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Research Article

Suitability of Newly Released Sugarcane Varieties in Farmers Field Condition under High Ganges River Floodplain of Bangladesh

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Abstract

A field experiment was conducted in farmer's field of two locations under High Ganges River Floodplain (AEZ-11) of Bangladesh during 2013-2014 cropping season for evaluating the comparative suitability regarding yield and economic performances of six newly released sugarcane varieties viz, Isd 34, Isd 36, Isd 37, Isd 38, Isd 39 and Isd 40 with the old popular variety Isd 16. The experiment was laid out in a Randomized Complete Block (RCB) design with three replications. At Chuadanga the highest cane yield of 112.54 t ha-1 was obtained in Isd 37 which is statistically similar with Isd 39 and Isd 40 and the lowest yield was obtained in Isd 34. But at Jessore the maximum yield of 110.19 t ha-1 was recorded from Isd 39 followed by Isd 37 (99.22 t ha-1) and the minimum from Isd 36. Similarly, the newly released varieties Isd 37, Isd 39 and Isd 40 gave higher economic return compared to old variety Isd 16 in High Ganges River Floodplain of Bangladesh. Therefore, these three sugarcane varieties can be cultivated in this area with recommended management practices for acquiring higher yield and economic benefit.

ABBREVIATIONS

Isd: Ishurdi; TSP: Triple Super Phosphate; MoP: Muriate of Potash; AEZ: Agro Ecological Zone; WP: Wettable Powder; GR: Granular; DMRT: Duncan Multiple Range Test; T ha^{-1}: Ton per Hectare; NS: Not Significant; LSD: Least Significant Difference; T kt^{-1}: Taka Per Ton

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) one of the most important crops in tropical and sub-tropical countries, is the first major sugar crop worldwide. In Bangladesh, sugarcane is one of the most important cash-cum industrial crops. It covers 0.11 million hectares of land with a total annual production of 4.43 million metric tons [1]. The sugarcane yield of a particular variety depends upon the heredity potential of the genotype and the environment where it is exposed the course of its life cycle [2]. Variety of a crop plays an important role as regards to the yield and quality, sugarcane is no exception [3]. Although most of the varieties of sugarcane now grown in the sugar mill zones of Bangladesh are recommended for cultivation but a promising variety may not show better performance in all the ecological zones due to variations of agro-climatic factors [4]. Sugarcane varieties which were developed in late fifties and eighties namely Isd 2-54 and Isd 16 are still occupying a major part of total cane acreage both in mill and non-mill zone of Bangladesh [5]. The progress of dissemination of latest developed sugarcane varieties is very low in all the mills zone of Bangladesh. On the other hand, sugar cane varieties gradually degenerate over a considerable period of cultivation and show a tendency to decline yield and vigor [6,7]. In Bangladesh, the average yield of cane is 45.81 t ha^{-1} which is the lowest compared to other cane producing countries [8]. There are number of reasons for lower cane yield and one of those is the planting of low yielding varieties. Adoption of high yielding varieties and improved production packages are highly demanding in order to enhance productivity and profitability of commercial scale sugarcane cultivation [9]. Due to the above reasons dissemination of newly released varieties is of utmost importance in sugar mill as well as farmers field of Bangladesh. The area of High Ganges River Floodplain (AEZ-11) is 13.21 million hectare comprising of 43% highland, 32% medium highland, 12% medium lowland, 2% lowland and 11% homestead and water bodies [10]. This is the largest sugarcane producing zone of Bangladesh. Therefore, the field experiment was undertaken to evaluate the comparative suitability regarding yield and economic performances of some newly

released sugarcane varieties with the old popular variety Isd 16 at farmer's field condition under High Ganges River Floodplain.

MATERIALS AND METHODS

The experiment was conducted in farmer's field of Uthali, Chuadanga and Baro Bazar, Jessore under High Ganges River Floodplain (AEZ-11) during 2013-2014 cropping season. The land was medium high and the soil was typical loamy with pH 7.5. The experiment was laid out in a Randomized Complete Block (RCB) design with three replications. Six newly released sugarcane varieties such as Isd 34, Isd 36, Isd 37, Isd 38, Isd 39, Isd 40 and one older popular variety Isd 16 were included as treatments. The unit plot size was 8m×8m where one meter row to row distance was maintained. After well preparation of land 25 cm deep trenches were made by spade. Plantation was done on 6th November, 2013 with two budded setts after treating with Bavisitn 50 WP for 30 minutes. Urea, TSP, MoP, gypsum and zinc sulphate were applied @ 326, 253, 180, 189 and 10 kg ha^{-1} respectively. One third of urea and MoP and full doses of other fertilizers were applied in the trenches before planting and mixed properly with soil by spade. The rest amount of urea and MoP were applied as side dressings at 120 and 150 days after planting in two equal splits. Application of Regent 3GR @ 20 kg ha^{-1} and Furadan 5GR @ 40 kg ha^{-1} were done during basal and side dressings of fertilizers respectively. Other intercultural operations like weeding, irrigation, mulching, earthing up, tying and cultural control of insect pest etc. were done as and when required. Data were collected at different growth stages of crop. Brix reading was taken by hand refractometer from standing cane at proper maturity. The crop was harvested on 19th December, 2014. Collected data were compiled and tabulated in proper form and were subjected to statistical analyses using the computer package Statistix 10 program for Windows version. Finally economic analysis was done following standard procedure to assess the income earned from different cane varieties.

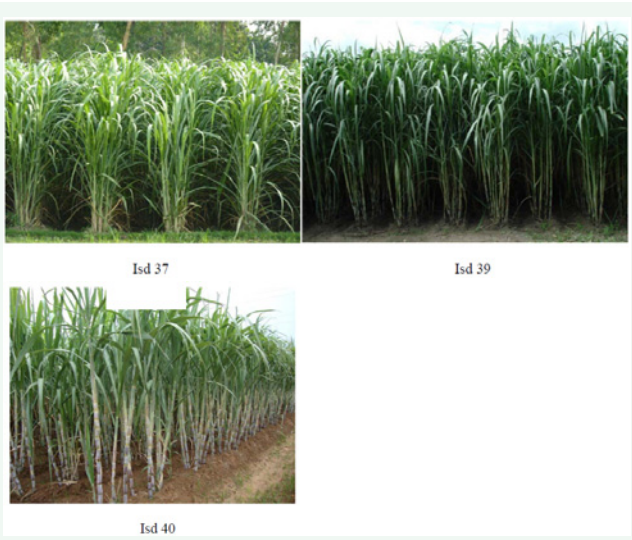

Figure 1 Sugarcane varieties showing better performance in High Ganges River Floodplain.

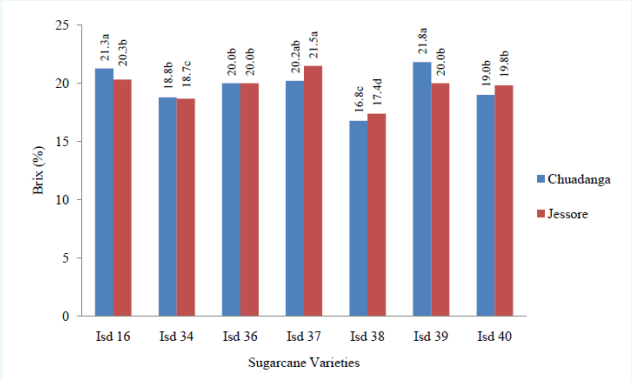

Figure 2 Brix (%) of the tested sugarcane varieties in Chuadanga and Jessore.

RESULTS AND DISCUSSION

Tiller population

Tillering is the most desirable character of sugarcane from farmers' point of view. Good tillering ensures good yields and better ratoon ability of a sugarcane crop [11]. Data presented in table 1 showed that there was significant difference in tiller population among the sugarcane varieties at both locations. At Chuadanga, the highest number of tiller populations was obtained from the variety Isd 34 (252.64×10^3 ha^{-1}) which was statistically similar with Isd 39 (247.99×10^3 ha^{-1}) and Isd 40 (245×10^3 ha^{-1}) while the lowest number (192.08×10^3 ha^{-1}) from Isd 16. On the other hand, At Jessore Isd 39 produced the highest number of tiller (326.11×10^3 ha^{-1}) followed by Isd 34, Isd 38 and Isd 40. The lowest number of tiller (181.11×10^3 ha^{-1}) was produced by Isd 37 (Figure 1). Variation in tiller population among different varieties could be probably attributed to the differences in the genetic makeup of the varieties [12]. The results are also supported by [1,16].

Millable cane

Effective tillers at proper maturity regarded as millable cane [13], reported that millable canes are most important yield contributing parameters. Data on number of millable cane at Chuadanga showed that there was no significant difference in number of millable cane among the varieties. However at Jessore, there was a significant difference among the varieties in case of number of millable cane. The maximum number of millable cane (135.42×10^3 ha^{-1}) was recorded from the variety Isd 34 followed by Isd 40 and Isd 38 while the minimum number (93.89×10^3 ha^{-1}) was obtained from Isd 36. The maximum number of millable cane production might be due to the higher number of tiller population. Similar results on millable cane production were also reported by [14-16].

Brix

Brix is the percent amount of sugars and minerals dissolved in water. However, many other chemicals may be present and contribute some small factor to the brix reading. The tested sugarcane varieties exhibited variation in brix (%) at both locations (Figure 2). At Chuadanga, the highest brix% was found in Isd 39 (21.8) followed by Isd 16 (21.3) while at Jessore, the highest brix% was found in Isd 37 (21.5) followed by Isd 16

Table 1: Number of tiller, number of millable cane and cane yield of the tested sugarcane varieties in Chuadanga and Jessore.

Treatments (sugarcane varieties)	Chuadanga			Jessore		
	No. of tiller (10^3 ha^{-1})	No. of millable cane (10^3 ha^{-1})	Cane yield (t ha^{-1})	No. of tiller (10^3 ha^{-1})	No. of millable cane (10^3 ha^{-1})	Cane yield (t ha^{-1})
Isd 16	192.08b	106.53	91.91bc	243.33bc	99.24d	77.50cd
Isd 34	252.64a	113.33	81.34cd	285.83ab	135.42a	65.33de
Isd 36	208.54b	87.50	82.78cd	190.56c	93.89d	55.76e
Isd 37	214.24b	108.47	112.54a	181.11c	103.27cd	99.22ab
Isd 38	213.19b	90.84	72.54d	283.89ab	121.34ab	59.34e
Isd 39	247.99a	95.00	105.69ab	326.11a	115.98bc	110.19a
Isd 40	245.00a	105.33	102.22ab	281.11ab	122.09ab	84.39bc
LSD (0.05)	26.67	NS	17.92	73.62	14.99	16.03

Figures in different columns accompanied by similar letters do not differ significantly as per DMRT at 0.05 levels.

Table 2: Economic analysis of the tested sugarcane varieties in Chuadanga and Jessore.

Treatments (sugarcane varieties)	Total production cost (Tk. ha^{-1})	Chuadanga			Jessore		
		Gross return (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})	Benefit cost ratio (BCR)	Gross return (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})	Benefit cost ratio (BCR)
Isd 16	1,20,000	2,29,775	1,09,775	1.91	1,93,750	73,750	1.64
Isd 34	1,20,000	2,03,350	83,350	1.69	1,63,325	43,325	1.36
Isd 36	1,20,000	2,06,950	86,950	1.72	1,39,400	19,400	1.16
Isd 37	1,20,000	2,81,350	1,61,350	2.34	2,48,050	1,28,050	2.07
Isd 38	1,20,000	1,81,350	61,350	1.51	1,48,350	28,350	1.24
Isd 39	1,20,000	2,64,225	1,44,225	2.20	2,75,475	1,55,475	2.30
Isd 40	1,20,000	2,55,550	1,35,550	2.13	2,10,975	90,975	1.76

Price of sugarcane: 2500.00 Tk. t^{-1}

(20.3). At both locations, the lowest brix% was recorded in Isd 38. Higher brix percentage of any variety is an indication for the production of higher sugar, jaggery and bio-fuel.

Cane yield

Cane yield is the contribution of several attributes like tiller, millable cane, stalk length and girth of cane. It is evident from the Table 1 that at Chuadanga, the highest yield of 112.54 t ha^{-1} was obtained in Isd 37 which is statistically similar with Isd 39 (105.69 t ha^{-1}) and Isd 40 (102.22 t ha^{-1}) and the lowest yield was obtained in Isd 34. But at Jessore the maximum value of 110.19 t ha^{-1} was recorded from Isd 39 followed by Isd 37 (99.22 t ha^{-1}) and the minimum from Isd 36. The varying response of sugarcane varieties may be attributed to genetic varying potential under the prevailing environmental conditions [17].The findings are also in agreement with [18].

Economic analysis

Economic performance of different sugarcane varieties is presented in Table 2. Gross margin is the difference between gross return and total production cost, and BCR is the ratio of the gross return and total production cost. At Chuadanga the highest gross return (2, 81,350 Tk. ha^{-1}), gross margin (1,61,350 Tk. ha^{-1}) and BCR (2.37) was achieved from cultivating Isd 37 followed by Isd 39 and Isd 40. The lowest economic return was recorded from Isd 38. However at Jessore, the highest gross return (2,75,475 Tk. ha^{-1}), gross margin (1,55,475 Tk. ha^{-1}) and BCR (2.30) was achieved from Isd 39 followed by Isd 37 and Isd 40. Therefore, Isd 37, Isd 39 and Isd 40 were found economically superior varieties compared to Isd 16.

CONCLUSION

From the above results and discussions, it is evident that the newly released sugarcane varieties Isd 37, Isd 39 and Isd 40 showed better performance regarding yield and economic return compared to the old variety Isd 16 in High Ganges River Floodplain (AEZ-11) of Bangladesh. Therefore, cultivation of these three sugarcane varieties with recommended management practices can be followed in this area for acquiring higher yield and economic benefit.

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