



Smallholder Sugarcane Farming in Cameroon: Farmers' Preferred Traits, Constraints and Genetic Resources

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ABSTRACT

Background: The study aimed at assessing the current state of sugarcane production, farmers' perceived production constraints and preferred traits in the five agro-ecological zones in Cameroon.

Methods: This study was conducted in five regions that represent the five agro-ecological zones of Cameroon. Primary data was obtained using key informants, semi-structured interviews (SSI), focus group discussions (FGD) and direct field observations during the implementation of a baseline survey. A total of 212 farmers were interviewed using a pre-designed semi-structured questionnaire which was produced in both the English and French languages to suit the English and French speaking respondents.

Results: Findings from this study show that mixed cropping was identified as the predominant sugarcane farming system. The main production constraints were financial and marketing constraints as identified by 47.8% and 14.8 respectively of the respondent farmers. A limited number (16) of landraces was collected from the study zones. Respondent farmers prioritized early maturity and marketability of the cane (40.2%), sweetness of the cane (30.8%) and cultural and medicinal values (3.9%) as the top preferred traits of sugarcane.

Conclusions: The findings from this study would serve as baseline information towards sugarcane research and development emphasizing the constraints and preferences of smallholder sugarcane growers in Cameroon. If all the products and bi-products of sugarcane could be maximized, high returns could be ensured and more emphasis on reducing constraints to the barest minimal would have been the priority of the agricultural sector.

INTRODUCTION

Sugarcane production worldwide was reported to be 1,884,246,253 tons in 2014 (FAOSTAT, 2015) with 195 countries involved in its production (El Bassam, 2010). It is an important crop in most regions of sub-Saharan Africa, since it is cultivated for multiple purposes: sugar, ethanol and wine production as well as for local consumption (chewing). In Cameroon, it is mostly cultivated by the sugar agro-industries: SOSUCAM (Societe Sucriere du Cameroun) which owns approximately 46,207 acres plantations, NOSUCA (Nouvelles Sucriere du Cameroun), SUMOCAM and New Food. Cameroon sugarcane production is on the decline with 1.450.000 tons produced in 1990 and gradually dropping to 1,216,320 tons, representing 1% of world production, in 2014 (FAOSTAT, 2015).

In Cameroon, like in most sub-Saharan countries, the demand for sugar far exceeds production. This sometimes leads to the importation of tons of sugar, about 25,000 tons, from Brazil when such a product crisis occurs. The sugarcane variety improvement network of Central and Western Africa, comprising of seven countries, eight companies and eleven production units including SOSUCAM in Cameroon, ensures that varieties of sugarcane are imported into each one of these countries. This is because none of them possess a variety breeding unit. Variety renewal in some of these countries tends to be slow or absent. As a result, there is a restricted range of varieties that is being cultivated (Marion et al, 2002). And most of the varieties imported do not respond to the needs of smallholder farmers who are an untapped resource for increasing sugarcane production. The production of smallholder farmers can be harnessed and accompanied because their involvement could contribute significantly in boosting sugarcane production and providing raw materials for the manufacture of sugar and other products.

Sugarcane cultivation by smallholder subsistence farmers started centuries ago and preceded the commercial sector in Ethiopia (Esayas, 2014). This is not the case with Cameroon where sugarcane production is only recently being adopted by smallholder

farmers. The sector had long been monopolised by large agro industries. Hence, there is little information on sugarcane production systems, farmers' perceptions on preferred traits and constraints under small-scale sugarcane farming systems in Cameroon. According to De Groote and Bellon (2000), the best way to capture farmers' needs, perceptions, constraints, and preferences is through Participatory rural appraisal (PRA). This approach allows farmers to participate in research activities for easy adoption of the technologies. Several authors (Ashby and Lilja, 2004; Asiedu-Darko, 2014; Ghimire et al, 2015; Meijer et al, 2015) reported that agricultural technologies, developed through participatory research, have a greater chance of being adopted.

In this light, this study has as objectives to document the current state of sugarcane production in Cameroon, farmers' perceived production constraints, preferred traits and sugarcane germplasm collected across the five agro-ecological zones of the country.

MATERIAL AND METHODS

Sampling procedures

This study was conducted in five regions that represent the five agro-ecological zones of Cameroon. A stratified random sampling was applied in the selection of study sites. From each region, three administrative divisions were randomly selected for sampling. The number of divisions and the localities finally sampled (Table 1) depended on information obtained from key informants on the availability of sugarcane farmers in that area. A simple random sampling strategy was used to obtain respondents from all the localities studied. However, a door-to-door approach was used in localities made up of about 50 households or less. A total of 212 farmers were interviewed using a pre-designed semi-structured questionnaire which was produced in both the English and French language to suit the English and French speaking respondents respectively.

Table 1: Localities in the five regions sampled

Agro-ecological zone	Region	Division	Localities
Zone I (Sudano-sahelian)	North	Benoue	Lagdo
		Faro	Poli
Zone II (High savanna)	Guinea Adamawa	Vina	Lac Tizon
		Mbere	Nganhi Roblin
Zone III (Western highlands)	West	Menoua	Dschang
		Noun	Foumbot
Zone IV (Humid forest with monomodal rainfall)	South West	Fako	Buea, Muea, Tiko, Limbe, Ekona, Muyuka
		Kupe-Muanenguba	Tombel, Nsukke
		Lebialem	Aloh, Menji
Zone V (Humid forest with bimodal rainfall)	Centre	Mfoundi	Ahala II
		Upper Sanaga	Mbandjock, Nkoteng
		Lekie	Obala

Sugarcane germplasm collection

Sugarcane germplasm was collected during the 2015/2016 growing season from home gardens, farmers' fields and local markets visited since there was no relevant information on the genetic material available to farmers in Cameroon. This would be used for establishing a sugarcane germplasm storage base for eventual characterisation and breeding of varieties for the future.

Data collection

Primary data was obtained using key informants, semi-structured interviews (SSI), focus group discussions (FGD) and direct field observations during the implementation of a baseline survey. Key informants included the delegates of the Ministry of Agriculture and Rural Development (MINADER) at the divisional and sub-divisional levels, MINADER extension workers and management officials of SOSUCAM. Focus group interviews were mostly aimed at discussing general issues relating to sugarcane production and problems faced by farmers. One-on-one semi-structured interviews with sugarcane farmers were carried out to explore specific issues, particularly those that were traditionally sensitive to the farmers. Finally, farm visits for observational assessments were also employed.

During the one-on-one semi-structured interviews, farmers were asked to (1) describe cultural practices of sugarcane production and main production constraints, (2) identify main cropping season and the major crops grown, (3) List sugarcane varieties that they grow using local names as well as the number of varieties known, (4) describe the uses of sugarcane and (5) list and rank their criteria for variety selection. These variables are considered as having an impact on the low sugarcane production and productivity under smallholder farming systems (Tena et al, 2016).

The objectives and significance of the project were explained to the farmers and key informants. Farmers were encouraged to use any language they were familiar with. A member of the research team most versed with the local language in a particular area facilitated the group discussions. Checklists were developed and questionnaires prepared to collect primary data. The survey was undertaken by a multidisciplinary team in a single phase from May to September 2015 in the designated five regions of Cameroon (Table 1). Secondary data was obtained from literature review even though literature considering smallholder sugarcane farming in Cameroon proved scarce.

Data analysis

Data from SSIs and FGDs were coded and summary statistics such as the mean, proportions and ranks were computed using the SPSS computer package (SPSS version 21) as well as data describing the germplasm collected and the type of farming operations were summarized using the same software.

RESULTS AND DISCUSSIONS

Farming systems as operated by smallholders

The average farm size was 2.5 hectares (ha) with 98% of the farmers having less than 3ha for sugarcane farming. Unlike in other areas where sugarcane is sole cropped, mixed cropping was the dominant farming system in all study zones. The labour employed in sugarcane farming was mainly family labour and the farmers mostly grow sugarcane with *Musa spp*, cereals (maize, sorghum and millet), vegetables and roots and tubers like cassava, potatoes, sweet potatoes, and taro. This is in accordance with Berdegue and

Fuentealba (2011) who described smallholder agriculture as comprising of farms which are operated by farm families and whose labour is mainly from these families.

Farming practices were somewhat similar in some aspects but different in others. Planting material was predominantly acquired from other farmers (67%) or from the market (22.2%) and the main parts used were the cane 'heads' (uppermost portion of the cane stalk) (48.6%) and cane setts (33.5%). Only a very limited number of farmers practiced ratooning or the use of suckers. For farmers using cane setts, the middle and upper part of the cane stalk was normally used and each sett usually had at least 3 buds. 79 % of the farmers believed that to obtain quality planting material, the cane stalk from which the setts were obtained should be 6 months to 9 months old maximum. Land preparation was mainly done manually using rudimentary farm tools. During planting, 75% of farmers preferred digging holes to plant rather than planting on beds or mounds, inserting two or three sets or heads per stand at varying plant spacing: 80 x 80 cm, 100 x 100 cm or 120 x 120 cm. The setts were either planted parallel to each other, slanted at approximately 45° (Verheye, 2013), covered completely with soil or planted vertically with part above the ground. A very peculiar practice noticed in some localities of Fako Division (Muea and Tole) in the South West Region was the planting of sugarcane in stony areas and on slopes. Farmers believe that sugarcane does well when planted in this manner. This could also be because Fako division has a lot of fragmented volcanic rocks in the form of stones in most farm lands since it is at the foot of Mount Cameroon.

In all the study zones, farmers planted at any time of the year with no preference to a particular season. However, it was observed that 63.7 % of farmers carried out some form of irrigation in the dry season indicating that there may be a seasonal effect on sprouting and growth of sugarcane which will need further investigation. The main forms of irrigation used by the farmers included canal irrigation (40.6%) mainly used in the North, West and Adamawa regions, use of a watering can (14.2 %) and sprinkler irrigation (2.8 %) predominant in the South West and Centre Regions. The main sources of water used where streams or rivers (44.8 %), wells (8 %), and public taps (6.1 %). The North and West Regions exhibited the highest number of farmers who irrigated with 95.6 and 83.9 %. The highest number of farmers using irrigation were located in the North region. This is probably due to the high temperatures and severe drought conditions experienced there, which is representative of the sudano-sahelian agro-ecological zone. The lowest number of farmers using any form of irrigation was observed in the South West region where there is abundant rainfall most of the year with short dry periods.

The use of agricultural inputs like fertiliser was practically very low with only 20% of farmers applying inorganic fertilisers to their crops. This was common only in the Adamawa and North regions whereas in the other

regions, the use of organic manure was common only with farmers who grew sugarcane in home gardens.

Farmers identified principally stem borers, termites and rodents as the main pests to sugarcane in all study zones. To control insect pests, 61.1% of farmers used insecticides, with the South West, Centre and North regions recording the highest rate in decreasing order. Manual weeding is mostly done and the reasons advanced for the low use of pesticides (including herbicides) is the lack of sufficient knowledge on their application. Generally, smallholder sugarcane farmers in the study areas are not following recommended sugarcane cultivation practices as compared to some districts in India where more than 60% of the farmers are reported to be adopting recommended technologies (Surat, 2009). Most farmers harvest sugarcane at 8 to 12 months after planting. Most farmers stated that sugarcane was mainly for household consumption (chewing) but they sometimes sold for immediate cash or gave as gifts to friends and neighbours. When asked if sugarcane farming sustained their household, 60.4 % of respondents disagreed to that.

Sugarcane production constraints

The main constraints to sugarcane production in the study zones as identified by respondent farmers are summarized in Table 2. These constraints include: financial constraints, marketing constraints, lack of improved varieties to ensure better performance, identification and treatment of pests and diseases, land scarcity, drought stress, low soil fertility, fluctuating prices and poor extension services. Financial constraints were identified as the most limiting factor to sugarcane production by 47.8% of the respondent farmers. They explained that if they receive financial assistance, it will help them buy fertilisers and pesticides as well as pay for labour to increase cropped surface area.

14% of respondent farmers indicated that price fluctuation of sugarcane was their major marketing problem (Table 2), especially in the main harvesting periods. Most of the farmers (86.7%) sold their sugarcane in the local village markets to wholesalers and retailers who come from neighbouring towns to buy. Only 2.8% of farmers transport their produce to the town markets for sale. The cane is the sole product of the crop that the farmers get to sell despite the fact that there are other bi-products that can be obtained from it. As such, it is imperative for the development of a value-added chain for this crop so that products like sugarcane juice and wine can also be produced and sold by these farmers or other entrepreneurs. Thus, there is a need to establish cottage industries, medium-size sugarcane enterprises and processing plants to increase the market value of sugarcane through production of other products including confectioneries. These market constraints are further exacerbated by the high transport costs due to poor roads. Similar challenges are being faced by local sugarcane growers in other countries on the African

continent like Nigeria, South Africa (Girei and Giroh, 2012; Singels et al, 2013) and Ethiopia (Tena et al, 2016) yielding low returns for investments made, unlike those in Zambia who obtained high returns on investments in sugarcane production (World Bank, 2009) just because they are organized under the outgrowers scheme of the sugar industry. If there has to be a boost in sugarcane production in Cameroon, sugar agro-industries like SOSUCAM may have to work hand in hand with sugarcane smallholder farmers to initiate the outgrowers scheme so that increase in returns, as is the case with the Zambian famers, can be achieved.

Lack of quality genetic material, inability to identify and treat diseases as well as land scarcity were also reported as major sugarcane production constraints. Land scarcity was very severe in the South West region than in any other region. This is probably due to the fact that most of the arable land is occupied by palm, banana and rubber plantations of the CDC. Also, the fast-growing urban nature and rapid

development of market gardens (considered more profitable than sugarcane) in the last decade in this region, has seen the allocation of more land to market gardens and food crops to the detriment of sugarcane production.

Extension services are an important tool for disseminating new technologies for adoption by farmers. The sugar agro-industry, SOSUCAM, should assist in providing extension services, training, and organizational support to smallholder sugarcane growers in pursuit of developing this sector. The efforts made by the extension agents of the Ministry of Agriculture and Rural Development (MINADER) in Cameroon are not felt by sugarcane farmers within most localities. This is reflected by the 93.7% of respondent farmers who attest to not receiving any form of technical advice from the government agents. In addition, research support and access to credit services are prioritized to main cash and food crops like cocoa, coffee and cassava.

Table 2: Constraints in sugarcane production and their relative importance (%) across all study zones

Constraint	Region					Total %
	South West	West	Centre	Adamawa	North	
Lack of quality planting material	3.7	0.5	0	5.3	0.5	10.1
Unable to identify and treat diseases	2.6	2.6	2.1	2.1	0.5	10.1
Insufficient knowledge on the use of agro-chemicals	0	0	1.6	1.1	0.5	3.2
Difficult access to markets	2.1	3.2	3.7	1.6	4.2	14.8
Land scarcity	7.4	0	1.6	0.5	0.5	10.1
No access to credit (Finance)	14.8	12.7	0	4.2	16.9	48.7
No extension assistance	0.5	0	0	0.5	0	1.1
Poor soils and pests	0	0	0.5	0	0	0.5
Insufficient labour	0	0	1.6	0	0	1.6
Total	31.2	19	11.1	15.3	23.3	100

Farmers' preferred sugarcane traits

Farmers' preferred traits consisted of early maturity (fast growth), high marketability, drought tolerance, high sucrose content in juice (sweetness), medicinal and cultural value, pest and disease resistance, availability of variety, attractiveness of cane (appearance) and being easy to peel. Their most preferred traits were early maturity and marketability of the cane (40.2 %), closely followed by the sweetness (30.8%) of the juice. Sweetness, ease to peel (soft peel), and good eye appeal (e.g. red yellow colour) were the key traits that increased marketability of their sugarcane. Its medicinal value (stemming from the species name *officinarum* or *officinalis* which means 'used in medicine') and cultural value were also noted as important traits. It is a valuable medicinal plant, significant in alternative healing methods (Kadam et al, 2008), providing relief against diseases like jaundice, haemorrhage, dysuria, anuria,

and other urinary diseases (Singh et al, 2015). Resistance to pest and diseases was the least preferred trait.

Sugarcane varieties grown by small holder farmers

Sixteen (16) phenotypically different varieties were collected from the study zones recorded by their local names. This number is very small compared to the broad range of sugarcane landraces (90) in the sugarcane growing zones of southern Ethiopia (Tena et al, 2016). Some of the landraces were commonly recognized by most farmers within and across zones, whereas some were rare varieties known only by few farmers. The diversity could be attributed to SOSUCAM that may have introduced new varieties into the country, the diverse climatic conditions of the different agro-ecological zones or continuous selection in farmers' fields.

It was observed that 94% of farmers knew at most three different local varieties, whereas 65% of them planted only one variety. Very few farmers (0.5%) planted as many as four (4) varieties. The most cultivated varieties were black sugarcane or Malay (33%) and the red sugarcane (25%). Some of the known varieties grown by the farmers were introduced by workers employed at SOSUCAM but it is not known if this was done formally or was smuggled out of the companies' plantation by workers. Attribution of local names to these varieties by farmers depended on the country of origin or area of establishment or abundance of a particular variety. For instance, the variety 'American sugarcane' originated from the United States of America whereas the 'Mbandjock' variety recorded in several locations in different agro-ecological zones originates from Mbandjock in the Haute Sanaga Division of the Centre region. Another popular variety is the 'Red or Muea sugarcane' which is commonly found in Muea, a small locality in Fako Division of the South West region of Cameroon.

CONCLUSIONS

Smallholder sugarcane farmers in Cameroon are faced with a number of production constraints ranging from financial, marketing, to poor soils and poor extension services, which could easily be addressed. But the fact that the crop is not a food crop, it is being undermined and so many of its bi-products like ethanol that could serve as biofuels to compliment the non-renewable fuel currently supplied at our fuel stations, are neglected and not given any importance. Maximizing all the products and bi-products of sugarcane is sure to yield higher returns and boost the sugarcane sector. The findings of this study could serve as a basis for improvement of sugarcane production in Cameroon. The sugarcane germplasm collected throughout the survey are currently being conserved in a field gene bank and are valuable genetic resources for sugarcane breeding and improvement.

AUTHORS' CONTRIBUTION

SSA conceived the project. SSA and NBK developed the protocol and participated fully in the survey. FEE processed and analysed the data. SSA and FEE wrote the first and second drafts. All three authors read and approved the final manuscript.

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