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Screening Sugarcane Clones for Maturity Status and Quality Gur Production

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ABSTRACT

Studies were conducted under Zonal Yield Trial stages (ZYT-I, ZYT-II & ZYT-III) at the Bangladesh Sugarcane Research Institute (BSRI) farm to screen promising clones for gur manufacture. The BSRI developed promising sugarcane clones along with one standard variety, Isd 36, were tested for maturity behaviour and quality gur production during 2004-07 cropping seasons. The clones I 133-00 and I 149-00 were observed as early maturing potential and the rest of the clones tested were mid maturing potential. Physical and Chemical properties of gur prepared using clones I 133-00 and I 149-00 were found superior. As such these two clones might be recommended for quality gur production.

Key Words: Sugarcane, maturity, quality, gur production

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is the main source of raw material for production of plantation white sugar and gur in Bangladesh. Before releasing a variety for cultivation in farmers' field, it is essential to identify its maturity behaviour, and grouping as early, medium and late maturing potential. Although maturity is largely dependent on varietal characters and environmental factors, the management practices have also great impact on maturity. Maturity status has direct impact on sugar production as well as quality gur production (Anon., 2005-06). Recovery of sugar is dependent on several factors viz. variety, climate, physiological maturity, milling performance etc. Among different factors, variety occupies prime place in influencing sugar yield (Singh and Singh, 2000).

Temperature and humidity are very important factors for cane maturity. Cold clear sunsine and dry weather promote maturation of cane plants. Formation of sugar in sugarcane greatly depends on sunlight. Accumulation of sugar in sugarcane depends on night temperature and it occurs at 20°C or below this temperature. In Bangladesh, sugar production per unit area is much less than that in other sugar producing countries due to low cane yield and sugar recovery per cent. One of the major factors responsible for low sugar recovery is crushing of immature and over matured cane by sugar mills. Maturity determination and crushing of cane at its peak maturity phase is very important to obtain higher recovery of both white sugar and gur. In sugarcane normally an inverse relationship exists between cane yield and sucrose content. High tonnage varieties possess lower sugar potential and vice versa. Generally high yielding varieties play an important role in increasing the productivity of sugarcane (Singh *et al.*, 2001).

Gur is manufactured almost in all parts of Bangladesh where sugarcane is grown in abundance. Selection of sugarcane varieties/clones suitable for quality gur production is

important. The varieties suitable for gur making are found to be equally good for sugar production. However, a variety suitable for sugar production may not be equally suitable for gur making (Singh *et al.*, 1975). Gur quality is considered by its sucrose content, reducing sugars, colour etc. (Gopal and Chiranjivi, 1959). Though quality may be further modified by method of boiling and clarificants used for preparation of gur. Chemical composition of gur and its quality are dependent on composition of juice from which gur is made. The quality of gur may be influenced by climate, soil type, crop management, clarificants used, stage of maturity at harvest and method of juice boiling adopted but mainly depends upon the variety from which it is made (Kapur *et al.*, 1988).

Gur is highly hygroscopic in nature and as a result it becomes soft and sticky and often liquifies completely at high humidity period. Some micro-organisms are responsible for fermentation which brings about various changes resulting in heavy losses both in weight and quality of gur (Farooque, 1960; Sarker *et al.*, 1985). There are wide variations in quality of gur prepared from different varieties like chemical composition of gur, colour and deterioration during storage (Patil *et al.*, 1994). The present experiment was undertaken with objectives to screen some new promising early maturing varieties with high sucrose and noticeable cane yield for quality gur production at early part of the crushing period.

METERIALS AND METHODS

Five promising clones viz I 24-00, I 80-00, I 124-00, I 133-00 and I 149-00 were evaluated for their performance compared with one variety Isd 36 (standard) in three successive cropping seasons (2004-2007) under Zonal Yield Trial (ZYT) stage. Two budded setts of each clone/variety were planted in 10 m × 10 m plots with three replications. Intercultural operations including control of pests and diseases were done as and when necessary. Cane samples were collected from each plot and crushed for analysis. Data on Brix, Pol% Cane, Purity, Reducing Sugars%, phosphate content of juice and fibre% cane from individual clones were recorded.

Brix was determined by Brix hydrometric method. Pol % Cane was measured in Horne's dry lead sub acetate method by Polarimeter (Laboratory Manual for Queensland Sugar Mills, 1970), while reducing sugars were measured by Lane and Eynon method (Chen, 1985). Phosphate was determined by L-ascorbic acid graphical method (Chen, C. P. 1985). Fibre % cane was determined by wet disintegrate method. Gur was prepared from each clone by simple open pan boiling method without adding/using chemical clarificant. Physical and chemical properties of prepared gur from clones under ZYT stage for sucrose, colour (at 0.25N solution), pH, reducing sugars were determined by following method of Roy (1954). Data on sucrose, colour (transmittance), moisture % gur and reducing sugar per cent of prepared gur from same clones were recorded. Data have been presented in graphical form.

RESULTS AND DISCUSSION

Results of the experiment have been presented in Figs 1-10. The clones tested were found different in pol % cane, reducing sugars and fibre content. Five promising clones including variety Isd 36 (standard) have been chemically analysed at monthly interval beginning from mid September to mid February. The early maturing potential clones were

grouped on the basis of higher pol% cane and lower reducing sugars content in the month of October and mid maturing potential clones were grouped on the basis of the same in the month of December. Results have been shown in Figures 1 & 2. It is seen from the Figure 1 that pol % cane of clones and variety Isd 36 were quadratic in nature creating peaks in December and January. It is also seen that clones I 133-00 and I 149-00 had higher rate of increase in pol% cane upto December compared to rest clones and pol% cane declined after December except clones I 24-00, I 80-00 and I 124-00. Pol % cane of these clones were increased upto February. Similar results were reported in this laboratory earlier (Jabber *et al.*, 2005). However, in case of reducing sugars content opposite trend was observed in all clones tested in the present investigation. It is seen from the figure 2 that reducing sugars of clones I 133-00 and I 149-00 decreased gradually upto February. Since pol% cane in clones I 133-00 and I 149-00 were above 10% in October with peak in December, reducing sugars per cent was below 1% in October, as such clones I 133-00 and I 149-00 may be considered as early maturing potential. The rest clones tested may be considered as mid maturing potential.

The softness and juiciness of a sugarcane variety mainly depends on its fibre content. Higher is the fibre content lower is the juice extraction and cane quality. Higher fibre content leads to higher bagasse production and lower juice extraction resulting higher loss of pol in bagasse (Islam, 1984). Results of fibre % cane have been shown in the Figure 3. The lowest fibre % cane was obtained in clone I 149-00 (15.2%) followed by clones I 133-00 (15.5 %), I 124-00 (15.8 %), I 24-00 (16.1 %) and I 80-00 (16.2%). Similar result was shown earlier by Jabber *et al.* (2005).

Phosphate in cane juice is generally present in the order of 250-400 ppm. About 350 ppm P_2O_5 content in juice is supposed to be optimum in most of the cane juice in order to get good clarification. If the phosphate content is found to be lower than in range in cane juice, it is essential to add phosphate in solution in cane juice to get good juice clarification. (Chen, 1985). The varying level of phosphate in cane juice might be due to soil condition, phosphatic fertilizer usage and variety. Results of phosphate content in cane juice have been shown in Fig 4. The higest phosphate content was obtained in clone I 149-00 (307 ppm) followed by clones I 133-00 (301 ppm), I 80-00 (286 ppm), I 24-00 (285 ppm) and I 124-00 (281 ppm) compared to standered Isd 36 (320 ppm).

In case of physical properties of gur, clones I 133-00 and I 149-00 clones showed superior quality gur due to golden colour and good crystalline nature compared to rest clones tested (Table 1). It is seen from the Figure 5 that highest sucrose per cent were recorded in clones I 133-00 (73.1%) followed by I 149-00 (72.8 %) & I 124-00 (71.2 %) and the lowest value is in the clone I 80-00 (66.5 %) compared to standard variety Isd 36 (74.3 %). It may be mentioned that sucrose per cent is the main sweetening factor of gur. Reducing sugars per cent of gur of clones I 133-00 (7.2 %) and I 149-00 (7.3 %) in Figure 6 were found to be similar with variety used as standard, while sucrose contents of clones I 24-00, I 80-00 and I 124-00 were found to be at par with one another (Fig. 5) variety. Similar results were obtained by Gaur *et al.* (1979) who reported that a good quality gur should have higher sucrose and lower reducing sugars per cent. Gur containing higher per cent of reducing sugars generally discouraged; because it is hygroscopic, has poor quality and low shelf-life.

The colour transmittance of gur is shown in the Figure 7. It is seen that the higher colour transmittance of gur was obtained in the clone I 149-00 (66.0) and I 133-00 (65.0) compared to standard variety (67.0) followed by clones, I 124-00 (61.0) and I 80-00

(60.0). It is evident from the data that colour transmittance of gur prepared from the clone I 24-00 (57.0) were comparatively lower and clone I 149-00 (66.0) and I 133-00 (65.0) had the higher value. Similar findings were reported by Sarker *et al.*, (1985). Light coloured gur is always preferred by consumers for eating purpose, and good quality gur is characterized by light colour. Higher pH of gur was recorded in clone I 133-00 (5.64) and I 149-00 (5.62) compared to other clones/variety (Fig. 8). Lower pH indicates acidic in nature. Figure 8 shows that pH value of gur prepared from clone I 133-00 (5.64) and I 149-00 (5.62) are equivalent to neutral pH than other clones, and gur from these types of clones is suitable for consumption.

Figure 9 shows that the lowest moisture is obtained in the clone I 133-00 (6.1 %) followed by I 149-00 (6.4 %) while I 24-00 (8.1 %) have the highest moisture per cent followed by I 80-00 (7.6 %) and I 124-00 (7.5 %). Higher percentage of moisture containing gur is not suitable for long term preservation (Gaur *et al.*, 1979). The highest gur recovery per cent was obtained in clone I 149-00 (10.6 %) followed by variety Isd 36 (10.4 %) and clone I 133-00 (10.2 %) and the lowest in clone I 24-00 (Fig. 10).

Depending on results, it might be stated that all quality characters except reducing sugars increases from September, and continued till January irrespective of varieties and their maturity groups. Since the temperature of Bangladesh declining from September onward the growth of cane becomes stunted and glucose began to convert into sucrose. The rate of sugar accumulation within cane stalk is much faster in early maturing varieties as compared to mid and late maturing varieties. As the temperature rises from January onward in general, deterioration of cane quality especially recoverable sucrose starts declining. The sucrose accumulation is higher in early maturing varieties. Superior quality of gur is associated with higher sucrose, high colour transmittance, lower reducing sugars content and lower moisture content. The proper distribution of these in juice is essential for producing good quality gur with standard food value. It may be concluded that the clones I 133-00 and I 149-00 might be considered as early maturing and the rest of the clones as mid maturing potential along with other qualities. Therefore, the clones I 133-00 and I 149-00 might be recommended for good quality gur producing varieties.

Table 1 : Physical properties of gur of different clones/varieties

Clones/Variety	Physical properties		
	Texture	Crystalline in nature	Colour in solid state
Isd 36	Hard	Good	Golden
I 24-00	Soft	Medium	Brown
I 80-00	Soft	Medium	Brown
I 124-00	Hard	Good	Brown
I 133-00	Hard	Good	Golden
I 149-00	Hard	Good	Golden

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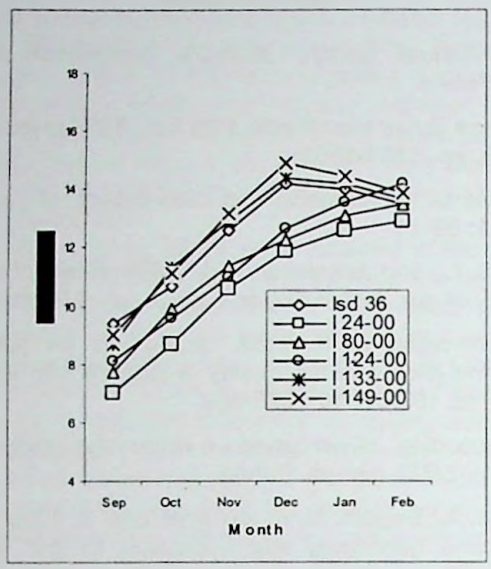

Figure 1 : Pol % cane of clones at different months (Mean of 3 seasons)

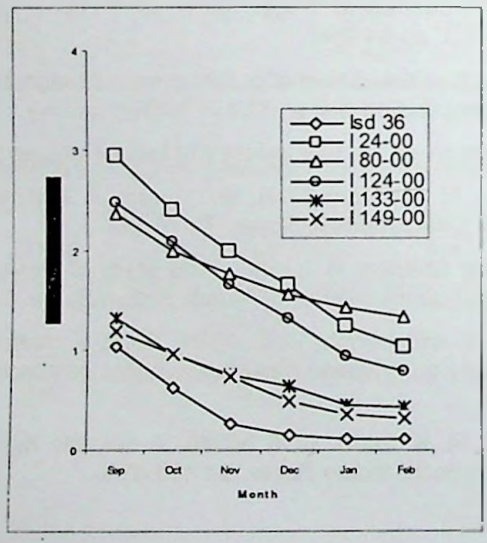

Figure 2 : Reducing sugars % of clones at different months (Mean of 3 seasons)

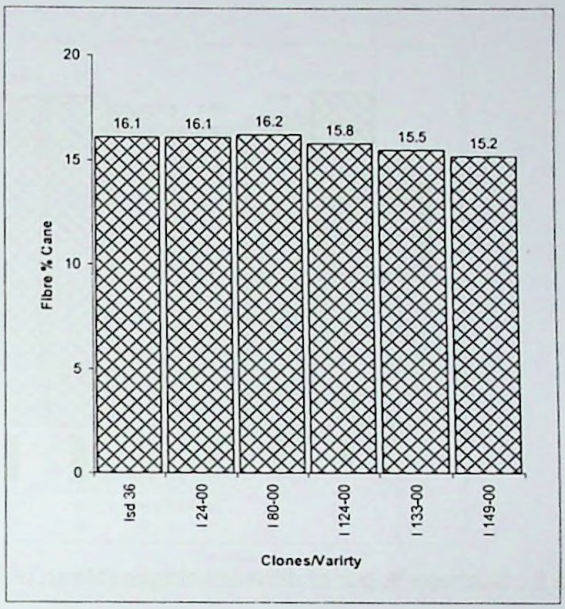

Figure 3 : Fibre % Cane (Mean of 3 seasons)

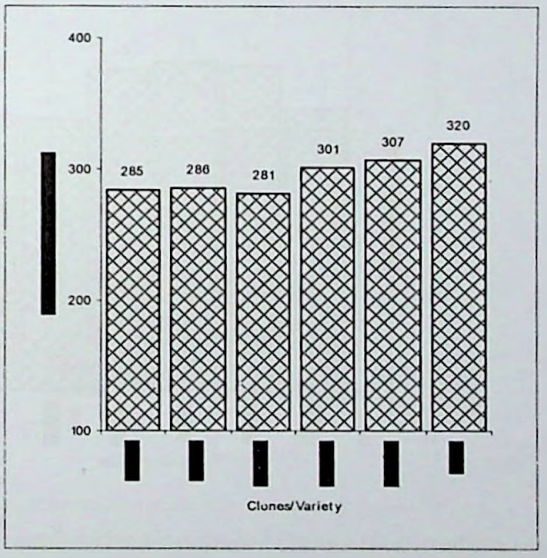

Figure 4. Phosphorus content (ppm) of cane juice of different clones (Mean of 3 Years)

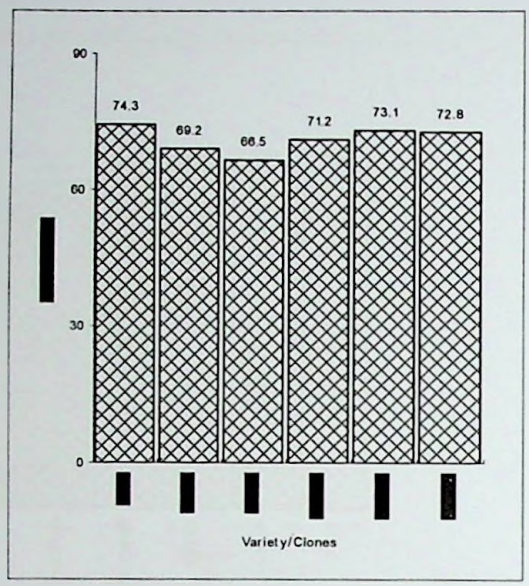

Figure 5 : Sucrose % gur of different clones (Mean of 3 seasons)

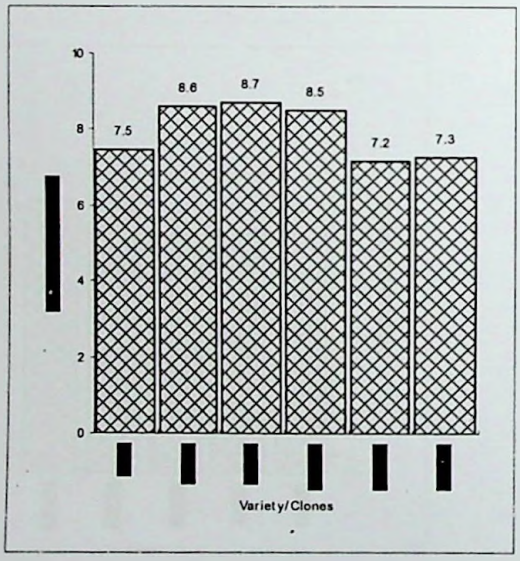

Figure 6 : Reducing cugars % cur of different clones (Mean of 3 seasons)

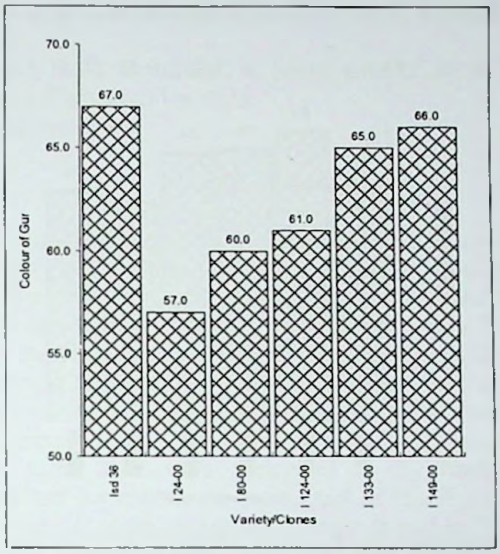

Figure 7 : Colour transmittance of gur prepared from different clones (Mean of 3 seasons)

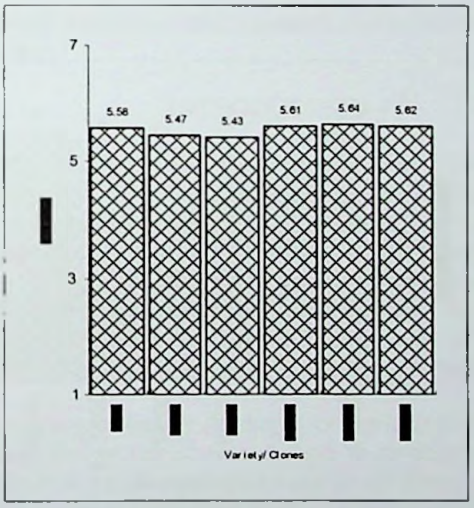

Figure 8 : pH of gur prepared from different clones (Mean of 3 seasons)

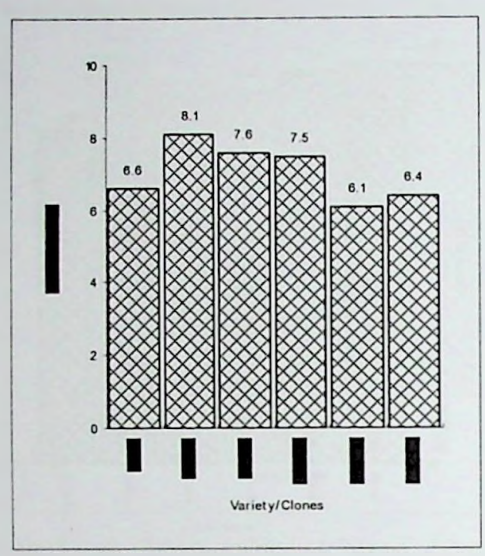

Figure 9 : Moisture % gur prepared from different clones (Mean of 3 seasons)

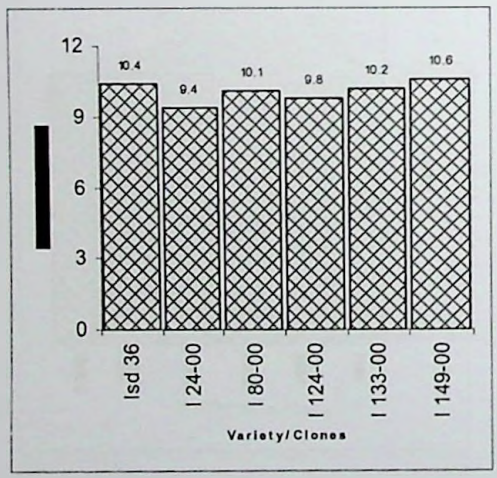

Figure 10 : Recvery % gur prepared from different clones (Mean of 3 seasons)