Influence of Different Genotypes and Harvesting Time on Yield Attributes of Sugarbeet

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ABSTRACT

The experiments were carried out at the field laboratory farm of Bangladesh Sugarcrop Research Institute (BSRI), Ishurdi, Pabna during the cropping season 2012-2015 for field performance of tropical cultivars of sugarbeet viz., CS 0327, CS 0328, HI 0044, HI 0473, Shubhra and Cauvery. All the genotypes on field evaluation exhibited variation regarding different yield attributes. Root fresh weight, Root length, Root diameter, Root dry weight, Root yield, Brix% and Pol percent were measured at five times, started at 120 DAP up to 180 DAP at 15 days interval. Root fresh weight (g/plant) of six sugarbeet genotypes was significantly influenced by different harvesting time. Cultivar CS 0328 produced the highest root fresh weight (g/plant) and cultivar Shubhra produced the lowest root fresh weight. Root length of sugarbeet was significantly affected due to age and cultivars. The highest and the lowest root length was obtained from cultivar CS 0328 and Shubhra respectively. Similar trend was also observed in case of root diameter. Cultivar CS 0328 and Shubhra was observed to created the highest and lowest root diameter respectively. The highest root dry weight was noticed in cultivar CS 0328 and the lowest was found in cultivar HI 0473. Cultivar CS 0328 yielded the highest root yield at 180 DAP and at the same time the lowest root yield was found in cultivar Shubhra. Brix % significantly varied depending on cultivars and harvesting time in this study. Among the five harvesting period the highest Brix % was obtained at fourth harvest (165 DAP) by cultivar HI 0044 and the lowest Brix % was found in cultivar CS 0327 at first harvest (120 DAP). Pol percentage was affected by genotypes and different harvesting time. Genotype HI 0044 made the highest pol per cent beet at fourth harvest (165 DAP) and the lowest pol per cent was obtained from CS 0327 at first harvest (120 DAP). Among the six genotypes CS 0328 performed better for beet yield and genotype HI 0044 was most suitable for pol per cent beet at the harvest time of 165 DAP.

Key words: Yield attributes, sugarbeet, genotypes, harvesting time, influence

INTRODUCTION

The climatic conditions of Bangladesh are unfavorable for floral induction of sugarbeet. That led to import its seeds from abroad especially from Europe. So, we need to optimize imported cultivars production by evaluation and adaptation under Bangladeshi conditions. Many studies confirm the importance of selection suitable cultivars for increasing yield and quality of sugar beet (Oad *et al*., 2001; Ramadan *et al*., 2003; Azzazy, 2004). Sugarbeet (*Beta vulgaris* L.) is the only species of agricultural important crop belongs to Chenopodiaceae family.

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Sugarbeet is the major sucrose-producing crop grown in temperate zones and provides at about 25% of the world sugar for human consumptions ranking second to sugarcane in terms of sugar production in the world (Draycott, 2006; Joersbo, 2007). In addition to sugar from sugarbeet, it is possible to obtain a considerable amount of leaves, slices from roots and molasses, which are valuable as animal feed. Sugarbeet is the second crop to producing the world's sugar and recently sugarbeet becoming an important biofuel alternative to fossil fuel energy (Zhang *et al*., 2008). Sugarbeet is low delta crop of short duration (4 to 6 months) with low irrigation requirements of 5-6 times compared to 25-30 irrigations required by sugarcane high delta crop. Sugarbeet has a fairly wide adaptability and is relatively resistant to cold, withstand drought, and are not overly sensitive to salinity (Ahmad and Rasool, 2011; Ahmad *et al*., 2012). It has also high tolerance to alkaline conditions.

It is a man-made crop and is the product of human selection from fodder beet for higher sugar content. Sugarbeet is a very efficient converter of solar energy to a form that can be utilized by men and animals. Most plants consume sugar for their own use but a few store it in the plant parts, which act as warehouse. Sugarcane and sugarbeet are such plants. Though sugarbeet is a crop of the temperate region but its cultivation is now expanding from subtropical tracts to tropical world. Besides its conventional home in the temperate zone, it is now being successfully grown in Iran, Iraq, Algeria, Egypt, Afghanistan and Pakistan (Pathak and Raman, 2013). Sugarbeet is the second most important source of sugar which is grown in 57 countries (Shrivastava *et al*., 2013). Today beet sugar industry is well established in 45 countries spread over four continents of the world (Pathak and Raman, 2013).

As such, it has good prospects for bridging the gap between present sugar production and anticipated national sugar requirement. Because of its high chemical quality, beet molasses is a priced item with potentialities for export. Hence, sugarbeet is capable of occupying an important place in the sugar economy of the country. Sugarbeet is a versatile crop as it can withstand various climatic and soil conditions. Being tolerant to salinity and frost, it can help to bring several hundred hectares of uncultivable land under cultivation. The crop also can help to extend the factory season and consequently promote employment. Available in the beginning of April, sugarbeet enables the factory to process both the raw materials-sugarcane and sugarbeet during their high efficiency periods (Pathak and Raman, 2013). Both the sugar crops sugarcane and sugarbeet can be grown side by side. It is obvious from the said facts that sugarbeet is not only the supplement crop of sugarcane but also can be grown with the sugarcane. Sugarcane and sugarbeet intercropping system may expand the crushing season of sugar industry up to 45 days and may also improve the sugar recovery with ultimate reduced cost of sugar production (Draycott, 2006). Large areas, such as salt-affected soils not suited for sugarcane cultivation may be brought under sugarbeet. Farmers with small holding may prefer sugarbeet in there cropping system due to its short duration. A varietal adaptability trial in district Bannu, Khyber Pakhtoon Khawah (KPK) comprising four sugarbeet varieties, viz. Kave poly, Kavemira, Kaveterma and Zwan poly.

It was reported that beet cultivar Kave-poly produced maximum beet root yield while Kaveterma was superior in sugar contents (Pol = 12.41%). Similarly, Khan *et al*. (2004) reported that varieties differed significantly for yield and sugar contents in Bannu, Dera Ismail Khan and Kohat Districts of southern Pakistan. The average beet yield remained 36.0 to 72.8 t ha^{-1}. It has been reported from three years of sugarbeet varietal trials that in different parts of Punjab sugarbeet varieties performed differently with respect to germination, yield and sugar recovery (Ahmad and Rasool, 2011). It can be successfully grown as an intercropping in autumn sugarcane. The climatic conditions are unfavorable for floral induction of sugarbeet in Bangladesh. That led to import its seeds from abroad especially from Europe. So, we need to optimize imported cultivars production by evaluation and adaptation under tropical conditions. Many studies confirm the importance of selection suitable cultivars for increasing yield and quality of sugarbeet (Azzazy, 2004). Keeping the above facts in view, we took an interest to optimize yield and quality of sugarbeet in new area through different methods especially evaluation and adaptation of exotic commercial cultivars and their regenerates. Considering these facts, the present study has been undertaken.

MATERIALS AND METHODS

The experiments were conducted at the field and laboratory farm of Bangladesh Sugarcrop Research Institute (BSRI),Ishurdi, Pabna during 2014-2015. Six sugarbeet genotypes viz., CS 0327, CS 0328, HI 0044, HI 473, Shubrha and Cauvery were used as plant materials. Seeds were soaked for 4-5 hours in 0.2 % solution of mercuric chloride for better germination. Design of the experiment was RCBD with three replications. The unit plot size was 4 m x 3 m ($12m^2$). Seed was sowing manually and the depth of sowing was 4-5 cm with 50 cm row to row and 20 cm plant to plant spacing. Seed rate was 8 kg ha^{-1}. Sugarbeet is a heavy feeder of nutrients. Cow dung, Urea, Triple supper phosphate (TSP), Muriate of potash (MoP), Gypsum, Boric acid and Zinc sulphate were applied @ 15000, 260, 100, 225, 100, 20 and 10 Kg ha^{-1} respectively. Intercultural operations, chemical, cultural and mechanical control measures were done for insect-pests and disease management as when required. Harvesting was conducted at five times viz., 120 Days After Plantation (DAP), 135 DAP, 150 DAP 165 DAP and 180 DAP and required data (Fresh weight of unit beet, Beet length, Beet diameter, Beet dry weight, Yield of sugarbeet, Brix and Pol %) were recorded as per schedule. Three plants were randomly selected from each replication for recording data. The collected data were statistically analyzed using the "Analysis of variance" (ANOVA) technique and the significance of mean differences were adjusted by the Duncan's New Multiple Range Test (DMRT) with the help of computer package MSTAT-C programme (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Germination (%)

Seed germination percentage was significantly varied due to different genotypes shown in Figure 1. The highest germination rate (89.67 %) was obtained from genotype CS 0328 and the second highest germination rate (88.00 %) produced the genotype HI 0044 and followed by Cauvery (84.33%), CS 0327 (84.00%) and

Shubhra (81.67%). The lowest germination rate (79.67%) was found in genotype HI 0473 which was statistically at per with the genotype Shubhra.

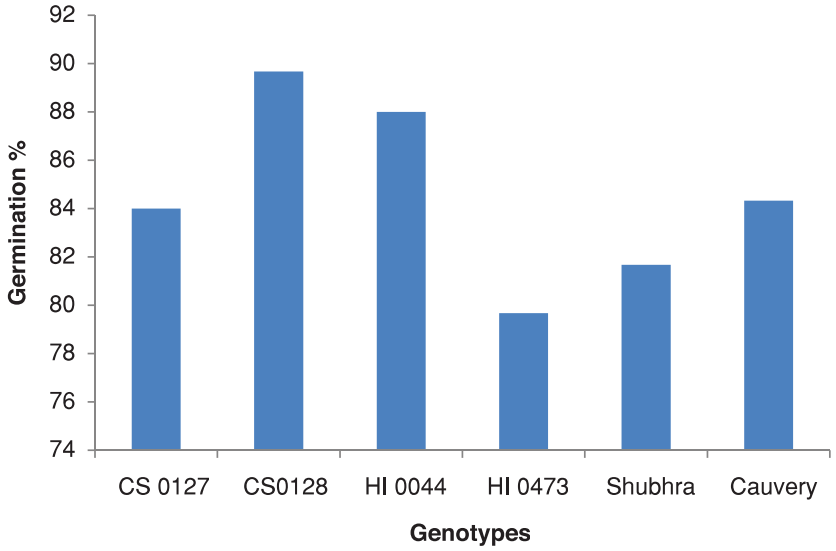

Figure 1. Germination % of different genotypes of sugarbeet after 15 days of sowing in the field

Root fresh weight (g/plant)

Root fresh weight was measured at five times, started at 4.0 months aged up to 6.0 months at 15 days interval. Root fresh weight (g/plant) of six sugarbeet genotypes was significantly influenced by different harvesting time shown in Table 1 & Figure 2. First harvest was conducted when sugarbeet was 4 months aged (120 DAP). The highest root fresh weight (677.67 g) was obtained from genotype CS 0328 and second highest was noted (644.33 g) in Cauvery, while the lowest (531.33 g) root fresh weight was observed in genotype CS 0327 which was statistically at per with Shubhra (533.00 g). At the time of second harvest (145 DAP) the genotype CS 0328 also produced the highest root (712.00 g) weight which was statistically similar with Cauvery (690.67 g) followed by HI 0044 (654.33 g), HI 0473 (642.00 g) and CS 0327 (576.67 g), while the lowest weight was recorded from genotype Shubhra (547.67 g). At third harvest (150 DAP) the highest root fresh weight was observed in genotype CS 0328 (722.33 g) and the second highest (709.00 g) was obtained from Cauvery. Genotype CS 0327 produced the lowest root fresh weight of 568.00 g. At the time of fourth harvest (165 DAP) maximum weight (778.00 g) was found in genotype CS 0328 followed by Cauvery (739.33 g), HI 0044 (730.67 g), HI 0473 (677.33 g) and CS 0327 (658.67 g), while the lowest root fresh weight was obtained from genotype Shubhra (627.67 g). In case of final harvest (180 DAP) the highest fresh root weight was noted in genotype CS 0328 (789.00 g) and the second highest weight (751.67 g) was found in genotype Cauvery, while the lowest root fresh weight was produced by genotype Shubhra (625.00 g).

Table 1. Averages of root fresh weight (g/plant) as influenced by harvesting time and genotypes of sugarbeet, 2014-15

Genotypes	Root fresh weight at different harvesting time (g/plant)				
	1st Harvest (120 DAP)	2nd Harvest (135 DAP)	3rd Harvest (150 DAP)	4th Harvest (165 DAP)	5th Harvest (180 DAP)
CS 0327	531.33 c	576.67 bc	568.00 c	658.67 bc	654.67 bc
CS 0328	677 .67 a	712.00 a	722.33 a	778.00 a	789.00 a
HI 0044	595.33 bc	654.33 ab	687.00 ab	730.67 ab	736.67 ab
HI 0473	575.67 bc	642.00 ab	655.00 abc	677.33 bc	655.00 bc
Shubhra	533.00 c	547.67 c	616.33 bc	627.67 c	625.00 c
Cauvery	644.33 ab	690.67 a	709.00 ab	739.33 ab	751.67 ab
LSD (0.05)	70.00	79.46	95.85	85.20	99.02

In a column, figure having same letter(s) do not differ significantly by DMRT at the 5% level

Root length (cm)

Data illustrated in Table 2 shown that duration of sugarbeet had a significant effect on root length of six sugarbeet genotypes. At the time of first harvest (120 DAP), CS 0328 produced the longest (29.00 cm) root which was statistically similar with Cauvery (28.83 cm). On the other hand, shortest root length (25.00 cm) was noted in genotype CS 0327, which was significantly different from other genotypes except HI 0473 (25.63 cm). In second harvest (145 DAP), same genotype produced the highest root length (29.57 cm) followed by CS 0327 (28.47 cm), Shubhra (28.47 cm), HI 0044 (28.10 cm) and Cauvery (27.70 cm). The lowest length of root was obtained from genotype HI 0473 (27.48 cm). Similarly, in third harvest (150 DAP) genotype CS 0328 produced the statistically nonsignificant longest root (29.57 cm) and second longest root (28.20 cm) was found in HI 0473, while the shortest root (27.37 cm) was found from genotype HI 0044. When sugarbeet was 165 days aged (at fourth harvest), the maximum root length (29.68 cm) was observed in same genotype CS 0328 followed by Cauvery (29.28 cm), HI 0473 (28.72 cm), Shubhra (28.47 cm) and HI 0044 (18.37 cm) while, the minimum root length was found in genotype CS 0327 (28.15 cm). At the time of final harvest (180 DAP), the longest root (30.20 cm) was produced by the genotype CS 0328 and the second highest length of root was found in genotype Shubhra (29.53 cm) while, the lowest length of root was noted in genotype Cauvery (28.20 cm). Significant difference found among the studied genotypes of sugarbeet at different harvesting period in root length (cm) and varied 25-30.20 cm. Genotype CS 0328 produced the highest root length, while the lowest root length was produced by Cauvery at the time of final harvest.

Table 2. Averages of root length (cm) as influenced by harvesting time and genotypes of sugarbeet, 2014-15

Genotypes	Length of root at different harvesting time (cm)				
	1st Harvest (120 DAP)	2nd Harvest (135 DAP)	3rd Harvest (150 DAP)	4th Harvest (165 DAP)	5th Harvest (180 DAP)
CS 0327	25.00 d	28.47 ab	27.98 ab	28.15 b	28.30 bc
CS 0328	29.00 a	29.57 a	29.57 a	29.68 a	30.20 a
HI 0044	27.33 b	28.10 ab	27.37 b	28.37 ab	28.50 bc
HI 0473	25.63 cd	27.48 b	28.20 ab	28.72 ab	28.70 bc
Shubhra	26.17 c	28.47 ab	28.10 ab	28.47 ab	29.53 ab
Cauvery	28.83 a	27.70 b	27.80 b	29.28 ab	28.20 c
LSD (0.05)	0.95	1.50	1.63	1.19	1.31

In a column, figure having same letter(s) do not differ significantly by DMRT at the 5% level

Root diameter (cm)

Root diameter exhibited significant differences among genotypes in different harvesting time (Table 3). The highest root diameter was produced from genotype CS 0328 followed by CS 0327, HI 0044, HI 0473 and Cauvery at first harvest. Whereas, the lowest root (5.41 cm) diameter was obtained from genotype Shubhra which was significantly different from other genotypes. At the time of second harvest (135 DAP), genotype HI 0473 produced the highest root (7.37 cm) diameter and the second highest root (7.37 cm) diameter was observed in CS 0328 while, genotype CS 0327 produced the thinnest root (6.43 cm). Incase of third harvest (150 DAP), the thickest root (7.48 cm) was found in the genotype Cauvery followed by CS 0328 (7.15 cm), Shubhra (7.03 cm), CS 0327 (6.99 cm) and HI 0473 (6.92 cm) whereas, the thinnest root (6.40 cm) was noted in genotype HI 0044. At the time of fourth harvest (165 DAP), all genotypes produced the statistically similar root diameter. At final harvest (180 DAP), the highest root diameter (7.87 cm) was recorded from genotype CS 0328 followed by Cauvery (7.73 cm), HI 0044 (7.13 cm), HI 0473 (7.07 cm) and CS 0327 (6.97 cm) whereas the lowest root diameter was noted in genotype Shubhra (6.90 cm). There were no significant differences among cultivars regarding yields were significant. Varietal differences in root parameters were also recorded by Khan *et al*. (2004); Zahoor-ul-Haq *et al*. (2006); Ebrahimian *et al*. (2009) and Ahmed *et al*. (2012). This result is in good agreement with those confirmed by Abd EL Gawad *et al*. (2000), Abdou (2000) and Kandil *et al*. (2002).

Table 3. Averages of root diameter (cm) as influenced by harvesting time and genotypes of sugarbeet, 2014-15

Genotypes	Diameter of root at different harvesting time (cm)				
	1st Harvest (120 DAP)	2nd Harvest (135 DAP)	3rd Harvest (150 DAP)	4th Harvest (165 DAP)	5th Harvest (180 DAP)
CS 0327	6.72 a	6.43 b	6.99 ab	6.93	6.97 ab
CS 0328	6.82 a	7.27 ab	7.15 ab	7.30	7.87 a
HI 0044	6.62 a	6.97 ab	6.40 b	7.07	7.13 ab
HI 0473	6.62 a	7.37 a	6.92 ab	7.23	7.07 ab
Shubhra	5.41 c	6.77 ab	7.03 ab	6.87	6.90 b
Cauvery	6.20 b	6.83 ab	7.48 a	7.37	7.73 ab
LSD (0.05)	0.37	0.86	0.89	NS	1.05

In a column, figure having same letter(s) do not differ significantly by DMRT at the 5% level

Root dry weight (g/plant)

Revealed data in Table 4 indicated a significant difference among the genotypes and different harvesting period of root dry weight. At the time of first harvest (120 DAP), all the genotypes except Cauvery (68.03 g) produced statistically similar dry weight (57.33-61.70 g/plant) whereas genotype Cauvery produced the significantly highest dry weight (68.03 g). The highest dry weight was noted in genotype CS 0328 (105.52 g)at second harvest (135 DAP) and the second highest dry weight was found in genotype Cauvery (101.78 g) followed by HI 0473 (97.75 g), Shubhra (96.60 g) and HI 0044 (91.50 g) while, the lowest dry weight was achieved from genotype CS 0327 (86.55 g). At the time of third harvest (150 DAP), the highest dry weight (121.73 g) was obtained from the similar genotype (CS 0328) followed by Shubhra (113.00 g), Cauvery (106.03 g), CS 0327 (103.72 g) and HI 0044 (103.37 g) while, the lowest weight was found in HI 0044 (92.17 g). At fourth harvest (165 DAP) the highest dry weight was achieved from genotype CS 0328 (122.50 g) which was statistically at per with Cauvery (119.20 g), Shubhra (119.03 g) and HI 0044 (112.20 g). In contrast, the lowest dry weight (101.20 g) was harvested from genotype HI 0473. At final harvest (180 DAP), the highest root dry weight was observed from genotype Shubhra (116.67 g) and the second highest dry weight was found in Cauvery (108.10 g) whereas, the Genotype CS 0328 produced the highest mean root dry weight, while the lowest root dry weight was produced by CS 0327 at different harvest time. Maximum root dry weight was noticed at fourth harvest (165 DAP) after 165 DAP, root dry weight gradually decreased. Decreasing of root dry weight might be occurred due to breakdown of sucrose after physiological maturity.

Table 4. Averages of root dry weight (g/plant) as influenced by harvesting time and genotypes of sugarbeet, 2014-15

Genotypes	Root dry weight at different harvesting time (g/plant)				
	1st Harvest (120 DAP)	2nd Harvest (135 DAP)	3rd Harvest (150 DAP)	4th Harvest (165 DAP)	5th Harvest (180 DAP)
CS 0327	57.33 b	86.55 c	103.72 bc	104.23 bc	98.33 cd
CS 0328	61.07 b	105.52 a	121.73 a	122.50 a	100.02 bc
HI 0044	60.10 b	91.50 bc	100.37 cd	112.20 ab	104.03 bc
HI 0473	58.00 b	97.75 ab	92.17 d	101.20 c	90.67 d
Shubhra	61.70 b	96.60 abc	113.00 ab	119.03 a	116.67 a
Cauvery	68.03 a	101.78 ab	106.03 bc	119.20 a	108.10 ab
LSD (0.05)	6.00	10.89	10.14	10.69	8.95

In a column, figure having same letter(s) do not differ significantly by DMRT at the 5% level

Beet yield (t ha^{-1})

Genotypes of sugarbeet exhibited significant effect on beet yield in the five harvesting date of sugarbeet in this study (Table 5). At first harvest (120 DAP), genotype CS 0328 produced the highest values of root yield (67.78 t ha^{-1}) followed by Cauvery (64.40 t ha^{-1}), HI 0473 (60.91 t ha^{-1}), HI 0044 (59.50 t ha^{-1}) and Shubhra (55.30 t ha^{-1}). In contrast, the lowest beet yield was observed in genotype CS 0327 (53.12 t ha^{-1}). The highest beet yield (71.18 t ha^{-1}) was obtained from the same genotype (CS 0328) at second harvest (135 DAP) and the second highest root yield was found in genotype Cauvery (69.05 t ha^{-1}). Whereas, the lowest root yield (54.75 t ha^{-1}) was noted in genotype Shubhra. At the time of third harvest (150 DAP), the genotype CS 0328 again produced the maximum root yield (72.20 t ha^{-1}) which was statistically at per with Cauvery (70.87 t ha^{-1}), HI 0044 (68.68 t ha^{-1}) and HI 0473 (65.47 t ha^{-1}). In contrast, the lowest root yield (56.80 t ha^{-1}) was observed in genotype CS 0327. At fourth harvest (165 DAP), the highest root yield (77.78 t ha^{-1}) was produced by genotype CS 0328 followed by Cauvery (74.00 t ha^{-1}), HI 0044 (73.05 t ha^{-1}), HI 0473 (67.71 t ha^{-1}) and CS 0327 (65.85 t ha^{-1}) while, the lowest root yield (62.75 t ha^{-1}) was obtained from genotype Shubhra. At final harvest the genotype CS 0328 produced the highest root yield (78.89 t ha^{-1}) and the second highest beet yield (75.15 t ha^{-1}) (Burba *et al.*, 2001 and Ahmad, 2012). Many investigators indicated that the beet yield differed with different cultivars at different location of Egypt (El-Geddawy *et al.*, 2006; Abo-Elftooh *et al.*, 2007; Shalaby *et al.*, 2011; Hussein *et al.*, 2012).

Table 5. Averages of root yield (t ha^{-1}) as influenced by harvesting time and genotypes of sugarbeet, 2014-15

Genotypes	Fresh root yield at different harvesting (t ha^{-1}) time				
	1st Harvest (120 DAP)	2nd Harvest (135 DAP)	3rd Harvest (150 DAP)	4th Harvest (165 DAP)	5th Harvest (180 DAP)
CS 0327	53.12 b	57.65 c	56.80 c	65.85 bc	65.45 cd
CS 0328	67.78 a	71.18 a	72.20 a	77.78 a	78.89 a
HI 0044	59.50 ab	65.40 ab	68.68 ab	73.05 ab	73.65 abc
HI 0473	60.91 ab	64.20 ab	65.47 abc	67.71 bc	68.48 bcd
Shubhra	55.30 b	54.75 c	61.62 bc	62.75 c	62.50 d
Cauvery	64.40 a	69.05 a	70.87 ab	74.00 ab	75.15 ab
LSD (0.05)	8.64	7.93	9.63	8.54	8.28

In a column, figure having same letter(s) do not differ significantly by DMRT at the 5% level

Brix (%)

According to the analysis of variance from the obtained data, it can be stated that genotypes and harvesting date of sugarbeet significantly affected Brix% in the present study (Table 6). The highest Brix% (14.03) was observed in genotype HI 0044 which was statistically similar to Shubhra (13.57), followed by Cauvery (13.43), HI 0473 (12.87) and CS 0327 (12.80) at the time of first harvest (120 DAP), whereas the lowest Brix% (12.47) was obtained from genotype CS 0327. At second harvest (135 DAP), the highest Brix% was observed from genotype HI 0044 (16.75) which was statistically similar with CS 0327 (16.27), Cauvery (16.20) and HI 0473 (15.67). In contrast, the lowest Brix% (14.67) was calculated from genotype CS 0327 and HI 0473. At the time of third harvest (150 DAP), genotype Cauvery produced the highest Brix% (18.60) followed by HI 0044 (18.23), HI 0473 (17.23), CS 0327 (17.07) whereas, the lowest Brix% (17.03) was found in genotype Shubhra. Incase of fourth harvest (165 DAP), highest Brix% (21.67) was achieved from genotype HI 0044 which was significantly different from other genotype and the second highest Brix% (20.33) was obtained from Cauvery. On the other hand the lowest mean Brix% (19.07) was calculated from CS 0327. At final harvest (180 DAP), the significantly highest Brix% (19.53) was observed in HI 0044 followed by CS 0327 (18.27), Cauvery (18.13), CS 0328 (17.10) and Shubhra (16.50). In contrast, the lowest Brix% was noted from genotype HI 0473 (16.47).

Table 6. Averages of Brix as influenced by harvesting time and genotypes of sugarbeet, 2014-15

Genotypes	Brix % at different harvesting time				
	1st Harvest (120 DAP)	2nd Harvest (135 DAP)	3rd Harvest (150 DAP)	4th Harvest (165 DAP)	5th Harvest (180 DAP)
CS 0327	12.47 c	14.67 b	17.07 c	19.07 c	18.27 b
CS 0328	12.80 bc	16.27 a	17.07 c	19.73 bc	17.10 cd
HI 0044	14.03 a	16.75 a	18.23 ab	21.67 a	19.53 a
HI 0473	12.87 bc	14.67 b	17.23 bc	19.93 bc	16.47 d
Shubhra	13.57 a	15.67 ab	17.03 c	19.63 bc	16.50 d
Cauvery	13.43 ab	16.20 a	18.60 a	20.33 b	18.13 b
LSD (0.05)	0.67	1.09	1.15	1.16	1.08

In a column, figure having same letter(s) do not differ significantly by DMRT at the 5% level

Regarding Brix% content, the tested cultivars gave ranging values (12.47-21.67%). The lowest Brix % was noticed at the time of first harvest (120 DAP) in cultivar CS 0327 and the highest Brix% was produced by cultivar HI 0044. Brix content gradually increased up to fourth harvest (165 DAP). After fourth harvest Brix% gradually decreased might be due to physiological maturity. Reports indicated that Brix% might be varied due to heterozygous nature of sugarbeet. Similar report also given by Kashem *et al*. (2005).

Pol (%) beet

Data presented in Table 7 bring out the means of pol percentage as affected by genotypes and different harvesting time. Genotype CS 0327 produced the highest pol percentage (10.70) beet which was statistically at per with HI 0473 (10.05 %), Shubhra (9.96%) and Cauvery (9.83%) at first harvest (120 DAP) whereas, the lowest pol percentage beet was obtained from genotype CS 0327 (9.08%). At second harvest (135 DAP), the highest pol % beet was achieved from genotype Shubhra (12.58) and second highest pol % beet was found in genotype HI 0044 (12.56) while, the lowest pol percentage beet was determined in genotype CS 0328 (11.57). At the time of third harvest (150 DAP), genotype HI 0044 produced the highest pol % beet (13.55) which was statistically similar with genotype Shubhra (13.53), Cauvery (13.23) and CS 0328 (12.85). In contrast, the lowest pol percentage beet was found in genotype CS 0327 (12.42).

At fourth harvest (165 DAP), the highest pol percentage beet (15.02%) was observed in genotype HI 0044 followed by CS 0328 (14.06 %), Cauvery (14.02 %), CS 0327 (13.71%) and Shubhra (13.49%) while, the lowest pol % beet was found in genotype HI 0473 (13.00%). At final harvest (180 DAP), genotype HI 0044 produced the highest pol percentage beet which was statistically at per with genotype HI 0473 (13.34%), CS 0328 (13.17%) and CS 0327 (13.05%). On the other hand, the lowest pol percentage beet was observed in genotype Cauvery (12.43%). The data of pol percentage revealed significant differences among the tested cultivars. Maximum pol percentage was found in juice extracted from the root of cultivar HI 0044. However, the minimum pol percentage of juice was recorded in roots of Cauvery at final harvest (180 DAP). The pol percentage in the tested cultivars ranged from 9.08 to 15.02% in different harvesting period. The highest pol % was observed at fourth harvest (165 DAP) and after that period it decreased gradually, which might be due to break down of sucrose.

Table 7. Averages of pol% as influenced by harvesting time and genotypes of sugarbeet

Genotypes	Pol % at different harvesting time				
	1st Harvest (120 DAP)	2nd Harvest (135 DAP)	3rd Harvest (150 DAP)	4th Harvest (165 DAP)	5th Harvest (180 DAP)
CS 0327	9.08 b	11.85 abc	12.42 c	13.71 bc	13.05 abc
CS 0328	9.10 b	11.57 c	12.85 abc	14.06 ab	13.17 abc
HI 0044	10.70 a	12.56 a	13.55 a	15.02 a	13.67 a
HI 0473	10.05 a	11.63 bc	12.67 bc	13.00 c	13.34 ab
Shubhra	9.83 ab	12.58 a	13.53 a	13.49 bc	12.59 bc
Cauvery	9.96 ab	12.39 ab	13.23 ab	14.02 b	12.43 c
LSD (0.05)	0.91	0.81	0.74	0.97	0.83

In a column, figure having same letter(s) do not differ significantly by DMRT at the 5% level

The differences among cultivars used in this study might be attributed to the differences in genetic constituents for each cultivar and their ability to benefit from the environmental factors which enabled it to adapt and achieve better yield and quality parameters. These results are in line with those obtained by Shehata *et al.* (2000), Gobarah and Mekki (2005) and Ismail (2002). The overall chemical composition of sugarbeet in Europe may vary considerably due to differences in cultivars and growing conditions (Bohn, 1998 and Burba *et al*., 2001). Similar finding was obtained by Sultan *et al*. (1999); Bassal *et al*. (2001); Maareg *et al*. (2001); Necdet *et al*. (2007) ; Ebrahimian *et al*. (2009) and Ahmad *et al*. (2012).

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