1.4.2 Conversion of Coconut Waste to Marketable Products: Fibre Chemical Characteristics for Kenyan Coconut

Githaiga J, Sijali I, Hai M, Ngugi K and Mayaka A

Introduction

A study was conducted to determine the chemical properties of coconut fibre from Kwale, Malindi and Kilifi. Husks collected from three regions were processed to produce fibre and coco-peat using the machines currently available at Kenya Agricultural Research Institute (KARI), Mtwapa, Mombasa. After separation of the fibre (Figure 1) and coco pit, samples were taken to the laboratory for analysis.

Figure 1. Fibre separated from coconut husks

Materials and Methods

Sample handling and preparation for chemical analysis

The plant samples were dried in oven at 70 ^{o}C for 48 hours. Fully dried samples were ground completely to a particle size of less than 1 mm and mixed thoroughly before a sub-sample of suitable size was taken for analysis.

Sampling

Digestion in tubes with H2SO4 - salicylic acid - H2O2 and selenium. The methods in Hinga *et al.* 1980 and Walinga *et al.* 1989 were followed. A sample weighing 0.3 g was measured to an accuracy of 0.01 g then transferred in to a digestion tube. A 2.5 mls solution of mixed sulphuric acid and selenium was added to the digestion tube. The mixtures were placed in a heating block at 100 ^{o}C for 2 hours. The mixtures were then removed from the digestion block and allowed to cool for 15 to 20 minutes. Three (3) mls of H_2O_2 were a carefully added to the sample. The sample was returned to the digestion block and heated to 330 ^{o}C for 2 hours until the digest turned to colourless liquid or light yellow, then 48.3 ml of distilled water was added followed by thorough mixing with vortex and the sample allowed to stand overnight. The following sample was taken for instrumentation.

Potassium (K) was determined with a flame photometer, phosphorus (P) with calorimetrically on spectrophotometer, N-total was measured by distillation followed by titration with standardized 0.01 N HCl; and Ca, Mg, Cu, Zn, Mn & Fe – were measured with Atomic Absorption Spectrophotometer (AAS). P was analysed using the P Olsen method.

Reporting of data
The reporting procedures of the National Agricultural Research Laboratories were followed - the analyzed concentrations in plant materials are reported in percent (%) or mg kg^{-1} (ppm) of dry matter. For major elements they are best expressed in % and for trace elements, in mg kg^{-1}.

Results and Discussion
The analytical results of the coconut fibre samples showed that mean nitrogen levels were 0.63, 0.76 and 0.56% for Malindi, Kwale and Kaloleni, respectively. This was slightly higher than 0.44% reported for organic manure samples of Coconut Husk Chips analysed from the Soil and Plant Nutrition Division, Coconut Research Institute, Sri Lanka. The levels were highest in Kwale (0.76%).

Mean Phosphorus content was 0.2 for all sites. These levels were much higher compared to Sri Lanka where the levels were only 0.034%. Mean potassium contents were 2.83, 3.36 and 3.45% for Malindi, Kwale and Kaloleni, respectively compared to Sir Lanka's 0.14%. Hence the fibre is a possible source of NPK.

Calcium contents were 0.11, 0.10 and 0.06% for Malindi, Kwale and Kaloleni, respectively compared to Sir Lanka's 0.42%. Magnesium levels were 0.07, 0.07 and 0.06% for Malindi, Kwale and Kaloleni, respectively compared to Sir Lanka's 0.13%. Iron contents were 1120, 1167 and 707 mg kg^{-1} for Malindi, Kwale and Kaloleni, respectively while corresponding Copper levels were 17.17, 18.83 and 15.78 mg kg^{-1}. Manganese contents were 621.4, 796.5 and 504.4 mg kg^{-1} while Zinc levels were 40.5, 42.5 and 3877 mg kg^{-1} both for Malindi, Kwale and Kaloleni, respectively. No results on Zinc content were found from the Sri Lanka to compare with.

The results indicate a potential use of fibre as organic fertilizer (macro and micro elements). Hence, these fibres could have an additional beneficial effect when used for soil moisture conservation as mulch or as a coconut textile (c textile) in soil erosion control as the crops and regenerating vegetation benefit from the nutrients.

Conclusion and Recommendations
The results indicate a potential use of fibre as organic fertilizer. It is also possible that these fibres could have an added nutrient source effect when used for soil moisture conservation as mulch or as a c-textile in soil erosion control. Additional benefits would be in the change of soil physical properties such as moisture retention, bulk density, aeration, hydraulic conductivity. Hence, fibres should be further investigated as an organic fertilizer and soil nutrient and moisture enhancement product and will form part of the intended field studies.

Refrences
Hinga G, Muchena FN and Njihia CM. 1980. Physical and Chemical Methods of Soil Analysis. National Agricultural Laboratories, Nairobi.

Coconut Research Institute. Undated. Technical Properties of Coir Products - Chemical Composition of Coconut Husk Chips. Analysis report of organic manure samples of Coconut Husk Chips. Soil and Plant Nutrition Division, Coconut Research Institute, Bandirippuwa Estate, Lunuwila 61150 Sri Lanka.

Walinga I, Vark W. van, Houba VJG and Lee JJ van der. (eds). 1989. Soil and plant analysis. Part 7. Plant analysis procedures. Syllabus. Wageningen Agricultural University, the Netherlands.