahaean and Ernawanto, 2015), paired row trench plantation system had 2.70 benefit cost ratio (BCR) with 17.4% higher than conventional planting method (Prem *et al.*, 2017), 120 cm trench planting system stimulated BCR up to 1.98 with 29.4% increasing compared to conventional one (Nadeem *et al.*, 2020). In the study, R/C ratio of DTS 50/135 planting system was 1.16 in IP than increased up to 1.94 in SR-1 and reduced thereafter down to 1.53 in SR-2. Improvement of R/C ratio on IP was only 11.5% on DTS 50/135 and significant enhancement up to 18.3% was noted on SR-1 then reduced down to 10.1% on SR-2. However, the R/C ratio and improvement values were lower than STS 120 planting system in IP and SR-1.

Conclusions

Finally it can be concluded that improvement of sugarcane growth and yield performances via application of different planting methods and their partial economic analysis was successfully revealed in the study. DTS 50/135 was the most appropriate planting method to improve cane growth and yield performances of PS.862 variety and its economic analysis. The higher sugarcane growth and yield performances were primarily induced by number of productive tillers and number of stalks per m trench. Percentage of cane productivity was increased up to 40.8% in IP, 51.1% in SR-1 and 64.6% in SR-2. Higher results were also indicated by STS 120 than the STS 110. Higher R/C ratio was stimulated by STS 120 and DTS 50/135 than STS 110. Increasing R/C ratio from the planting method and DTS 50/135 was varied from 9.4 - 21.3% in the IP, SR-1 and SR-2 compared to STS 110 as planting method.

Authors' Contributions

B.H. contributed on research planning, executing till finishing and preparing research report. H and F.D.A took part in helping the research planning and data analyzing. S.M. and R.H.P. were involved in observing and taking research data. B.W. has important roles in rechecking, re-analyzing and fixing data performances; guiding authors in writing, reviewing and revising manuscript till manuscript ready for international journal submission; helping authors in selecting journal target, formatting, preparing supplement data for submission, helping in manuscript revision till proofreading.

All authors read and approved the final manuscript.

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Conflict of Interests

The authors declare that there are no conflicts of interest related to this article.

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