EFFECT OF NPK FERTILIZER ON APPARENT PURITY, REDUCING SUGAR AND BRIX QUALITY OF SUGARCANE JUICE CULTIVATED IN PAPALANTO, OGUN STATE

***Afolayan O. A. #Makanjuola J. O.**
*Department of Science Laboratory Technology, The Federal Polytechnic, Ilaro
#Department of Food Technology, The Federal Polytechnic, Ilaro

Abstract

In Papalanto, sugarcane saccharum officinarum is a crucial crop that plays a major role in both food security and income generation. Despite these crucial roles played by this grass, its potentials are still unknown. In this study, two sugarcane types were collected from Papalanto Ilaro, Ogun State; sugarcane samples and the juices were extracted in order to analyze their biochemical qualities such as brix, reducing sugar and apparent purity. The brix was determined using a hand refractometer, the apparent purity was calculated from the known brix, reducing sugar content was determined using the benedict reagent quantitative procedure and the fibre content was determined using the AOAC method. Among the different parameters analyzed, significant differences were observed in the reducing sugar and brix and the apparent purity of the untreated sample (fertilizer added) and the NPK-treated (fertilizer added) sample except in fibre content. The treated samples showing significantly ($p<0.05$) higher content of the brix, apparent purity and reducing sugar than the untreated samples (no fertilizer added). Based on the results of the study, the sugarcane types were found to be of good quality in terms of the parameters assayed for in this research work.

Keywords: Brix, fiber, reducing sugar and sugarcane.

Introduction

The sugar cane crop is also known as chewing and noble cane. It grows well in tropical and subtropical regions. It will require well-drained soil of pH 7.5 - 8.5 and high organic matter, along with a hot and humid environment (Amandeep., et al 2015). Sugarcane is the most important cash crop and it has an important position in the Agrarian economy of India. Almost six million farmers grow sugarcane and also large numbers of agricultural laborers are engaged in cane cultivation. It provides the employment opportunities to more than half a million people, either skilled or semi-skilled workers, mostly from rural areas (Ajay & Pritee 2014).

Fig 1: Diagrammatic representation of sugarcane and its juice.

Sugarcane Juice and its Components

Sugarcane juice contains water (70–75%), sucrose (13–15%), and fiber (10–15%) (Chinnaraja, 2017). Sugarcane juice is a very popular drink and it is rarely available commercially in packaged form. It is extracted by crushing the sugarcane between roller crusher and consumed with or without ice. Sugarcane juice also contains non reducing sugars (sucrose 10 to 21%), reducing sugars (glucose and fructose 0.3 to 3%), organic substances (0.5 to 1%), inorganic matter (0.2 to 0.6%) and nitrogenous bodies (0.1 to 1%) (Krishnakumar, Thamilselvic & Devadas, 2013).

In Nigeria, particularly in the northern part, *Saccharum spp*, popularly known as sugarcane is consumed as a snack, by chewing the stem pulp to extract its juice, while the bagasse is thrown away. Ekpélikpézé1, Dansi1, Agbangla, Akoegninou, & Sanni, (2016). carried out a research work on the biochemical characterization of sugarcane varieties cultivated in Benin. In this research work, Ekpelikpeze., et al (2016) collected 42 sugarcane landraces in Benin and analyzed their biochemical components such as brix, polarity, purity of the juice, juice content, fiber content, phosphorus content, saccharose and sugar content.

Reducing Sugars in Sugarcane Juice

Reducing sugars refer to saccharides that reduce Tollens' or Fehlings' reagents. While all monosaccharide and most disaccharides are reducing sugars, the term as it is used in sugar milling mainly refer to glucose and fructose, as opposed to sucrose which is a non-reducing sugar. Sugarcane juice consists of fermentable carbohydrates (i.e., sucrose, glucose, and fructose) and some non-sugar organic materials (e.g., pigments, amino acids, inorganic salts, phenolic compounds) (Baikow, 2013).

Brix and Apparent Purity of Sugarcane Juice

The characteristic of sugarcane juice purity is directly related to the quality of the raw material and is influenced by the mineral and vegetal impurities that are added to the sugarcane at the time of harvest (Oliveira, Braga, Walker 2015). Brix can be defined as the percentages in 'weight, or in volume, of soluble solids expressed as sucrose and it is a quantitative measurement of the total solids (including sugars), not giving any qualitative information (Sonal, Narendra, Shailesh , Naik and Mistry, 2017).

Methodology

Sample Collection

Matured stems of local cultivar of sugarcane *(Saccharum officinarum*) were purchased from local market of Papalanto, Ilaro, Ogun state. They were kept in a dry and safe place.

Preparation of Sugarcane Juice

The sugarcane was peeled with a clean knife and was cut into smaller pieces. The sugarcane was crushed with sugarcane juice extractor and the juice was collected in a clean sample bottle. The sample was kept in a refrigerator to prevent it from fermentation pending the time it was used.

DETERMINATION OF BRIX IN SUGARCANE JUICE; The brix was determined using the method of Sonal et al., 2017. Brix is the measurement in percentage by weight of sucrose in a solution. 20% brix is equal to 20g of sucrose in 100ml of a solution. The surface of the prism was washed with distilled water and wiped using kim wipes. A drop of the juice sample was placed on the refractometer surface; at a temperature of 68^{o}F. Readings were accurately

taken.

Determination of Apparent Purity of Sugarcane Juice; Determination was done according to the method of Sonal et al., 2017. Apparent purity is the percentage of sugar in brix (Chen and Chou, 1993). It is expressed as polarization divided by refractometer. The polarization of juice was read using a polarimeter and calculations were done using the formular below;
Apparent purity =

$$\mathbf{PA} = \frac{\mathbf{Pol\%}}{\mathbf{CorrectedBrix}} \text{x } 100$$

Determination of Reducing Sugar: The reducing sugar content was determined using the method of Sonal et al., 2017. 15 ml of the sugarcane juice was been measured into the burette solution. The burette was clamped so that it is positioned above the hot plate. 10 ml of Benedict's Quantitative Solution was Pipette into a 125-mL Erlenmeyer flask. 2 g of anhydrous sodium carbonate was placed in the flask. The mixture was properly mixed to suspend the sodium carbonate. The flask was placed on a hot plate situated underneath the burette and the contents in the flask was Heated to boiling. The Benedict's Quantitative Solution in the flask was titrated with the sugar solution in the burette. The concentration of the reducing sugar was calculated.

Determination of Fiber Content: The fibre content determination was carried out using AOAC (1990) method 2ml of the juice sample was weighed and placed in the conical flask.100ml of 0.1concentrated H_2SO_4 was measured and poured into the conical flask containing the weighed juice sample. This was boiled for 30 minutes, after which the acid was filtered and rinsed away. The same was done using NAOH. The obtained residue was made to be contained in already weighed crucibles and then heated in the muffle furnace for three hours. After which this was then weighed and recorded.

Results and Discussion

Table 1: EFFECT OF NPK FERTILIZER ON APPARENT PURITY, REDUCING SUGAR AND BRIX QUALITY OF SUGARCANE JUICE

Parameter	NPK-TREATED SAMPLE	UNTREATED SAMPLES
Brix %	35.80 ± 0.2^a	17.20 ± 0.2^b
Apparent purity %	52.30 ± 0.296^a	85.73 ± 1.195^b
Reducing sugar %	2.033 ± 0.068^a	1.663 ± 0.0152^b
Fibre %	0.2033 ± 0.025^a	0.2067 ± 0.0153^a

Table1: presents results for the test samples. All parameters assayed for showed significant ($p < 0.05$) differences in the parameters assayed. There was no significant ($p < 0.05$) difference in fiber quantity between both samples.

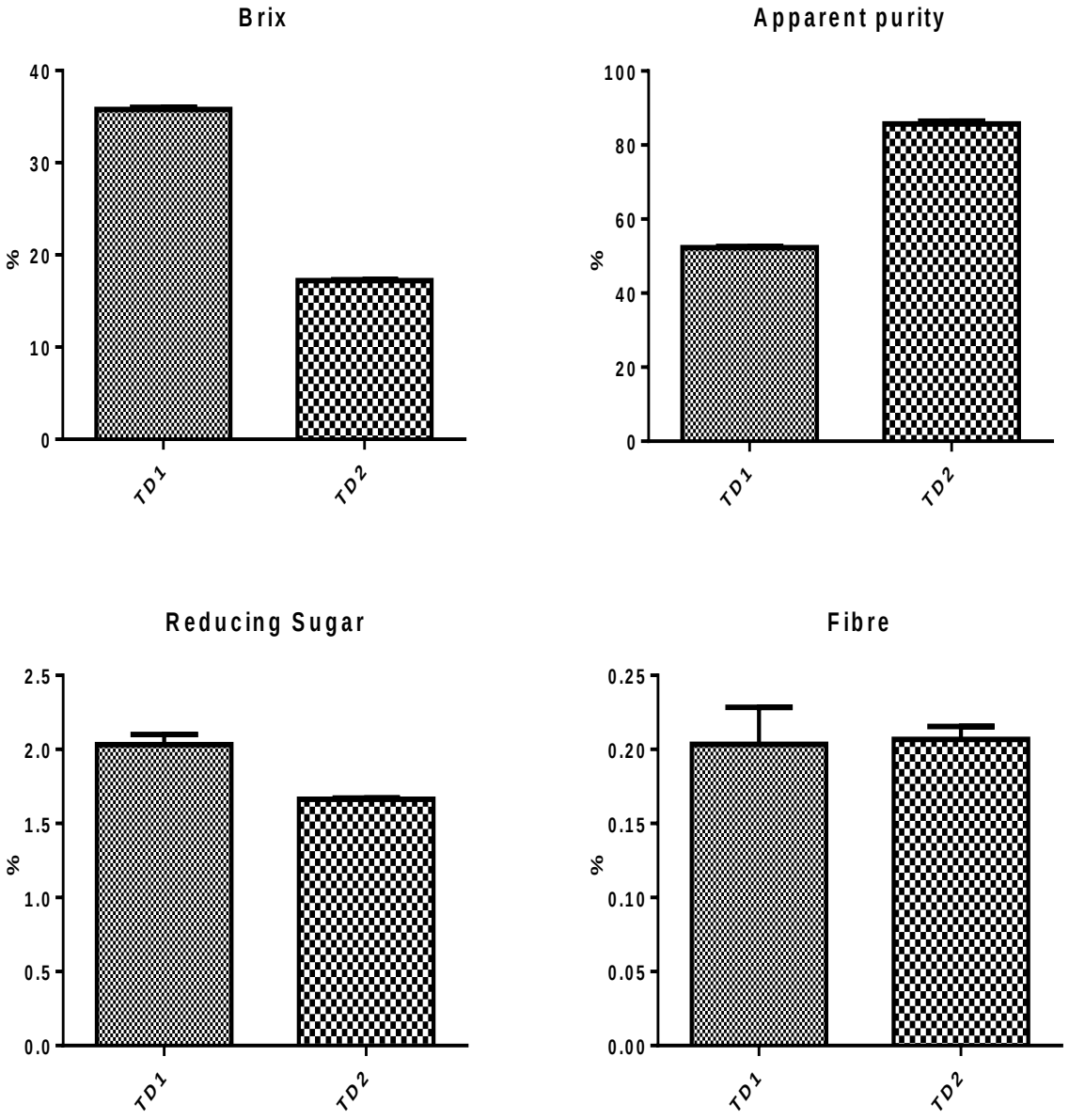

Figure 2: Showing chats for brix, apparent purity, reducing sugar and fibre

Discussion

Abdelmahmoud and Ahmed (2012) have revealed variability in sugarcane using biochemical characterization. Biochemical characterization is important to identify varieties with desirable technological traits to meet industrial requirements. In fact, sugar production companies require sugar meeting some standard in terms of biochemical composition and the quality of extraction of derived products. The percentage of juice, Brix value and purity content are widely used as key biochemical element to assess the quality of sugarcane. In this study, variability is observed in the majority of biochemical variables (reducing sugar, brix and apparent purity) of the sugarcane collected in

Papalanto, similar findings were reported by Abdelmahmoud and Amed (2012). Reducing sugar content showed high variability as compared to the results obtained by Ekpelikpeze., et al (2016). Reducing sugar content showed high variability in both samples as compared to the results obtained by Marina et al., (2010) while conducting similar study. Total reducing sugar content of sugarcane is important to evaluate the quality of the raw material (Jeferson., 2011). Furthermore, Brix contribute more to the genetic variability. The NPK-treated samples has a higher brix than the Untreated samples. According to (Hanna, 2014), different types of sugarcane can differ greatly in their brix quality; brix quality can vary from 15% to 23% brix. Sugarcane with a brix percentage closer to 23% brix is considered to produce the highest quality of sugar. This research work also revealed variation in apparent purity between the untreated and NPK-treated samples. This was also observes in the research carried out by Ekpelikpeze., et al (2016) who also reported a similar result in his study.

Conclusion

In conclusion, the present study results identify the sugarcane types grown in Paplanto Ilaro, Ogun State with such a high biochemical properties. The types worked with showed an important variability in terms of apparent purity, brix, reducing sugar and fiber content.

References

Amandeep S., Uma R., Hayat M., Prabh S., Gagan S., & Ravi K. (2015). Phytochemical profile of sugarcane and its potential health aspects. *Pharmacognosy review*. 9(17). 45-54.

A.O.A.C., (1990). Official *Methods* of Analysis. Association of Official Analytical Chemists,. The Association: Arlington, 15th editions.

Ajay K., & Pritee S. (2014). Climate Change and sugarcane productivity in indian: an econometric analysis. Indian institute of technology Indore, *Indian. Journal of social and development science*. 5(2). 111-122.

Baikow, V. E. (2013). Final molasses in manufacture and refining of raw cane sugar, Elsevier. https://doi.org/10.1016/*C2013*-0-12459-2.

Chen, C.P., & Chou C.C. (1993). Cane sugar handbook, a manual for cane sugars manufacturers and their chemists. John Willey and Sons.

Chinnadurai C., (2017). Sugarcane biotechnology: challenges and prospects. Springer International Publishing Ag 2017.https://doi.org/ 10.1007/978-3-319-58946-6_1.l

Ekpélikpézé1 S., Dansi1 A., Agbangla C., Akoegninou A., & Sanni A. (2016). Biochemical characterization of sugarcane varieties cultivated in Benin. *International Journal of Current Microbiology and Applied Sciences*, 5(2), 368-379.

Krishnakumar T., Thamilselvic C. & Devadas C. (2013). Effect of Sugarcane Juice Pre-Treatment on the Quality and Crystallization of Sugarcane Syrup (Treacle). *Journal of Food Processing &Technology*, 11(7), 834.

Jeferson L., Jansle V., Rubens A. (2011). Sugarcane yield estimates using time series analysis of spot vegetation images. *Sci. agric. (Piracicaba, Braz.)*, 68(2).

Oliveira R., Braga M., Walker A., (2015). Behavior vegetative and technological characteristics sugarcane cultivars under water stress in semi-arid conditions of Brazil. *Rev Bras Geo Fis*, 8, 525-541.

Marina O., Marcelo M., Adriano V., Silvia A., Rubens M., Carlos E., (2010). Improving bioethanol production from sugarcane: evaluation of distillation,thermal integration and cogeneration systems. *Elsevier,* 30(2010), 1-13.

Sonal T., Narendra S., Shailesh M., Naik R., & Mistry S. (2017). Sugarcane/Sugarcane Juice Quality Evaluation by FT-NIR Spectrometer. *International Journal of Current Microbiology and Applied Sciences*. 6(9), 3025-3032.