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Assessment of apparent purity, reducing sugar and brix quality of sugarcane juice cultivated at Papalanto, Ogun State

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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 fiber 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 fiber 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, sugarcane

Introduction
The sugarcane (*Saccharum officinarum*) crop can also be referred to as chewing and noble cane. It thrives well in tropical and subtropical areas. It needs a well-drained soil of pH 7.5-8.5 and high organic matter, along with a hot and humid environment (Amandeep, *et al.*, 2015) [1]. Sugarcane is an most cash crop. It offers employment privilege to more than half a million individuals, either skilled or semi-skilled workers, mostly from rural areas (Ajay and Pritee 2014) [3]. The aim of this study is to analyze the components of sugarcane juice cultivated in Papalanto and the specific objectives are to determine: reducing sugar content brix content, apparent purity.
Sugarcane juice comprises 70-75% of water, 13-15% of sucrose and 10-15% fiber (Chinnaraja, 2017) [6]. Sugarcane juice is a very common drink and it is hardly offered commercially in packaged form. It is extracted by crushing the sugarcane between roller crusher and consumed with or without ice. Sugarcane juice also comprises non-reducing sugars (10 to 21% sucrose), reducing sugars (0.3 to 3% glucose and fructose), organic substances (0.5 to 1%), inorganic matter (0.2 to 0.6%) and nitrogenous bodies (0.1 to 1%) (Krishnakumar, Thamilselvic and Devadas, 2013) [8]. In Nigeria, especially in the northern part, *Saccharum* spp, generally known as sugarcane is consumed as a snack, by chewing the stem pulp to extract its juice, while the bagasse is been disposed. Ekpélikpézél *et al.,* (2016) [7]. Carried out a research work on the biochemical characterization of sugarcane varieties cultivated in Benin. In this research work, in this research work 42 sugarcane landraces were collected in Benin and 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) [4].

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) [12].

Methodology

Sample collection

Mature stems of local sugarcane samples *(Saccharum officinarum*) were harvested from local farms within Papalanto, Ilaro, Ogun state and were kept in a dry and safe place.

Preparation of sugarcane juice

The sugarcane samples were peeled with a clean knife and cut into smaller pieces. The sample was crushed with sugarcane juice extractor and the juice was collected in a clean sample bottle. And kept in refrigerator to prevent fermentation.

Determination of brix in sugarcane juice

The brix was determined by the method of Sonal *et al.,* (2017) [12]. 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 68ºF. Readings were accurately taken.

Determination of apparent purity of sugarcane juice

Apparent purity was determined according to the method of Sonal *et al.,* (2017) [12]. Apparent purity is the percentage of sugar in brix (Chen and Chou, 1993) [5]. It is expressed as polarization divided by refractometer. The polarization of juice was read using a polarimeter and calculations were done using the formula below;

Apparent purity =

$$PA = \frac{Pol\%}{CorrectedBrix} \times 100$$

Determination of reducing sugar

The reducing sugar content was determined using the method of Sonal *et al.,* (2017) [12]. Sugarcane juice was been measured, 15ml into the burette solution. Benedict's Quantitative Solution 10ml 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 fiber content determination was carried out using AOAC (1990) [2]. The juice sample, 2ml was weighed and placed in the conical flask and 100ml of 0.1 concentrated 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 weighed in crucibles and heated in muffle furnace for 3 hours. Then, the weight of the samples was taken.

Results and Discussion

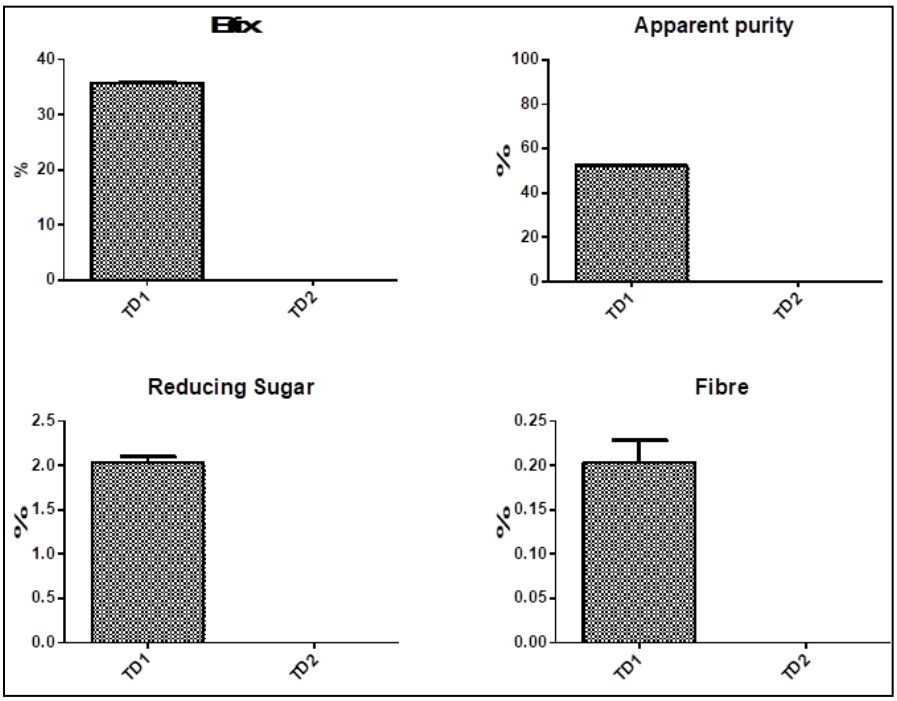

Fig 1: Showing chats for brix, apparent purity, reducing sugar and fiber

Table 1: Effect of NPK fertilizer on apparent purity, reducing sugar and brix quality of sugarcane juice

Parameter	NPK-treated	NPK-untreated
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}

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) [7]. 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 contributes more to the genetic variability. The NPK-treated samples have 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 observed in the research carried out by Ekpelikpeze, *et al.*, (2016) [7] who also reported a similar result in his study.

Conclusion

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

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