

## Short Communication

# Drying process and Ghanaian green coffee quality crude protein, pH and caffeine levels

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**Green coffee beans were dried using three methods (drying on raised platform, drying on polythene sheet kept on ground and drying on concrete floor) at three different densities (20, 30 and 40 Kg/m<sup>2</sup>). All drying methods and densities had no effect on % crude protein and caffeine levels while strongly affected the pH of dried beans. Drying on concrete floor at 40 kg/m<sup>2</sup> density yielded a significantly lower pH.**

**Key words:** Green coffee, pH, crude protein and caffeine.

## INTRODUCTION

An important attribute of coffee brew or infusion quality is the perceived acidity (Woodman 1985; Degenhardt et al., 2006a)). Aliphatic carboxylic acids are the main acids found in coffee and coffee infusions. Acidity in the strict sense is determined by the hydrogen ion concentration (pH), which is related to the degree of ionisation of a given acid present in aqueous solution. Changes in pH can therefore lead to changes in the character of the flavour as well as the acidity. Coffee beans may require more days to dry depending on the method of drying and the density at which the beans are dried.

However information on the effect of drying method and density of drying on the perceived acidity of the green bean (*Coffea canephora var robusta*) and other indicators like crude protein and caffeine in Ghana is limited.

This paper discusses the effect of drying method and density of drying on the acidity, crude protein and caffeine content of green coffee beans.

## MATERIALS AND METHODS

The experiment was carried out at the Cocoa Research Institute of Ghana (CRIG), Tafo. Freshly harvested *robusta* green coffee

beans from three research plots were bulked and mixed thoroughly. The sub samples were taken and used in a completely randomised design with three replicates. The factors investigated were drying methods (drying on raised platform, drying on polythene sheet kept on ground and drying on concrete floor) with three density levels (20, 30 and 40 Kg/m<sup>2</sup>). The green coffee was dried for six weeks at ambient temperature of 32<sup>o</sup>/23<sup>o</sup>C, day/night.

The dry weight of the samples was determined in triplicate by the Association of Analytical Chemist (A.O.A.C) method (1990).

The method for the pH determination was that of Office International du Cacao et du Chocolat (OICC) (1972). 10 g of ground coffee was extracted with 90 ml boiling de-ionised water. The coffee was extracted for 10 min, cooled to 25<sup>o</sup>C, and the pH was determined using a Mettler-Toledo pH meter.

Total nitrogen was determined by the method of A.O.A.C (1990). Crude protein content was then calculated from the total nitrogen and the value obtained corrected for % caffeine.

Caffeine content was measured by HPLC using the method of Anon (1990) with some modifications. In 250 ml capacity round bottom flask, weighed 0.200 g of defatted sample with 95 ml distilled water and refluxed for 25 min. After cooling weight of water added was adjusted to 100 g, thoroughly shaken and centrifuged for 5 min at 5000 rpm to obtain a supernatant. Prior to analysis, the extracts were filtered through a 0.45 µm Millex filter (SLHV013SL, Millipore, Carrigtwahill, Ireland). The HPLC system comprised a Waters 1525 binary HPLC pumps fitted with a 20µl sample loop and a waters 2487 dual absorbance detector set at 280 nm. A Hypersil ODS C18 column (25cm x 4.6mm) fitted with a guard column (H5ODS-1521A, HICHROM Ltd) was used to achieve the chromatographic separations. Compounds were eluted with an isocratic mobile phase of methanol: acetic acid: water (20: 1: 79; HPLC grade) at a flow rate of 1ml/min at 25<sup>o</sup>C.

Data was analysed statistically using the R software and contrasts used to separate differences between treatment means with significance of P ≤ 0.05.

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**Table 1.** The effect of drying method and density on pH, caffeine and crude protein in coffee beans.

Treatments	Drying density (Kg fresh coffee/m <sup>2</sup> )	pH	% Crude protein	% Caffeine
Drying on raised platform	20	6.14 ± 0.01ab	16.73 ± 2.45a	4.48 ± 0.18b
	30	6.13 ± 0.07ab	17.10 ± 1.73a	4.85 ± 0.29b
	40	6.10 ± 0.03ab	15.29 ± 2.18a	6.01 ± 0.60b
Drying on polythene sheet	20	6.10 ± 0.02ab	21.70 ± 6.17a	4.17 ± 1.42b
	30	6.09 ± 0.01ab	18.21 ± 4.82a	4.91 ± 1.42b
	40	6.03 ± 0.01a	16.44 ± 5.92a	4.82 ± 1.27b
Drying on concrete floor	20	5.97 ± 0.06ab	13.75 ± 1.73a	5.04 ± 0.35b
	30	6.02 ± 0.01ab	14.75 ± 2.60a	4.97 ± 0.18b
	40	6.07 ± 0.03b	15.86 ± 1.91a	5.70 ± 0.52b

In table, numbers in a column with the same letter are not significantly different at  $P \leq 0.05$ . Compositional data are given on a dry mass basis (dmb).

## RESULTS AND DISCUSSION

A pH of 6.08 has been reported for dry processed Robusta coffee from Brazil (Salva et al 2006). Similar values were obtained in this work. The method of drying significantly ( $P \leq 0.05$ ) affected the pH of some of the treatments (Table 1). Differences existed in the pH of beans dried on raised platform (T1) and on concrete floor (T3) at 40 Kg/m<sup>2</sup> density. The pH was higher in samples dried on raised platform (T1) than in those dried on concrete floor (T3). A similar trend was observed between drying on polythene sheet (T2) and drying on concrete floor (T3) at 40Kg/m<sup>2</sup> density. There was however no significant difference between treatments T1 and T2 at densities 20 and 30 kg/m<sup>2</sup>. At density 40 kg/m<sup>2</sup>, T1 had a significantly ( $P \leq 0.05$ ) higher pH than T2. Analysis of variance on the data obtained on the crude protein and the % caffeine did not indicate any significant differences between the treatments in these parameters. The percentage crude protein obtained for the sample falls within the range of 9.8 – 15.9 reported for Brazilian coffee (Mori et al. 2001). The caffeine values were however much higher than the range of 1.6 to 3% reported in literature (Coste, 1992).

Amino acids contained in green coffee proteins are known to play a major role in the formation of aroma (Strecker reactions) in roasted coffee (Coste, 1992). From results it was observed that any of the three drying processes and densities can be used initially to process green beans without affecting the total crude protein and caffeine levels. This confirms earlier findings that when total nitrogen is corrected for caffeine, no significant effect can be attributed to the method of green bean processing (Menchu and Ibarra, 1967; Roffi et al., 1971). The study however suggests that the acidity is affected and may possibly lead to changes in the final quality of processed coffee beans since pH levels have been identified as major drivers for flavour differences in different coffees (Degenhardt et al., 2006b). The work did

not indicate any relationship between pH, crude protein and caffeine content of the beans.

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