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On-farm Evaluation of Promising Sugarcane Clones in Different Agro-Ecological Zones

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ABSTRACT

An experiment was conducted in farmers' field at Chunarughat, Joypurhat, Kushtia and Chuadanga under irrigated condition during 2012-2013 cropping season to evaluate the performance of promising sugarcane clones in different Agro-Ecological Zones (AEZ). Five sugarcane clones namely I 39-04, I 223-06, I 310-06, I 347-06, Isd 18 (T_2) along with variety Isd 39 as check were included as factor one and four different locations were considered as factor two. The experiment was laid out in a randomized complete block design (RCBD) with three replications. The results revealed that both clones/variety and different locations had significant effect on all parameters like tiller population, millable cane population, yield and brix %. Among the clones and variety, the highest number of tiller and millable cane population was observed from clone I 223-06, I 347-06, Isd 18 (T_2) and variety Isd 39. The highest cane yield and brix(%) was attained from variety Isd 39 followed by clone I 223-06 and I 39-04. Among the four different locations, the highest number of tiller and millable cane was observed at Chuadanga and Kushtia but the highest cane yield was recorded at Joypurhat and the highest brix (%) was recorded at Chunarughat. Although the variety Isd 39 performed better in respect of yield and brix (%), clone I 223-06, I 347-06, Isd 18 (T_2) also performed well in few locations. So, these three clones can be trialed again to develop as varieties.

Key words: Sugarcane clone, tiller, millable cane, brix (%), yield

INTRODUCTION

The varieties of sugarcane developed by Bangladesh Sugarcane 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. 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 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 character, it is necessary to replace varieties every few years with new clones (Poehlman and Barthakur, 1959). Yield trial of newly developed promising clones

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in the different agro-ecological zones especially in the farmer's field is deemed imperative before releasing as varieties for commercial cultivation. 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 submit at the National Seed Board (NSB) for approval as commercial varieties. Therefore, the present study was undertaken to ascertain the performance of promising clones for the process of variety release.

MATERIALS AND METHODS

The experiment was conducted at four locations namely Chunarughat (Hobiganj, AEZ 30), Chuadanga (AEZ 11), Kushtia, (AEZ 11) and Joypurhat (AEZ 3) during the cropping season 2012-13. It was a factorial experiment. Five sugarcane clones namely I 39-04, I 223-06, I 310-06, I 347-06 and Isd 18 (T_2) along with variety Isd 39 as standard (check) were included as factor one and four 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 18 unit plots where the treatment combinations were allocated at random. There were altogether 72 plots in the experiment. The area of each unit plot was 8m x 6m where row to row and plant to plant distance maintained 1m and 45cm respectively. The experiment was established from first week to fourth week of November 2012 in all the locations following bag settlings. 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, 2005. 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 stage of sugarcane. Intercultural operations were done when required. Data on different parameters were taken in the month of February, March, May, September, December and January. The cane at different locations was harvested last week of December 2013 to second week of January 2014. Statistical analyses 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 clone I 223-06 (182.04 $x10^3$ ha^{-1}) which was statistically similar with clone I 347-06 (176.04 $x10^3$ ha^{-1}) and variety Isd 39 (171.62 x 10^3 ha^{-1}) while the lowest tiller population was observed from clone Isd 18(T_2) (153.52 x 10^3 ha^{-1}) which was statistically similar with clone I 310-06 (156.39 x 10^3 ha^{-1}) and I 39-04 (159.61 x 10^3 ha^{-1}). Variation in tiller production among the different clones/varieties was also 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 ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Yield (t ha^{-1})	Brix %
I 39-04	159.61bc	96.79c	81.06bc	20.59b
I 223-06	182.04a	106.40a	82.49b	20.36bc
I 310-06	156.39c	98.76bc	78.47cd	19.28d
I 347-06	176.04a	105.44a	77.99d	20.17bc
Isd 18(T_2)	153.52c	106.83a	77.39d	19.73cd
Isd 39	171.62ab	103.74ab	95.29a	21.68a
LSD (0.05)	12.13	6.48	3.02	0.69
CV (%)	8.86	7.65	4.48	4.13

* 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 Chuadanga (216.16 x 10^3 ha^{-1}) which was statistically similar with location Kustia (207.69 x 10^3 ha^{-1}) while the lowest tiller population was observed at Chunarughat (153.52 x 10^3 ha^{-1}).

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

Locations	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Yield (t ha^{-1})	Brix %
Chunarughat	102.67c	83.06c	73.55d	21.01a
Joypurhat	139.62b	89.63b	93.16a	20.82ab
Kustia	207.69a	118.72a	89.61c	19.03c
Chuadanga	216.16a	120.57a	82.13b	20.33b
LSD (0.05)	9.90	5.29	2.47	0.56
CV (%)	8.86	7.65	4.48	4.13

* Figures in the 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 clone I 347-06 (236.44 $x10^3$ ha^{-1}) at Chuadanga which was statistically similar with clone I 39-04 (224.64 $x10^3$ ha^{-1}), variety Isd 39 (221.05 x 10^3 ha^{-1}), clone I 223-06 (216.29 $x10^3$ ha^{-1}) at Chuadanga and I 347-06 (224.01 x 10^3 ha^{-1}) and I 223-06 (212.47 $x10^3$ ha^{-1}) at Kustia. The lowest tiller population was observed from clone I 310-06 (83.48 x 10^3 ha^{-1}) which was statistically similar with clone I 39-04 (90.41 x 10^3 ha^{-1}) at Chunarughat (Table 3). So, the result indicated that clone I 223-06, I 347-06 and variety Isd 39 had high tiller producing capacity and Chuadanga and Kustia were high tiller producing area.

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

Location	Clones/Variety	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Yield (t ha^{-1})	Brix %
Chunarughat	I 39-04	90.41ij	77.00 I	82.11f-h	21b-e
	I 223-06	113.24f-i	77.17kl	69.53ij	20.33c-f
	I 310-06	83.48j	75.00 I	69.17ij	29.33f-i
	I 347-06	110.57g-i	77.17kl	68.75ij	19.73e-h
	Isd 18(T_2)	110g-i	102.00f-i	67.92ij	21.50bc
	Isd 39	108.33hi	90.00i-j	83.85e-h	24.22a
Joypurhat	I 39-04	119.10e-h	77.20kl	82.37f-h	22.09b
	I 223-06	185.77d	100.63g-i	102.07ab	20.33c-f
	I 310-06	138.80e	81.07j-k	94.37cd	20.36c-f
	I 347-06	133.13e-g	96.40g-i	86.87ef	20.34bc
	Isd 18(T_2)	125.73e-h	90.37ij	88.00ef	18.87g-i
	Isd 39	135.20ef	92.13h-j	105.27a	21.94b
Kustia	I 39-04	204.30b-d	119.34a-d	89.45h	18.07i
	I 223-06	212.47a-c	119.18a-d	71.28i	19.00f-i
	I 310-06	201.39b-d	115.65b-e	79.30h	18.53hi
	I 347-06	224.01ab	121.26a-c	86.24e-g	19.27f-i
	Isd 18(T_2)	182.10d	107.74d-g	64.58j	19.93d-g
	Isd 39	221.88ab	129.19a	96.82bc	19.40f-i
Chuadanga	I 39-04	224.64ab	113.61c-f	80.31gh	21.22b-d
	I 223-06	216.69a-c	128.61a	87.08ef	21.78b
	I 310-06	201.86b-d	123.33a-c	71.04i	18.89g-i
	I 347-06	236.44a	126.94ab	70.10ij	20.33c-f
	Isd 18(T_2)	196.26cd	127.22ab	89.06de	18.61g-i
	Isd 39	221.05ab	103.67e-h	95.21c	21.17b-d
LSD (0.05)	-	24.25	12.96	6.04	1.38
CV (%)	-	8.86	7.65	4.48	4.13

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

Millable cane

Significant difference in millable cane population was observed among the clones and variety (Table 1). The highest number of millable cane was recorded from the clone Isd 18 (T_2) (106.83 $x10^3$ ha^{-1}) which was statistically similar with clone I 223-06 (106.40 $x10^3$ ha^{-1}), I 347-06 (105.44 $x10^3$ ha^{-1}) and variety Isd 39 (103.74 $x10^3$ ha^{-1}). The lowest millable cane population was observed from clone I 39-04 (96.79 $x10^3$ ha^{-1}) which was statistically at par with clone I 310-06 (98.96 $x10^3$ ha^{-1}). The result is in agreement 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 population was found in different locations (Table 2). The highest millable cane population was found in Chuadanga (120.57 $x10^3$ ha^{-1}) which was statistically similar with location Kustia (118.72 $x10^3$ ha^{-1}) while the lowest millable cane population was observed at Chunarughat (83.06 $x10^3$ ha^{-1}).

Significant variation was observed in millable cane population with the interaction effect of clones/variety and different locations. The highest millable cane was obtained from variety Isd 39 (129.19 $x10^3$ ha^{-1}) at Kustia which was statistically similar with clone I 223-06 (128.61 $x10^3$ ha^{-1}), Isd 18 (T_2) (127.22 x 10^3 ha^{-1}), I 347-06 (126.94 $x10^3$ ha^{-1}), 310-06 (123.33 $x10^3$ ha^{-1}) at Chuadanga and I 347-06 (121.26 $x10^3$ ha^{-1}), I 39-04 (119.34 $x10^3$ ha^{-1}), 223-06 (119.18 $x10^3$ ha^{-1}) at Kustia. The lowest millable cane population was obtained from clone 310-06 (75.00 x 10^3 ha^{-1}) which was statistically similar with clone I 39-04 (77.00 x 10^3 ha^{-1}), 223-06 (77.17 $x10^3$ ha^{-1}), I 347-06 (77.17 $x10^3$ ha^{-1}) at Chunarughat and I 39-04 (77.20 $x10^3$ ha^{-1}) at Joypurhat (Table 3). So, the result suggested that clone Isd 18 (T_2), I 347-06, I 223-06 and variety Isd 39 had high millable cane producing capacity and Chuadanga and Kustia were 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 (95.29 t ha^{-1}) followed by clone I 223-06 (82.49 t ha^{-1}) and I 39-04 (81.06 t ha^{-1}), respectively. The lowest cane yield was observed in clone 18 (T_2) (77.39 t ha^{-1}) which was statistically similar with I 347-06 (77.99 t ha^{-1}) and clone I 310-06 (78.47 t ha^{-1}). The cane yield variation among the clones and varieties might be due to the cumulative effect of yield contributing attributes. The findings of the present experiment is in agreement with Singh *et al.* (1999) and Arvind *et al.* (1997) where they found variation in cane yield among different varieties. Number of tiller ha^{-1} and stalk weight have some positive effect in increasing cane yield among the test clones/varieties in the experiment.

A significant difference in yield of cane was found in different locations (Table 2). The highest cane yield was recorded at Joypurhat (93.16 t ha^{-1}) followed by Kustia (89.61 t ha^{-1}) and Chuadanga (82.13 t ha^{-1}) respectively while the lowest cane yield was observed at Chunarughat (73.55 t ha^{-1}). All promising clones and variety showed better performance at Joypurhat and Kustia 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 (105.27 t ha^{-1}) at Joypurhat which was statistically similar with clone I 223-06 (102.07 t ha^{-1}) at same location. The lowest cane yield was observed from clone 18 (T_2) (64.58 t ha^{-1}) at Kustia which was statistically similar with clone 18 (T_2) (67.92 t ha^{-1}) I 347-06 (68.75 t ha^{-1}), I 310-06 (69.17 t ha^{-1}) and 223-06 (69.53 t ha^{-1}) at Chunarughat and I 347-06 (70.10 t ha^{-1}) at Chuadanga (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 Isd 39 (21.68%) while the lowest brix(%) was

observed from the clone I 310-06 (19.28%) which was statistically similar with clone Isd 18 (T_2) (19.73%).

A significant difference in brix(%) was found in different locations (Table 2). The highest brix(%) was observed at Chunarughat (21.01%) which was statistically similar with location Joypurhat (20.82%) while the lowest brix(%) was observed at Kustia (19.03%).

Interaction effect of clones/variety and different locations exhibited significant variation on brix(%). The highest brix(%) was obtained from variety Isd 39 (24.22%) at Chunarughat. The lowest brix(%) was observed from clone I 39-04 (18.07%) at Kustia which was statistically similar with clone I 310-06 (18.53%) at same location, Isd 18 (T_2) (18.61%), I 310-06 (18.89%) at Chuadanga and Isd 18 (T_2) (18.87%) at Joypurhat (Table 3).

The experimental results revealed that both clones/variety and different locations had a significant effect on all parameters like tiller population, millable cane population, yield and brix %. Among the clones and variety, highest number of tiller and millable cane population was observed from clone I 223-06, I 347-06, Isd 18 (T_2) and variety Isd 39. The highest cane yield and brix(%) was observed from variety Isd 39 followed clone I 223-06, I 347-06. Among the four different locations, the highest number of tiller and millable cane was observed at Chuadanga and Kushtia but the highest cane yield was noted at Joypurhat and the highest brix(%) was noted at Chunarughat. Although variety Isd 39 performs better in respect of yield and brix (%), clone I 223-06, I 347-06, Isd 18 (T_2) also performed well in few locations. So, these three clones can be further investigated to develop variety.

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