Performance of Promising Sugarcane Clones in Different Agro-Ecological Zones under Farmers' Field

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ABSTRACT

An experiment was conducted under farmer's field at Thakurgaon, Rajshahi, Kushtia, Chuadanga, Jamalpur and Chunarughat during 2014-2015 cropping season to evaluate the performance of promising sugarcane clones in different Agro-Ecological Zones (AEZ). Four sugarcane clones viz. I 133-07, I 200-07, I 207-08 and I 209-08 along with variety Isd 39 as check were included as factor one and six different locations were considered as factor two. The experiment was laid out in a randomized complete block design (RCBD) with three replications. The result revealed that both clones/variety and different locations had a significant effect on all parameters like tiller population, millable cane, yield and Brix%. Among the clones and variety highest number of tiller (196.24 x 103 ha^{-1}), millable cane (102.82 x 103 ha^{-1}) and yield (84.13 t ha^{-1}) was obtained from variety Isd 39 where as the highest Brix% (21.53) was found from clone I 200-07. Among the six different locations, the highest number of tiller was found at Thakurgaon (202.97 x 103 ha^{-1}) where as the highest number of millable cane was observed at Kushtia (202.97 x 103 ha^{-1}). The highest cane yield was recorded at Jamalpur (92.70 t ha^{-1}) and the highest Brix% was found at Rajshahi (21.87). Considering the all yield attributes variety Isd 39 perform better than the tested clones.

Key Words: Performance, clone, farmers' field, sugarcane

INTRODUCTION

On an average 4.5 million metric tons of sugarcane is produced annually from 0.12 million hectares of land in Bangladesh (FAO, 2012). The total production of sugar was 0.07 million tons and goor was about 0.4 million tons in 2010-2011 and the country imported 1.35 million tons of sugar (Patil and Patil, 2011). The minimum per capita consumption of sugar should be 13.0 kg or its equivalent quantity of 17.0 kg 'goor'. The total requirement of sugar is 1.95 million tons or 2.55 million tons of goor based on 150 million populations in the country. Our total production of sugar/goor is only 0.70 million ton. Therefore, there is a big gap of 1.25 million tons of sugar/goor in the country. In addition, presently average cane yield in Bangladesh is around 46 t ha^{-1} with average recovery of sugar is around 7.0%, which is quite low in comparison to other sugarcane growing countries. To fulfill the requirements, the country needs to import 1.3 million metric tons of sugar at the cost of hard earned foreign exchange. Development of location specific variety is useful tool for increasing sugarcane

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as well as sugar yield. The varieties developed by Bangladesh Sugarcrop Research Institute do not perform equally in all agro-ecological zones (Miah *et al.*, 1994). The sugarcane yield of a particular variety depends upon the heredity potential of the genotype and the environment where it is exposed during the course of its life cycle (Yadava, 1993). Variety of a crop plays an important role as regards to the yield and quality, sugarcane is no exception (Anon. 1978). Sugar industries in Bangladesh continuously need high yielding and high sugar content varieties. After a considerable period of cultivation sugarcane varieties show a tendency to decline in yield and vigor (Barnes, 1954 and Humbert, 1959). It is an obscure and puzzling problem to scientists, growers and processors. To maintain high yielding, it is necessary to replace varieties every few years with new clones (Poehlman and Barthakur, 1959). Yield trial of newly developed promising clones in the different agro-ecological zones especially in the farmer's field before releasing as varieties for commercially cultivation is very essential. So it is necessary to ensure the performance of a promising clone in particular locations before recommendation. Performance of promising clones under farmers condition is required to be submitted the NSB for approval as commercial cultivation. So, the present study was undertaken to ascertain the performance of promising clones as per requirement of National Seed Board (NSB) for releasing a new variety.

MATERIALS AND METHODS

The experiment was conducted at six locations viz. Thakurgaon (AEZ 1), Jamalpur (AEZ 9), Kushtia (AEZ 11), Chuadanga (AEZ 11), Rajshahi (Barind Tract, AEZ 26) and Chunarughat (Hobiganj, AEZ 30) during the cropping season 2014-2015. It was factorial experiment. Five sugarcane clones viz. I 133-07, I 200-07, I 207-08 a I 209-08 along with variety Isd 39 as standard (check) were included as factor one and six different locations were considered as factor two. The experiment was laid out in a randomized complete block design (RCBD) with three replications. Each location was divided into 15 unit plots where the treatment combinations were allocated at random. There were altogether 90 plots in the experiment. The unit plot size was 8m x 6m where row-to-row distance maintained 1 meter. The experiment was established from first week to fourth week of November 2014 in all the locations following STP (Poly bag settling) method. Urea, Triple Super Phosphate (TSP), Muriate of Potash (MoP) and Gypsum were used as the source of N, P, K and S, respectively. All fertilizers were applied as per BARC fertilizer recommendation guide, 2012. Full amount of TSP, Gypsum and one third of MoP were applied in trenches and thoroughly mixed with soil prior to settlings plantation. One third of Urea was applied as side dressing at 21 days after transplanting. The rest of MoP and Urea were applied in two equal splits at early tillering stage and late tillering phase of sugarcane. Intercultural operations were done as per required. Data were taken in the month of February, March, May, September, December and January. The cane at different locations was harvested from December 2015 to January 2016. Statistical analysis were done and mean values were compared using Least Significant Difference (LSD) at 5% level of probability (Gomez and Gomez, 1984)

RESULTS AND DISCUSSION

Tiller

Significant difference in tiller population was observed among the clones and variety. From table 1 it is observed that the highest tiller population was obtained from variety Isd 39 (196.24 x 10^3 ha^{-1}) which was significantly different from other clones while the lowest tiller population was observed from clone I 209-08 (112.48 x 10^3 ha^{-1}) which was statistically similar with clone I 200-07 (133.11 x 10^3 ha^{-1}) and clone I 133-07 (133.54 x 10^3 ha^{-1}). Variation in tiller production among the different clones/varieties was reported by Miah *et al.* (1994) and Rashid *et al.* (2001).

Table 1. Effect of clones/varieties on tiller, millable cane, yield and brix% of sugarcane

Clones/Variety	Tiller (x 10^3 ha^{-1})	Millable Cane (x 10^3 ha^{-1})	Yield (t ha^{-1})	Brix (%)
I 133-07	133.54 c	93.53 bc	74.72 bc	20.61 b
I 200-07	133.11 c	88.32 cd	72.23 cd	21.53 a
I 207-08	160.73 b	95.62 b	77.91 b	20.28 b
I 209-08	112.48 c	84.02 d	69.22 d	20.10 b
Isd 39	196.24 a	102.82 a	84.13 a	20.41 b
LSD (0.05)	22.05	5.38	3.78	0.58
CV (%)	22.45	8.69	7.48	4.19

Figures in a column having the same letter do not differed significantly as per DMRT

A significant difference in tiller population was found in different locations (Table 2). The highest tiller was observed at Thakurgaon (202.97 x 10^3 ha^{-1}) while the lowest tiller population was observed at Chunarughat (123.48 x 10^3 ha^{-1}) which was statistically similar with location Rajshahi (130.63 x 10^3 ha^{-1}), Kushtia (138.57 x 10^3 ha^{-1}), Jamalpur (141.99 x 10^3 ha^{-1}) and Chuadanga (145.69 x 10^3 ha^{-1}).

Table 2. Effect of different locations on tiller, millable cane, yield and Brix% of sugarcane

Locations	Tiller (x 10^3 ha^{-1})	Millable Cane (x 10^3 ha^{-1})	Yield (t ha^{-1})	Brix (%)
Thakurgaon	202.97 a	96.60 b	74.71 c	19.73 c
Rajshahi	130.63 b	69.65 d	66.89 d	21.87 a
Kushtia	138.57 b	124.10 a	83.66 b	20.67 b
Chuadanga	145.69 b	84.43 c	64.43 d	20.70 b
Jamalpur	141.99 b	85.88 c	92.70 a	20.15 bc
Chunarughat	123.48 b	96.49 b	71.47 c	20.43 b
LSD (0.05)	24.16	5.90	4.14	0.63
CV (%)	22.45	8.69	7.48	4.19

Figures in a column having the same letter do not differed significantly as per DMRT

Tiller population was significantly influenced by the interaction effect of clones/variety and different locations. The highest tiller population was obtained from variety Isd 39 at Thakurgaon (283.17 x 10^3 ha^{-1}) which was statistically similar with clone I 207-08 at same location. Almost all location variety Isd 39 and clone I 207-08 perform better. The Clone I 209-08 produced the lowest tiller almost all locations Chuadanga (81.53 x 10^3 ha^{-1}), Jamalpur (98.80 x 10^3 ha^{-1}), Chunarughat (107.20 x 10^3 ha^{-1}), Kushtia (126.58 x 10^3 ha^{-1}) and Thakurgaon (81.53 x 10^3 ha^{-1}) (Table 3). So, the result indicated that variety Isd 39 and clone I 207-08 had higher tiller producing capacity and Thakurgaon was high tiller producing area.

Table 3. Combined effect of clones/varieties and locations on tiller, millable cane, yield and brix% of sugarcane

Location	Clones/Variety	Tiller (x 10^3 ha^{-1})	Millable Cane (x 10^3 ha^{-1})	Yield (t ha^{-1})	Brix (%)
Thakurgaon	I 133-07	167.08 c-g	93.58 ghi	71.14 d-i	19.04 h
	I 200-07	164.17 c-h	87.47 hi	71.35 d-i	20.51 d-g
	I 207-08	256.67 ab	107.39 ef	74.16 c-h	19.35 gh
	I 209-08	143.75 e-j	85.83 hij	63.02 i-l	19.20 gh
	Isd 39	283.17 a	108.74 de	93.85 b	20.53 d-g
Rajshahi	I 133-07	132.37 e-j	67.76 m	69.88 f-k	22.00 abc
	I 200-07	121.44 f-k	69.70 lm	61.28 jkl	23.00 a
	I 207-08	110.43 h-k	72.76 j-m	60.81 kl	22.00 abc
	I 209-08	117.00 h-k	66.92 m	66.92 g-k	22.33 ab
	Isd 39	171.89 cdef	71.09 klm	75.53 c-g	20.00 fgh
Kushtia	I 133-07	135.45 e-j	124.01 b	79.40 c-e	20.53 d-g
	I 200-07	134.07 e-j	123.17 bc	74.44 c-h	21.40 b-f
	I 207-08	140.52 e-j	121.14 bcd	92.44 b	20.60 c-g
	I 209-08	126.58 f-k	110.24 cde	79.86 cd	20.60 c-g
	Isd 39	156.22 d-i	141.91 a	92.15 b	20.20 d-g
Chuadanga	I 133-07	118.23 f-k	89.13 hi	56.50 l	21.50 c-e
	I 200-07	134.60 e-j	82.33 i-l	74.17 c-h	22.28 ab
	I 207-08	181.77 cde	83.50 ijk	62.60 i-l	20.14 e-h
	I 209-08	81.53 k	74.00 j-	57.10 l	19.45 gh
	Isd 39	212.33 bc	93.20 ghi	71.77 d-i	20.11 e-h
Jamalpur	I 133-07	128.06 e-k	93.07 ghi	96.67 ab	20.00 fgh
	I 200-07	127.32 f-k	72.57 klm	81.71 c	20.53 d-g
	I 207-08	149.94 e-j	93.81 ghi	99.62 ab	19.60 gh
	I 209-08	98.80 jk	71.74 klm	79.77 cd	19.00 h
	Isd 39	205.81 bcd	98.24 e-h	105.72 a	21.60 a-d
Chunarughat	I 133-07	120.03 f-k	93.60 ghi	74.70 c-h	20.60 c-g
	I 200-07	117.08 g-k	94.65 f-i	70.46 e-j	21.50 c-e
	I 207-08	125.06 f-k	95.12 f-i	77.80 c-f	20.00 fgh
	I 209-08	107.20 ijk	95.36 f-i	68.65f-k	20.03 fgh
	Isd 39	148.01 e-j	103.73 efg	65.74 h-l	20.03 fgh
LSD (0.05)	-	NS	NS	9.25	1.41
CV (%)	-	22.45	8.69	7.48	4.19

Figures in a column having the same letter do not differed significantly as per DMRT

Millable cane

Significant difference in millable cane was observed among the clones and variety (Table 1). The highest number of millable cane was recorded from variety Isd 39 (102.82 x 10^3 ha^{-1}) which was significantly different from other clones while the lowest milable cane was observed from clone I 209-08 (84.02 x 10^3 ha^{-1}) which was statistically similar with clone I 200-07 (88.32 x 10^3 ha^{-1}). The result corroborated with the findings of Miah *et al* (1986) who found variation in number of millable cane production while studied the performance of some promising clones/varieties.

A significant difference in millable cane was found in different locations (Table 2). The highest millable cane was found at Kushtia (124.10 x 10^3 ha^{-1}) followed by Thakurgaon (96.60 x 10^3 ha^{-1}) and Chunarughat (96.49 x 10^3 ha^{-1}) while the lowest millable cane was observed at Rajshahi (69.65 x 10^3 ha^{-1}).

Significant variation was observed in millable cane with the interaction effect of clones/variety and different locations. The highest millable cane was obtained from variety Isd 39 (141.91 x 10^3 ha^{-1}) at Kushtia followed same variety at Thakurgaon (108.74 x 10^3 ha^{-1}) and Chunarughat (103.73 x 10^3 ha^{-1}). The lowest millable cane was found from clone I 209-08 (66.92 x 10^3 ha^{-1}) at Rajshahi which was statistically similar with clone I 133-07 (67.76 x 10^3 ha^{-1}) at same location. So, the result suggested that variety Isd 39 had high millable cane producing capacity and Kushtia was high millable cane producing area.

Yield

Clones and variety had significant influence on yield (Table 1). The highest cane yield was obtained from the variety Isd 39 (84.13 t ha^{-1}) followed by clone I 207-08 (77.91 t ha^{-1}) and clone I 133-07 (74.72 t ha^{-1}). The lowest cane yield was observed in clone I 209-08 (69.22 t ha^{-1}). The cane yield variation among the clones and varieties due to yield producing attributes. The findings of the present experiment was in agreement with Singh *et al.* (1999) and Arvind *et al.* (1997) where they found variation in cane yield among different varieties.

A significant difference in yield of cane was found in different locations (Table 2). The highest cane yield was recorded at Jamalpur (92.70 t ha^{-1}) followed by Kushtia (83.66 t ha^{-1}) and Thakurgaon (74.71 t ha^{-1}) while the lowest cane yield was found at Chuadanga (64.43 t ha^{-1}) which was statistically similar with Rajshahi (66.89 t ha^{-1}). All promising clones and variety showed better performance at Jamalpur and Kushtia as compared to other locations. From the above findings it can be concluded that varietal yield potentiality depends on the agro-climatic condition of the specific location.

Significant variation was observed in yield of cane with the interaction effect of clones/variety and different locations. The highest cane yield was obtained from variety Isd 39 (105.72 t ha^{-1}) at Jamalpur which was statistically similar with clone I 207-08 (99.62 t ha^{-1}) and clone I 133-07 (96.67 t ha^{-1}) at th e same location followed by

variety Isd 39 (93.85 t ha^{-1}) at Thakurgaon and clone I 207-08 (92.44 t ha^{-1}) and variety Isd 39 (92.15 t ha^{-1}) at Kushtia. The lowest cane yield was recorded from clone I 133-07 (56.50 t ha^{-1}) at Chuadanga which was statistically similar with clone I 209-08 (57.10 t ha^{-1}) at same location followed by clone I 207-08 (60.81 t ha^{-1}) and clone I 200-07 (61.28 t ha^{-1}) at Rajshahi (Table 3).

Brix (%)

Higher Brix (%) of any variety/clone is an indication to produce higher sugar. Significant difference in Brix (%) was observed among the clones and variety (Table 1). The highest Brix (%) was recorded from clone I 200-07 (21.53) while the lowest Brix (%) was observed from the clone I 209-08 (20.10%) which was statistically similar with clone I 207-08 (20.28), Isd 39 (20.41) and clone I 133-07 (20.61).

A significant difference in Brix (%) was found in different locations (Table 2). The highest Brix (%) was observed at Rajshahi (21.87) while the lowest Brix (%) was found at Thakurgaon (19.73) which was statistically similar at Jamalpur (20.15)

Interaction effect of clones/variety and different locations exhibited significant variation on Brix (%). The highest Brix (%) was obtained from clone I 200-07 (23.00%) at Rajshahi. The lowest Brix (%) was found from clone I 209-08 (19.00%) at Jamalpur which was statistically similar with clone I 133-07 (19.04%) and clone I 209-08 (19.20%) at Thakurgaon (Table 3).

The experiment results revealed that both clones/variety and different locations had a significant effect on all yield parameters like tiller population, millable cane, yield and Brix%. Among the clones and variety the highest number of tiller (196.24 x 10^3 ha^{-1}), millable cane (102.82 x 10^3 ha^{-1}) and yield (84.13 t ha^{-1}) was obtained from variety Isd 39 where as the highest Brix% (21.53) was found from clone I 200-07. Among the six different locations, the highest number of tiller was found at Thakurgaon (202.97 x 10^3 ha^{-1}) where as the highest number of millable cane was observed at Kushtia (202.97 x 10^3 ha^{-1}). The highest cane yield was recorded at Jamalpur (92.70 t ha^{-1}) and the highest Brix (%) was found at Rajshahi (21.87). Considering the all yield attributes variety Isd 39 perform better than tested clones. From the above findings it may be concluded that no clone is suitable for releasing as variety.

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