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Short Communication

Locational and maturity effects on cashew tree gum production in Ghana

E. Gyedu-Akoto[1]*, I. Oduro[2], F. M. Amoah[1], J. H. Oldham[2], W.O. Ellis[2], K. Opoku-Ameyaw[1] and Rasheed Bin Hakeem[1]

[1]Cocoa Research Institute of Ghana, Akim-Tafo, Ghana.
[2]Department of Biochemistry, Kwame Nkrumah University of Science and Technology Kumasi, Ghana.

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A comparative study of cashew gum yield trends per tree and picking in relation to age of tree and the location of tree was conducted at four cashew growing districts (Sampa, Wenchi, Bole and Jirapa) in Ghana for a period of 12 months. This was to develop cashew gum production for the food industry and to generate extra income for cashew farmers. Trees used in the study were of two age groups, those that were 10 years and below and those above 10 years. Yield trends in relation to rainfall were also compared. The minimum age of trees for the production of gum was found to be four years. Higher gum yields were obtained during the dry season from January to March when there was drought and the trees were under stress. Mature trees also produced more gums than younger trees. The average yield/tree varied from 13.7 to 276.0 g in young trees and 30.1 to 1237.1 g in mature trees. Organoleptic studies also showed that the gums were odourless and tasteless, comparing favourably to that of commercial gums such as gum arabic. The study showed that age and location of cashew trees have no significant effect on the production of gum.

Key words: Cashew gum, yield trends, organoleptic.

INTRODUCTION

Ghana has a land surface area of about 23.9 million km^2 and falls within latitude 4, 44^{o}S and 11,11^{o}N and longitude 3,11^{o}W and 1, 11^{o}E. There are six main ecological zones put into two categories, the closed forest area which covers about 34% of the country (8.22 million hectare) and the savanna area which covers 15.62 million ha or about 66% of the land area (Nsiah-Gyabaah, 1995). The climate is tropical in Ghana and rainfall decreases from south to north. Two main regimes of rainfall distribution are found in Ghana. The two maximum periods are from May to August and from September to October (Dickson and Benneh, 1988).

Gums are hydrophilic substances that give viscous solutions or dispersions when treated with hot or cold water. The structures of gums are made up of heterogeneous complex mixtures of closely related polysaccharides (Belitz et al., 2004). Natural gum is said to be found immediately under the bark of trees, where it is sometimes collected in regular cavities (FAO, 2002). It is formed within the plant by metamorphosis of the cells of the inner bark. While to some extent it is a natural change in trees, it is usually looked upon as being partly a pathological production, as gummosis develops more largely upon the wounding of the trees (Hiler, 1983). The attack of some plants by various insect pests is believed to account for the enormous production of gums in these plants (Hiler, 1983).

The major commercial processes involved in the production of gums are collecting, sorting, processing, quality control and end-use marketing (Chihongo, 2000). Gums are mostly not processed in countries of production but exported to overseas markets for processing (Chihongo, 2000). Gums are either produced by natural exudation from trees or by using artificial techniques to guarantee viability and quality improvement required for commercial products. The natural collection is by natural damage on trees by farmer or individuals and animals on casual basis (Fitwi, 2000). The artificial techniques used in gum production involve systematic controlled tapping and collection procedures. Gums impart food texture and structure, and they play a role in flavour release, appearance and shelf stability. In recent years, gums have been

*Corresponding author. E-mail: akua_akoto2004@yahoo.co.uk.

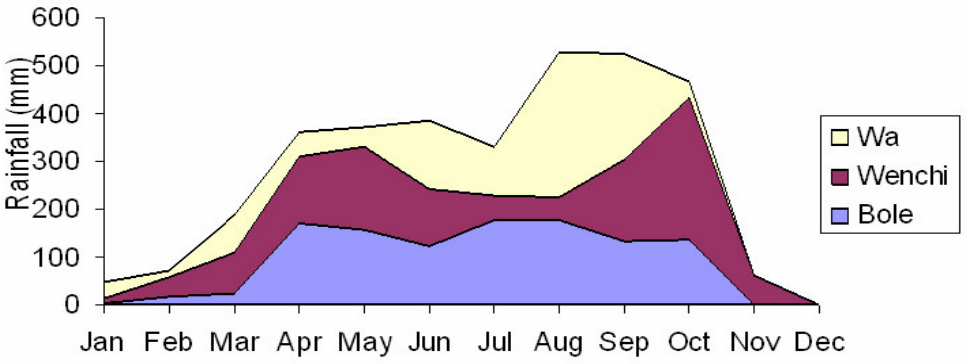

Figure 1. Rainfall pattern in the districts for the year 2006.

recognized as healthy sources of soluble fibre as well (Hundley, 2002).

The cashew tree (*Anacardium occidentale* L) has been reported to produce appreciable amounts of gum, which represents non-conventional alternatives for the tree (Smith and Montgomery, 1959). Cashew gum is similar to gum arabic and can be used as a substitute of liquid glue for paper, in the pharmaceutical and cosmetic industries as agglutinant for capsules and pills and in food industry as a stabilizer of juices. Thus, cashew tree gum extraction can represent an additional source of revenue for the farmer/producer, aside the cashew nut.

MATERIALS AND METHODS

Collection of cashew tree gum (nested design)

Farms were selected from two districts each within the Guinea Savannah (Bole and Jirapa) and the transitional belt zones (Wenchi and Sampa). Selection was done based on two different age groups. These are farms that were 10 years and below (young farms) and those above 10 years (mature farms). These age groups were used because cashew production was introduced into Ghana by the Adventist Development and Relief Agency (ADRA) in the early 1990s and this made most of the farms fall within the ages of 10 - 20 years. Under each age group a maximum of five farms were selected and six trees selected from each farm. Yield of gum per tree and the effects of location and maturity on the gum production were determined. Data obtained was analyzed using Kruskal-Wallis test and regression.

Sorting and grading

Gum exudates were cleaned after collection to remove pieces of bark and other foreign matter (BFOM). They were then sorted based on colour and brightness. The colour of the different grades was determined by using the Minolta CR 310 chroma meter. The hue angles, h^*, representing the degree of yellowness and the chroma, which is the brightness were calculated (Mabon, 1983).

RESULTS AND DISCUSSION

The selected farms were widely scattered making cashew gum collection highly labour intensive. The gum exuded spontaneously from the trunk and principal branches of the trees around the middle of November, after the rainy season. The dry winds, which prevailed after the rainy season, caused the bark to crack and the juice flowed out. Within some few days it thickened and hardened on exposure to the air, usually in the form of round or oval tears or in straight or curled cylindrical pieces of various sizes. It was observed that most of the trees produced white gums while a few produced amber coloured gums. The masses of gum were collected, either while adhering to the bark or after they fell to the ground.

The youngest cashew tree to produce gum was four years and the oldest tree was nineteen years. Generally, higher cashew gum yields were obtained in all four districts within the Guinea savannah and the transitional belt zones during the dry season (January - March). This may be explained on the basis of drought, which put the trees under stress a condition, which according to Fitwi (2000) stimulates gum production in trees. At Wenchi, yields were also high in July to August because there was a reduction in rainfall during that period (Figure 1).

Mature cashew trees were found to produce more gum than the young trees. This may be due to the fact that the young plants are actively growing and therefore using their sap for growth. However, there was no significant difference between cashew gum yields from the two age groups. Similarly, location had no effect on gum yield. These findings were supported by regression analysis (R^2 =7.1%), which showed no significant correlation between the yield, age groups and the locations.

The average cashew gum yield/tree varied from 13.7 g at Bole to 276.0 g at Wenchi in young trees and 30.1 g at Wenchi to 1237.1 g also at Wenchi in mature trees (Table 1). No gum was produced in young trees within all the four districts in May and August when there was high rainfall whereas in mature trees some gum was collected in Sampa and Jirapa in May and also in Sampa in August. Young trees from the transitional belt produced more gum than those within the Guinea savannah zone whereas mature trees from the Guinea savannah produced more gum than those within the transitional belt. A very old tree which according to local farmers was 45 years in Jirapa in the Guinea Savannah zone produced 7664.1, 3270.1 and 497.7 g of gum for January, May and August

Table 1. Average yield/tree for cashew gum.

Location	Below 10 years				Between 10 - 20 years			
	January	March	May	August	January	March	May	August
Sampa	72.3	71.1	-	-	77.1	92.1	37.1	93.9
Wenchi	58.1	276.0	-	-	30.1	116.8	-	237.9
Bole	13.7	-	-	-	84.4	-	-	-
Jirapa	24.8	56.0	-	-	150.0	152.5	346.7	-

Table 2. Organoleptic properties of cashew gum.

Grade	Chroma	Hue angle (h*)	Shape and form	Optical property	Odour	Taste
1	15.94	1.50	Glassy	Transparent	Odourless	Tasteless
2	11.92	0.34	Glassy	Translucent	Odourless	Tasteless
3	14.19	1.14	Globular	Translucent	Odourless	Tasteless

respectively. This however shows that although the age of the trees showed no effect on gum yield, very old trees are likely to produce more gum Table 1.

On the basis of colour and brightness three different grades were obtained. Grades 1 and 2 were whitish yellow in colour whilst the colour of grade 3 was amber and these conformed to the general physical properties of gums (Glicksman, 1969). The variation in the colour of the gum depended on factors like storage time, the age of the part of the tree that is tapped, duration of gum on tree before being picked and the presence of impurities (Glicksman, 1969). However, the variation in the colour of the grades obtained was due to the the age of the part of the tree that was tapped and the presence of impurities. The hue angle (h*) representing the degree of yellowness varied from 0.34 to 1.50 g whilst the chroma which is the brightness also varied from 11.92 to 15.94 g (Table 2). Organoleptic studies also showed that the gums were odourless and tasteless which confirms the general organoleptic properties of gums (Glicksman, 1969). Grade 1 of the cashew gum was found to be transparent whilst grades 2 and 3 were translucent. Best quality gums are generally tasteless, whitish, yellowish or pale brown in colour and transparent or translucent in appearance (Robbins, 1988). The lower grades are generally more strongly coloured than the higher grades. This therefore indicates that grades 1 and 2 obtained after sorting are of better quality than grade 3 (Table 2).

In conclusion, the age and location of cashew trees have no significant effect on the production of gum. However, drought resulted in high cashew gum yields. Gums produced by cashew trees are of good quality in terms of colour and organoleptic properties.

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