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Effect of Agro-ecological Zones on the Proximate Composition of Shea Latex (*Vitellaria paradoxa L.*)

A. K. Quainoo, B. Abdul-Aziz, F. K. Abagale, A. H. Abubakari

Faculty of Agriculture, University for Development Studies, Tamale, Ghana
Corresponding Author email : aquainoo@googlemail.com

Shea latex was tapped from different trees from cultivated and fallow fields at Yagaba, Nyankpala in the Northern Guinea Savannah Agro-ecological zone and Kawampe in the Transitional Agro-ecological zone of Ghana. Generally, agro-ecological zones and land use did not influence the quality of the proximate composition of the Shea latex. Proximate composition of the Shea latex did not differ with land use and agro-ecological zone. Crude fat, moisture content and ash content although were slightly higher in cultivated fields were not affected by land use and location. However, crude protein level in latex was significantly higher at Yagaba and significantly lower in cultivated fields

Key words: Shea- latex, proximate composition, land use crude fat, crude protein, moisture content, ash content, agro-ecological zone

Shea tree *(Vitellaria paradoxa L.)*is one of the most prevalent tree crops in northern Ghana with the Shea butter fat as the most important product from the tree. Difference in the Shea butter fat quality is mainly attributed to bioclimatic variations in temperature and rainfall (Quainoo *et al*., 2012). The tree is native to Africa and occurs across the Sahel region from Senegal to Nigeria and further east in Sudan and Uganda (Maranz, 2004). Shea is an important multipurpose tree, which plays an important role as the principal source of income for the local population in the Sahel region.

In 2013, Fosu and Quainoo compared the proximate composition of the latex from the Shea tree and the natural rubber (*Heveabrasilienesis)*. Results from their study indicated that latex proximate composition of the Shea varied considerably and may be dependent on a number of factors including climatic conditions, season of the year and time of tapping.

The low protein content of the shea latex which may cause less allergic reactions can be exploited and used in the manufacturing of products such as balloons, gloves and condoms (Fosu and Quainoo, 2013). Natural latex (NL) is a complex milky sap comprising; rubber (cis-1, 4-poly-isoprene), protein substances, minerals and polyphenols that is synthesized in specialized cells called laticifers in over 2,000 plants species categorized under 300 genera as a secondary metabolite (Cotter *et al.,* 2009). The purpose of this study was to investigate the effect of agro-ecological zones and land use on proximate composition of Shea latex.

Methodology

Shea latex was tapped from Shea trees from three (3) experimental locations in fallowed and cultivated fields at Yagaba and Nyankpala in the Northern Guinea Agro-ecological zone and Kawampe in the transitional zone of Ghana (Table 1).

Table 1 Agro-ecological Zones of the Experimental Locations

Location	Latitude	Longitude	Altitude(m)	Agro-ecological zone	District
Yagaba	10^0 13′37′′ N	$01^0$16′11′′ W	143	Northern Guinea-Savannah	Mamprugu-Moagduri
Nyankpala	09^0 25′93′′ N	$01^0$00′42′′ W	170	Northern Guinea - Savannah	Tolon
Kawampe	08^0 44′70′′ N	$01^0$33′58′′ W	125	Transitional-belt	Kintampo North

Ten shea trees were identified and tagged as experimental trees for Shea latex tapping in both fallowed and cultivated fields in each of the three experimental sites. Fallow fields are fields that had been under cultivation continuously for at least three years and allowed to rest. Cultivated fields are fields that had been allowed to rest continuously for at least three years and returned to cultivation. The Shea latex tree was tapped at an angle of 45˚ at monthly intervals from May to July 2014. Shea latex was collected in transparent vessels and dried under room temperature for a period of three (3) days prior to laboratory analysis.

Proximate Analyses of Shea Latex

Laboratory analysis of the Shea latex was carried out at the Faculty of Agriculture, University for Development Studies, Ghana. The samples were subjected to proximate analysis (% crude fat, % crude protein, % moisture content and % ash) based on procedure used by Fosu and Quainoo (2013) and the protocols of the International Association of Official Analytical Chemists (AOAC).

Various known methods such as the Kjeldahl method (digestion, distillation and titration) were used for the determination of the crude protein and the soxhlet method for the determination of crude fat percentage. The moisture analyzer was used to determine moisture content of the Shea latex set up at a temperature of 105 °C for one hour after which the moisture content in the samples was evaporated gradually and the final moisture content recorded.

Results and Discussions

The laboratory analysis of the Shea latex from the various sites indicated different levels of the composition of Crude fat and protein and the moisture and ash levels contain in it. Table 2 and 3 present the proximate composition and the effect of land use on proximate composition of Shea latex of the various sites.

Generally, varying levels of crude protein, crude fat, moisture and ash were recorded for the three (3) locations. This may be as a result of the difference between the soil dynamics of the locations (Abubakari*et al*, 2012) of the experiment as well as the slightly varying climatic indices.

Table 2: Proximate Composition of SheaLatex across Experimental Sites

Location	Crude Fat (%)	Crude Protein (%)	Moisture (%)	Ash (%)
Kawampe	52.030±5.500	0.976±0.131	2.039±0.680	5.040±0.491
Nyankpala	53.920±7.556	0.992±0.203	1.912±0.711	4.951±0.633
Yagaba	53.850±6.082	1.134±0.242	1.861±0.583	4.944±0.531
FPr	0.607	0.017	0.663	0.850
LSD	4.296	0.118	0.407	0.377

Table 3. Effect of Land Use on Proximate Composition of Shea Latex

Land use	Crude Fat (%)	Crude Protein (%)	Moisture (%)	Ash (%)
Cultivated	54.710±7.693	1.089±0.210	2.105±0.725	4.975±0.572
Fallow	51.83±4.434	0.979±0.181	1.770±0.530	4.982±0.530
FPr	3.508	0.026	0.048	0.965
LSD	0.105	0.096	0.333	0.308

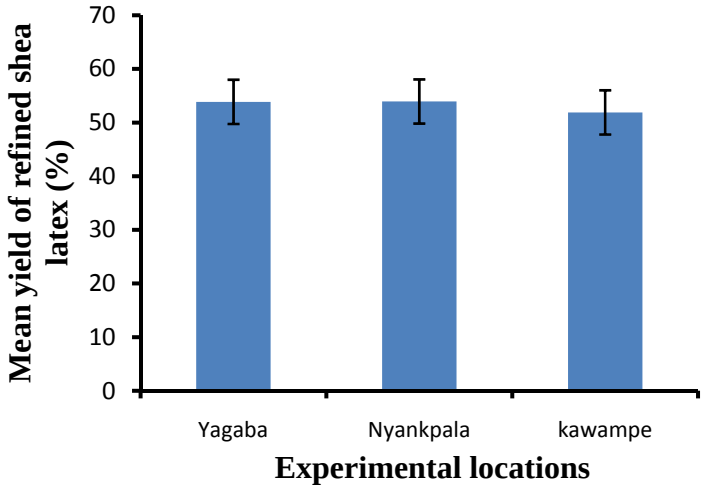

Figure 1. Yield of refined shea latex

Table 2 revealed no significant difference ($p>0.05$) in Shea latex with regards to crude fat, moisture and ash content across agro-ecological zones. However, crude protein level was significantly higher (1.134 %) at Yagaba and statistical different ($p<0.05$) , from Nyankpala (0.992 %) and Kawampe (0.976 %). Land use significantly affected crude protein and moisture composition, with cultivated lands showing higher crude protein levels (1.089 %) than fallow lands (0.979 %). Similarly, cultivated lands recorded higher moisture content (2.105 %) of Shea latex than fallow lands (1.770 %). These two parameters (crude protein and moisture content) were observed to be statistical different at the 5 % level of significance. Land use did not affect the crude fat and ash content of latex as presented in table 3. Crude fat and ash levels were however observed not to be statistically significant at 5 % level with Fpr of 3.508 and 0.965 respectively. Except ash which recorded higher levels in fallow lands than cultivated lands, higher levels of crude protein, crude fat and moisture levels were recorded in cultivated lands compared to the fallow lands in the three (3) sites. This may be attributed to the high nutrient content in the cultivated lands which have the benefit of enhanced nutrient content from the effect of decomposed organic matter over the period of fallow and the effect of artificial fertilizers.

Although Fosu and Quainoo (2013) demonstrated that the fatty acids of the Shea nut were affected by agro-ecological zones this was not the case for Shea proximate analysis. The refined Shea latex was also not affected by Agro-ecological zones and land use as presented in Figure 1.

Conclusions

Generally, except for crude protein and moisture content, agro-ecological zones and land use did not influence the quality of the proximate composition of the Shea latex. Cultivated fields recorded slightly higher proximate compositions than fallows fields. The age of the Shea tree, soil nutrient content and land use might have contributed to the significant difference recorded for crude protein and moisture levels observed as shown in the proximate analysis. A study of the management practices of farmers as well as the effect of edaphic factors and climatic indices on the composition and quality of the Shea latex is suggested for investigation. Flow rate of Shea latex for the different land use types and the time of the day of tapping will also provide useful information on the availability and quantities obtainable for the purpose of industrial exploitation. Effect of Shea latex tapping on other products such as the Shea nut size, Shea kernel size and the quality of nut needs to be studied.

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