SCREENING OF SOME SUGARCANE GENOTYPES FOR GUR*QUALITY

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ABSTRACT

A field study to screen five sugarcane genotypes viz; HSF-242, S97-US-127, S97-US-102, S97-US-161 and HSF-240 as standard for their gur quality was conducted at Sugarcane Research Institute Faisalabad during the cropping season 2002-03. Different qualitative parameters of gur including mineral matters%, color, moisture%, net rendements%, acidity, pol% and reducing sugars% were examined. Methods described in Gur Monograph (1951) were followed during experiment. The gur so prepared was stored in gunny bags for a period of ninety days while the analysis of freshly prepared and ninety days old gur was made. The results showed that genotype S97-US-161 produced gur with highest net rendements % and pol% before and after storage. Statistically significant differences were observed with respect to mineral matters%, color, acidity and reducing sugars% while non-significant differences for moisture%, net rendements% and pol% were reported.

Key words: *Sugarcane, genotypes, gur, pol %, reducing sugars %*

INTRODUCTION

The importance of sugarcane (*Saccharum officianarum* L.) in the agrarian economics of Pakistan needs no emphasis because of its higher value as a cash crop, a major source of white sugar, shakkar and gur. Gur manufacturing occupies a major position in the rural cottage industry of Pakistan. In these days, its role and importance has been increased many folds as its prices have surpassed white sugar in the local markets. The cane growers prefer to convert this crop into gur rather supplying it to sugar mills. This is why its production is increasing day by day and it was produced in an amount of 624.4 thousand tones during 2005-06 (GOP, 2006). Similarly, gur made in Pakistan has a large market in Afghanistan and central Asia where it is used making wines. Also, the Government, should have encouraged value addition product which can extend its exports to India and other regions like Africa. This can earn a big foreign exchange for the country (Khan, 2007).

However, its price, shelf life, keeping quality, taste, texture and structure depends upon the sugarcane genotype used for gur making because the quality of gur is the same as the quality of cane juice. A well matured high sugar recovery cane variety with reasonable juice extraction and purity is pre requisite for a better quality gur. Aiyar and Krishnamoorthy (1954) pointed out that non sugars affect the quality of product not quantity. Patil *et al.,* (1994) conducted a three years experiment to evaluate eleven different cane varieties for gur purpose harvested after ten and twelve months. They found that jaggery (gur) obtained from varieties harvested after ten months showed abrupt increase in reducing sugars during storage. The present study was conducted to evaluate five sugarcane genotypes, keeping HSF-240 as standard, for gur quality at Sugarcane Research Institute Faisalabad during 2002-03.

MATERIALS AND METHODS

An experiment was conducted during the year 2002-03 to screen out some spring planted sugarcane genotypes (HSF-242, S97-US-127, S97-US-102, S97-US-161 and HSF-240) for their gur quality. The crop was sown in the first week of March 2002 and harvested in the first week of March 2003. Sowing was done in RCBD arrangement where each treatment had three replicates. All the agronomic practices including irrigation, fertilization, weeding and plant protection measures were conducted as and when considered necessary. At harvesting, representative cane samples were brought to laboratory where juice was extracted at farmer's crusher and analyzed for brix %, pol %, purity %, gur %, ash %, acidity, reducing sugars %, CCS % and sugar recovery % according to methods described in PSST book (Anonymous, 1977). The gur was prepared using standard methods described in Gur Monograph (Roy, 1951). Freshly prepared gur was analyzed for its qualitative characteristics such as mineral matters%, color, moisture%, net rendements%, acidity, pol% and reducing sugars%. Then it was stored in gunny bags for a period of ninety days and analyzed for the same qualitative characteristics. The data thus collected were subjected to statistical analysis (Steel *et al.,* 1997).

RESULTS AND DISCUSSION

Cane and cane juice quality in relation to Gur: The results described in Table-1 show significant differences among all the means. The highest brix% juice (21.74%),

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pol% juice (18.72%), purity% juice (87.20%), gur% juice (20.77%), reducing sugars% (0.47%), bagasse% (47.47%), CCS% (14.10%), sugar recovery% (13.25%), lowest ash% (0.33%), acidity (5.23%) and juice% cane (52.52%) were given by genotype S97-US-161. The other genotypes showed results below and above these limits and most of the genotypes were statistically at par in cane and juice quality parameters with S 97-US-161.

Mineral matters%: It includes all the externally added inorganic substances during clarification as well as naturally present in cane juice and play an important role in gur quality deterioration if present in excessive amount. The results indicated significant differences among five genotype for mineral matters (Table. 2). The highest percentage of mineral matters (3.10%) was found in the gur of genotype S97-US-102 while the lowest one (2.44%) in the gur of genotype S97-US-161 as compared to standard HSF-240 (2.63). All the other genotypes except S97-US-161 were statistically at par with S97-US-102 with respect o mineral matters%. The results coincide with Singh *et al.* (1975) who reported similar observations.

Color (Colori metric units): It is an important physical parameter of gur quality as dark colored gur is disliked. The results of the present study revealed significant ($P < 0.05$) variation among colori metric units of gur both before and after storage. The standard genotype HSF-240 exhibited maximum colori metric units before storage (44.92) and after storage (42.63) and genotype S97-US-127 was statistically at par with HSF-240 in this parameter. The lowest colori metric units (32.13 and 29.85) were given by genotype HSF-242 before and after storage respectively. Similar results were reported by Patil *et al.,* (1994) who observed same trend in his experiment.

Moisture%: The higher moisture contents in gur deteriorate its quality by darkening color and encouraging microbial growth. There was a non significant difference for moisture contents in gur among genotypes. The highest moisture (6.2%) was shown by gur from genotype S97-US-102 that was equal to HSF-240 before storage while the lowest moisture (5.92%) was exhibited by gur of genotype S97-US-161. Similarly, after storage the maximum moisture contents (6.30%) were noted in genotype S97-US-102. High reducing sugars and mineral matters are the main causes of moisture absorption. Hence reduces the quality in storage. Genotype S 97-US 102 showed the highest mineral matter contents. So it absorbed higher moisture. These observations are in line with Singh *et al*, (1975) who observed a variable tendency of moisture absorption and contents among different cane varieties.

Net rendements%: It is an important chemical parameter for gur evaluation. Varietal differences regarding net rendements were non significant (Table. 2). The highest net rendements (65.16%) were produced by genotype S97-US-161 before storage as compare to standard HSF-240 that produced lowest net rendements (63.34%) before storage. Pol (sucrose) is the chief sweetening agent in gur. Genotype S97-US 161 showed maximum pol % before and after storage whereas minimum net rendements (62.23%) by S97-US-102 as compare to HSF-240 (62.81%).

Acidity: A direct relation is found between acidity and gur quality because high acidity deteriorates gur quality. The results of this parameter are indicative of the fact that the differences in acidity of gur from different genotypes were significant. The minimum acidity (5.22) was observed in the gur of genotype S97-US-161 before storage, as compare to standard HSF-240 (5.45) and it was followed by S97-US-102, S97-US-127 and HSF-242 in ascending order. While the lowest acidity 5.15, after storage, was shown by gur of genotype S97-US161 and it was followed by S97-US-102 (5.21), S97-US-127 (5.21), standard HSF-240 (5.39) and HSF-242 (5.50) in asending order. These demonstrations are in agreement with Patil *et al.* (1994) who reported variable acidity in eleven sugarcane varieties before and after storage.

Pol%: Being the major sweetening agent, it is the main factor in grading. It is evident from results that there were non significant variations among means for pol% gur. The maximum pol% gur (77.78%) before storage was found in genotype S97-US-161, as compare to HSF-240 (76.00%), that was followed by S97-US-102 (77.62%), HSF-242 (76.34%), and S97-US-127 (75.79%) in descending order. Similarly, highest value of pol% gur (77.78%) was observed in genotype S97-US-161 and lowest (75.79%) in S97-US-127. These explanations are in agreement with those obtained by Mishra (1991) while comparing twelve sugarcane cultivars with respect to pol percentage.

Reducing sugars%: It is also an important quality parameter from chemical point of view because higher concentration of reducing sugars makes gur hygroscopic. There were significant differences for reducing sugars among five genotypes (Table-2). The highest value of reducing sugars (4.08%) before storage was noticed in gur prepared from genotype S97-US-161 and it was statistically at par with standard genotype HSF-240. While the lowest value of reducing sugars (3.05%) before storage was recorded in HSF-242. Similarly maximum percentage of reducing sugars (4.32%) after storage was noted in the gur of S97-US-161 and it was found statistically at par with standard HSF-240 and S97-US-102. This discussion is in harmony with Singh *et al.* (1975) who reported an increase in trend in reducing sugars due to sucrose hydrolysis.

*Unrefined brown sugar prepared by conventional methods in rural areas of Pakistan.

Table-1: CANE AND CANE JUICE QUALITY IN RELATION TO GUR

Genotypes	Juice							Cane					
	Brix %	Pol %	Purity %	Gur %	Ash %	Acidity	Red. Sugars %	Pol %	Juice %	Bagasse %	Gur %	CCS %	Sugar Rec. %
HSF-242	20.74^{ab}	17.35^{b}	83.14^{b}	20.01^{ab}	0.52^{ab}	5.58^{a}	0.24^{c}	10.19^{a}	58.71^{b}	41.29^{c}	11.75^{a}	12.71^{b}	11.94^{b}
S97-US-127	20.48^{b}	16.98^{bc}	82.95^{b}	19.67^{b}	0.44^{b}	5.35^{c}	0.27^{c}	9.03^{b}	53.11^{d}	46.89^{a}	10.45^{c}	12.36^{b}	11.61^{b}
S97-US-102	19.13^{c}	16.33^{c}	85.36^{ab}	18.42^{c}	0.56^{a}	5.49^{b}	0.30^{bc}	10.06^{a}	61.60^{a}	38.40^{d}	11.35^{ab}	12.13^{b}	11.40^{b}
S97-US-161	21.74^{a}	18.72^{a}	87.20^{a}	20.77^{a}	0.33^{c}	5.23^{d}	0.47^{a}	9.84^{a}	52.52^{d}	47.47^{a}	10.91^{bc}	14.10^{a}	13.25^{a}
HSF-240 (Standard)	20.40^{b}	17.19^{bc}	84.24^{b}	19.73^{b}	0.48^{ab}	5.25^{d}	0.44^{ab}	9.46^{ab}	55.04^{c}	44.94^{b}	10.85^{bc}	12.65^{b}	11.89^{b}
LSD at 5%	0.7916	0.9584	2.704	0.7672	0.08439	0.08439	0.1387	0.7340	1.749	1.761	0.6482	0.9231	0.8674

CCS = Commercial Cane Sugar LSD = Least Significant Difference Red = Reducing
Rec. = Recovery Sugar Rec. = CCS % x 0.94

Table-2: PHYSICO-CHEMICAL COMPOSITION OF GUR FROM DIFFERENT GENOTYPES DURING STORAGE

Genotypes	Mineral matters%	Color (colorimetric unit)		Moisture %		Net rendements%		Acidity		Pol%		Red. Sugars%	
		B.S.	A.S.	B.S.	A.S.	B.S.	A.S.	B.S.	A.S.	B.S.	A.S.	B.S.	A.S.
HSF-242	2.77^{ab}	32.13^{b}	29.85^{b}	6.06	6.10	63.59	62.70	5.59^{a}	5.50^{a}	76.34	76.00	3.05^{b}	3.60^{b}
S97-US-127	2.60^{ab}	42.72^{a}	40.55^{a}	6.00	5.90	63.40	63.18	5.50^{b}	5.21^{a}	75.79	75.79	3.28^{b}	3.50^{b}
S97-US-102	3.10^{a}	34.67^{b}	33.20^{b}	6.20	6.30	63.52	62.23	5.50^{b}	5.21^{a}	77.62	77.10	3.27^{b}	3.85^{ab}
S97-US-161	2.44^{b}	35.50^{b}	32.47^{b}	5.92	5.96	65.16	64.92	5.22^{d}	5.15^{d}	77.78	77.78	4.08^{a}	4.32^{a}
HSF-240 (Standard)	2.63^{ab}	44.92^{a}	42.63^{a}	6.20	6.00	63.34	62.81	5.45^{c}	5.39^{b}	76.00	76.00	3.75^{a}	4.00^{ab}
LSD at 5%	0.4968	4.272	4.697	N.S.	N.S.	N.S.	N.S.	0.04872	0.4872	N.S.	N.S.	0.3479	0.511

A.S. = After Storage B.S. = Before Storage LSD= Least Significant Differences
N.S. = Non-Significant Red. = Reducing

Conclusion: The results revealed that genotype S97-US-161 came out as the best one on account of production of the highest gur % juice (20.77%) and good quality gur (77.78%) sucrose. It was followed by S97-US-102 due to high content of gur % cane (11.35%) and high sucrose % (77.62%). Whereas, genotype S97-US-127 remained at the bottom.

Recommendations: Genotypye S97-US-161 is recommended for sugarcane growers who are interested in gur making.

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