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Performance of Some Exotic Tropical Sugarbeet Genotypes under Agro-climatic Conditions of Bangladesh

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ABSTRACT

Sugarbeet is an important sugar producing crop in the world. Generally sugarbeet is grown in temperate regions but now-a-days some genotypes were introduced which can grow in tropical and subtropical regions in the world which is called tropical sugarbeet variety. As sugarbeet is a short duration (150-180 days) crop, so if we can introduce sugarbeet in Bangladesh, sugar production will be increased with a great extent. Before introducing sugarbeet we have to select suitable genotypes of sugarbeet which can grow well in Bangladesh agro-climatic conditions. A comparative study was conducted to assess the performance of 11 (eleven) exotic tropical sugarbeet genotypes viz.,Cauvery, Shubrha, HI 0044, HI 0473, SZ 35, PAC 60008, SV_1, Danicia, Aranka, Sereneda, Natura at Bangladesh Sugarcrop Research Institute (BSRI) farm, Pabna during the rabi season of 2013-2014 following randomized complete block design with three replications. Sugarbeet genotypes showed different behavior with respect to size, shape, beet yield and brix % of beet. Among the genotypes of sugarbeet the highest yield (98.80 tha^{-1}), brix % (18.48) and pol% (10.08) obtained from the genotype Aranka and the lowest from PAC 60008 (72.94 tha^{-1}). But in case of brix % and pol% of beet all other cultivar were shown statistically similar. The overall results revealed that the tropical sugarbeet genotypes Aranka, Cauvery, SZ 35, Danicia, Sereneda, Natura can be grown successfully in Bangladesh.

Key words: Tropical sugarbeet, pol %, beet yield

INTRODUCTION

Sugarbeet (*Beta vulgarisomit* L.) a member of chenopodiaceous family is the second important sugarcrop after sugarcane, producing about 40% of sugar annually all over the world (Amr and Gaffer, 2010). It is a fleshy root crop processed for sugar production. It is native to temperate countries and hence has been associated with the temperate environment. The leading sugarbeet producing region includes the European Union, the USA and Russia. Despite being a temperate crop, sugarbeet trials have been going on in some selected tropical countries like India, Pakistan, Sudan and South Africa. Kapur and Kanwar (1990) noted that sugarbeet can be grown successfully as a winter crop in subtropical. Asadi (2007) reported that in some tropical and subtropical regions like Sudan and Pakistan, sugarbeet processing can be done from 270 to 300 days per year. Sugarbeet with its relatively short season can be accommodated in the crop rotation of large agricultural schemes such as Gezira in Sudan. Proponents of tropical sugarbeet production argue that this would be a viable solution to problems facing

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sugarcane farmers in the tropics. According to David and Young (1981) sugarbeet matures and is ready for harvest in 5-6 months. The short maturity period of sugarbeet may result in a quick and reliable income for farmers like Bangladesh. Sugarbeet roots contain high concentration of sucrose (Memon *et al.*, 2004).

The yield and economic benefit from sugarbeet will be higher than any cereal crop. Moreover, realizing its high sugar content, short growing season, sugarbeet as a cash crop, will improve the income of farmers. For these reasons, intensive field tests on sugarbeet in Bangladesh have been continued unabated at the Bangladesh Sugarcrop Research Institute since early 2002 in an attempt to introduce sugarbeet in the sugar industry in Bangladesh beside sugarcane. The sugarbeet is particularly well adapted in irrigated agriculture (Follet *et al.*, 1964). Sugarbeet has no self regulatory mechanisms to promote sucrose accumulation but is dependent upon external stimuli from the climatic factors such as light, temperature and day length which determine to a great extent, the type of growth and the amount of sugar that gets stored in the root (Ulrich, 1952; Petkeviciene, 2009). All tropical sugarbeet genotypes are preferable to evaluate them under the agro-climatic conditions of Bangladesh to select the best suited ones. Osman *et al.* (2003) found significant differences in the studied sugarbeet varieties in different sources like root length, diameter, fresh weight, root and sugar yield (ton/fed), as well as sucrose and purity percent etc. Bangladesh requires about 2 million tons of sugar per year (FAO recommendation 13 kg sugar and 17 kg goor per person per annum) but the present domestic production is about 0.6 million tons (0.1 million ton sugar and 0.5 million tons jaggery) (Rahman *et al.*, 2006). For fulfilling the demand of sugar, an alternate new short duration sugar producing crop named sugarbeet has been introduced in Bangladsh. Field trials of this crop have been continued at Bangladesh Sugarcrop Research Institute. The results of these efforts were quite promising and in most cases very encouraging. For this reason an attempt has been made to evaluate the performance of exotic tropical sugarbeet genotypes under selected agro-climatic conditions of Bangladesh.

MATERIALS AND METHODS

The experiment was conducted at Bangladesh Sugarcrop Research Institute farm, Ishurdi, Pabna during the rabi season of 2013-2014. The trial consisted of 11 (eleven) genotypes of sugarbeet viz., Cauvery, Shubrha, HI 0044, HI 0473, SZ 35, PAC 60008, SV-1, Danicia, Aranka, Sereneda, Natura which were supplied by Syngenta (BD) Ltd.; SesvanderHave (Belgium) and KWS (Germany). The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Individual plot size was 6m x 6m. The experiment was located in High Ganges River Flood Plain soils under Agro-ecological Zone-11 with medium high land of typical sandy loam soil having pH 7.6. The soil of the field was non-saline, non-sodic, and alkaline in reaction and had low organic matter (OM), phosphorus (P) and nitrogen (N) contents. The experiment was set in the month of November 2013. All recommended agronomic and cultural operations including weeding, fertilization, irrigation and plant protection measures were followed during the entire course of study on a standardized uniform pattern for all the plots. After seed bed preparation Urea, TSP, MoP, Gypsum, Zinc sulphate and Boric acid were applied at the rate of 260 Kg, 120 Kg, 225 Kg, 100 Kg, 10 Kg and 20 Kg per hectare, respectively (Anonymous, 2005). Total TSP, Gypsum, Zinc sulphate, Boric acid, 1/3 Urea and MoP was applied in the line before ridge preparation. Rest amount of Urea and MoP

was applied in two installments at 30 and 60 days after sowing. Then the plots were prepared and layout was made. Manual sowing of seed of sugarbeet varieties was carried out and seeds were sown on light ridge soil at 3-4 cm depth. The distance between two ridges was 50 cm and seed to seed distance was 20 cm. Management practices, like thinning for once at 4-5 leaf stage, harrowing, weeding (3 times at 25, 50 and 75 DAS), irrigation (5 times at 1, 15, 30, 60 and 90 DAS) and other intercultural operations were done regularly. To control jute hairy caterpillar, soon after infestation, the larvae were destroyed by hand. To control Spodoptera litura (a Lepidopterous insect), an integrated approach was rendered. Nitro 505 EC (Chlorpyriphos + Cypermethrin) @ 0.1% was sprayed at 7 days interval. Sex pheromone trap (Spodoptera pheromone) was also placed @ 45 traps per hectare in the field to male insect. Predator insect (Bracon hebetor) was also released in the field to control Spodoptera litura. Ten plants were randomly harvested from each replication at 165 (five and half months) days after sowing to determine yield and yield attributes. Generated data were compiled and analyzed properly for interpretation of the results. Data regarding germination percentage, plant height (cm), beet length (cm), beet girth (cm), beet weight (gm), beet yield (tha-1) and beet brix % were collected. Germination (%) was recorded at thirty days after planting while plant height (cm), beet length (cm), beet girth (cm), beet weight (gm), beet yield (tha-1) and beet brix % were recorded at the time of harvest. Brix was measured with the help of hand refractometer.

A

B

C

D

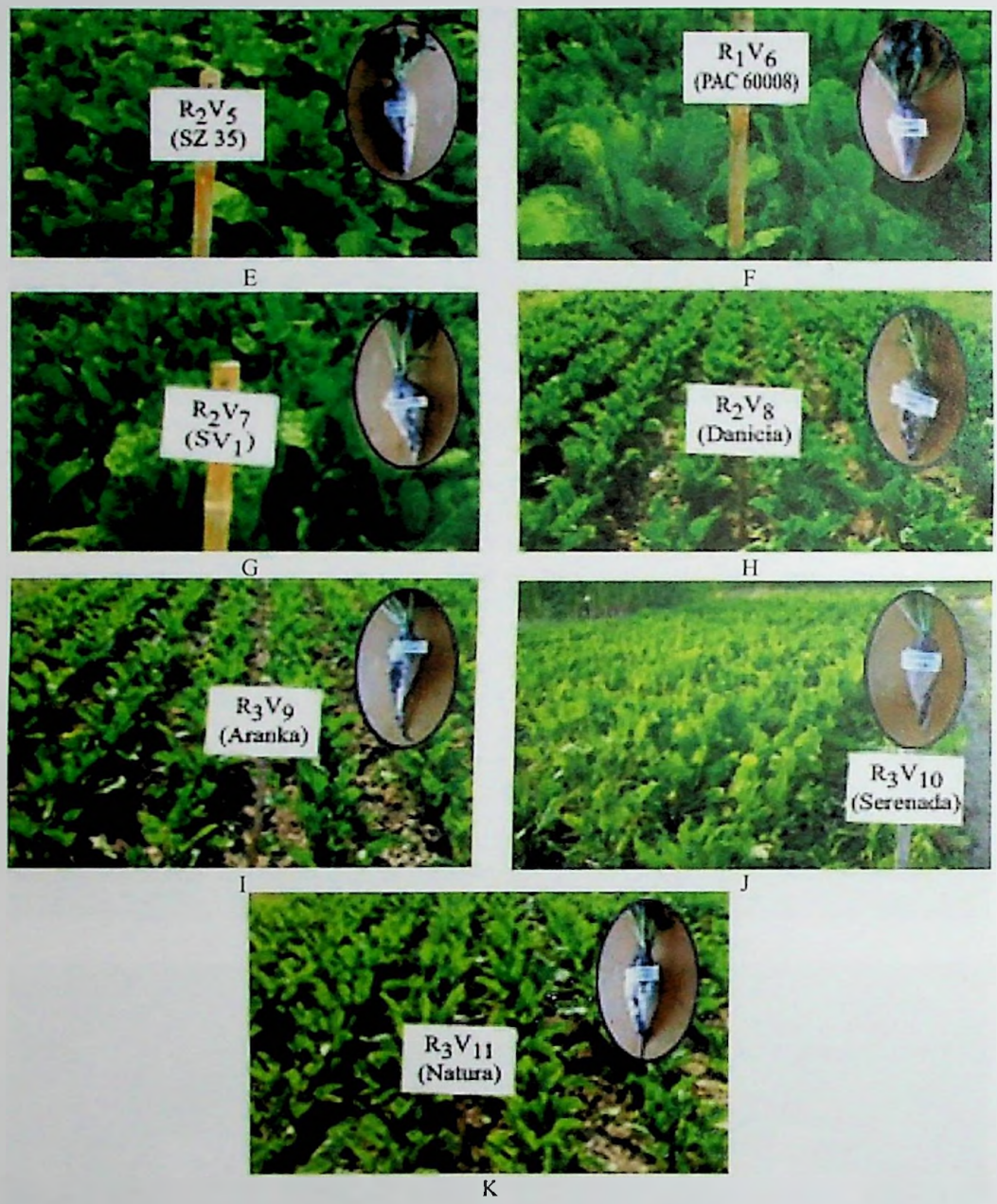

Figure 1. Picture of eleven exotic tropical sugarbeet genotypes (A = Cauvery, B = Shubrha, C = HI 0044, D = HI 0473, E = SZ 35, F = PAC 60008, G = SV1, H = Danicia, I = Aranka, J = Serenada and K = Natura)

RESULTS AND DISCUSSION

A well adapted plant does not show any sign of adverse effect on its life cycle at any stage of growth in new environment. Different yield attributing data such as germination (%), plant height (cm), beet length (cm), beet girth (cm), beet weight (gm), beet yield (tha^{-1}) and beet brix % are presented in Table 1.

Germination percentage

All genotypes of exotic tropical sugarbeet showed a good germination percentage. It was seen from the table 1 that germination percent among the genotypes varied significantly. The highest germination percent was found in variety PAC 60008 (93.14%) which is statistically similar with SV_1 and Cauvery (92.83 and 92.85%), respectively which is similar with the genotypes SV_1, Cauvery, Serenada, Natura, HI per control 0473, Danicia. The lowest germination was found in Shubrha (81.52 %).

Table 1. Growth and yield performance of different exotic Sugarbeet genotypes during rabi season of 2013-14 at BSRI farm, Ishurd, Pabna

Genotypes	Germination (%)	Plant height (cm)	Beet length (cm)	Beet girth (cm)	Beet yield (tha^{-1})
Cauvery	92.85 a	63.14 a-c	31.24	31.71 a-c	72.94 c-e
Shubrha	81.52 d	62.94 a-c	27.66	31.2 a-c	59.90 e
HI 0044	88.52 bc	67.18 a	30.44	33.48 ab	69.01 b-d
HI 0473	91.98 ab	66.00 ab	27.28	30.08 bc	65.43 de
SZ 35	86.53 c	65.19 ab	30.30	29.70 c	76.61 cd
PAC 60008	93.14 a	62.04 bc	27.67	30.99 a-c	72.94 c-e
SV_1	92.83 a	69.79 a	29.58	31.54 a-c	82.64 a-c
Danicia	90.01 a-c	65.07 ab	29.01	32.64 a-c	94.26 ab
Aranka	88.33 bc	66.37 ab	27.20	34.46 a	98.80 a
Serenada	90.77 ab	61.97 bc	27.18	32.0 a-c	85.76 a-c
Natura	91.72 ab	61.78 bc	30.54	30.89 a-c	85.91 a-c
LSD (0.05)	4.00	4.95	NS	3.75	16.63

In a column, figures with similar letters do not differ significantly at 5% level

Plant height (cm)

Results in table 1 showed that the plant height varies significantly in different tropical sugarbeet genotypes. The highest plant height was found in SV_1 (69.79 cm) and HI-0044 (67.18 cm) which was similar with the variety HI-0473, SZ-35, Danicia and Aranka. Variety Natura, Serenada and Natura 61.78% showed lowest plant height. The differences could be attributed to the genetic structure of the evaluated sugarbeet varieties. These results were similar to those obtained by Aly (2006), El-Bakary (2006) and Ismail *et al.* (2006).

Beet length (cm)

There were no significant differences in case of beet length among the tested tropical sugarbeet genotypes (Table 1).

Beet girth (cm)

Beet girth was significantly affected in different tropical sugarbeet genotypes. Maximum beet girth was found in variety Aranka (34.46 cm) which is similar with other varieties except SZ-35 (Table 1). These results were similar to those obtained by Aly (2006), El-Bakary (2006) and Ismail *et al.* (2006).

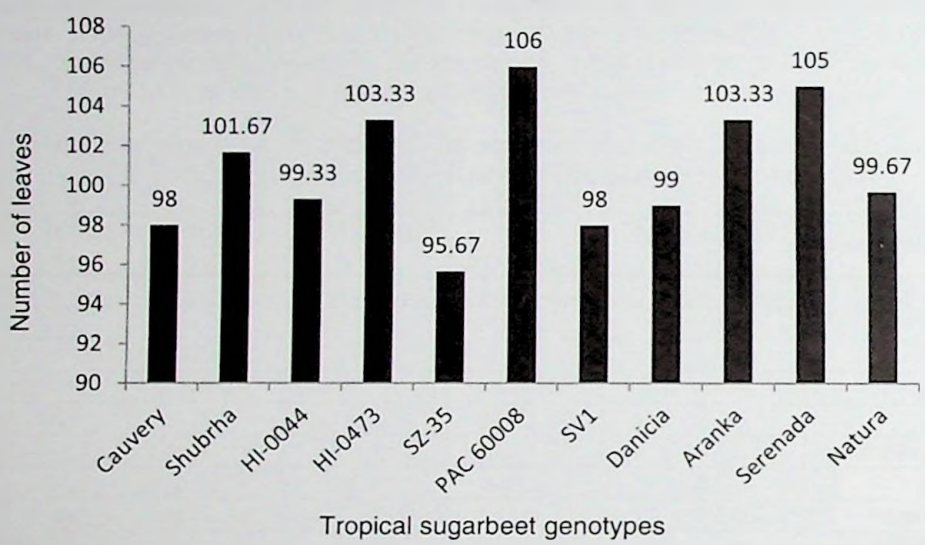

Figure 2. Number of leaves/plant of different exotic sugarbeet genotypes

Number of leaves per plant

Figure 2 indicated that there were significant differences in producing leaf during beet growth periods among the genotypes. The highest number of leaves was found in genotype PAC 60008 (106.00) and the lowest in SZ-35 (95.67). Rest of the genotypes was produced more or less number of leaves.

Unit beet weight (g)

Unit beet weight is an important parameter of sugarbeet as it is directly related to the yield per unit area. If unit beet weight is higher then yield will be higher. From figure 3 it was clear that unit beet weight is different among the tested tropical sugarbeet genotypes. The highest unit beet weight (995.70 g) was found in the genotype Cauvery and Aranka (992.76 g). The lowest beet weight was found in the genotype Shubrha (835.95 g) followed by Natura (840.96 g).

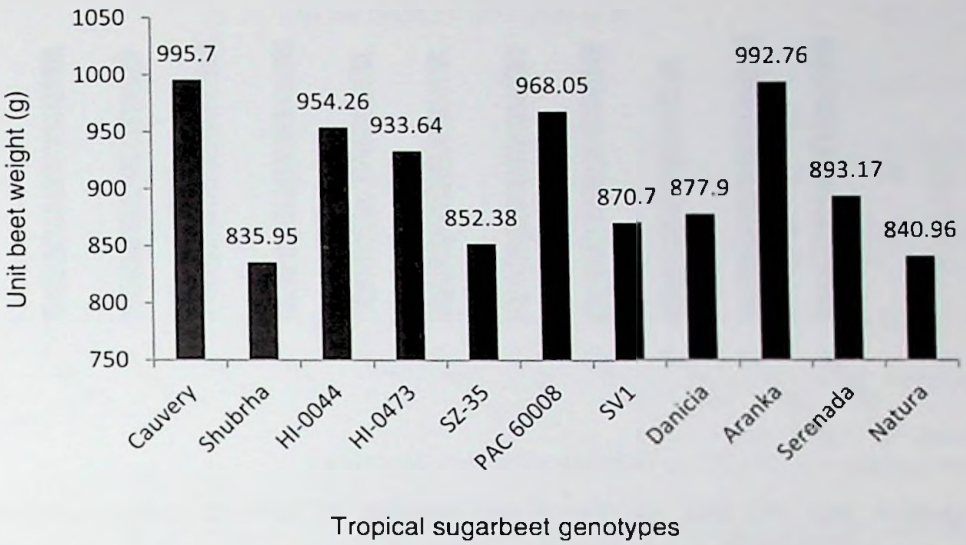

Figure 3. Unit beet weight of different exotic tropical sugarbeet genotypes

Beet yield (tha^{-1})

Results in table 1 indicated that tested tropical sugarbeet varieties showed significant differences in beet yield. Among eleven genotypes of sugarbeet Aranka gave the highest beet yield (98.80 tha^{-1}) followed by Danicia (94.26 tha^{-1}), Natura (85.91 tha^{-1}), Serenada (85.76 tha^{-1}) and SV_1 (82.64 tha^{-1}) genotypes. The lowest yield was found in Shubhra (59.90 tha^{-1}). The increase in root yield was strongly related to root performance, i.e., root length, diameter and fresh weight. Similar results were obtained by Aly (2006), El-Bakary (2006) and Ismail *et al.* (2006).

Sugar percent (Brix and pol % beet)

Regarding sugar contents, a significant difference was found among varieties for brix and pol% (Figure 4). The highest brix percentage was observed in Subhra, Cauvery Danicia and Aranka (18.48-18.87%) followed by SZ 35, PAC 60008, SV_1, Sereneda and Natura (17.88- 18.22 %), while the lowest in HI-0044 (17.39 %). Concerning pol percent in sugarbeet extract, variety Aranka had the highest pol%.

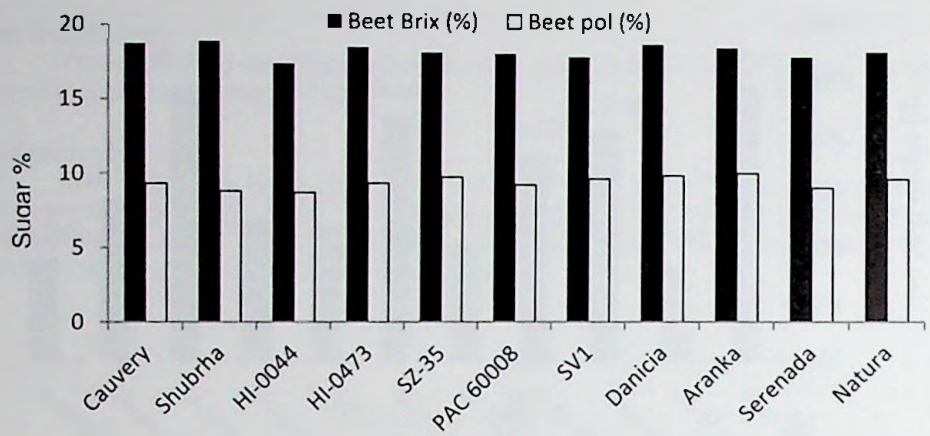

Figure 4. Brix (%) and pol (%) of beet obtained by different exotic sugarbeet genotypes

From the above results, it may be concluded that tropical sugarbeet cultivation is possible in Bangladesh. Among the eleven genotypes of exotic tropical sugarbeet Aranka, Cauvery, SZ 35, PAC 60008, Danicia, Sereneda, Natura performed better in respect of beet yield, yield contributing characters and sugar recovery. Hence, these genotypes can be successfully cultivated in Bangladesh.

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