



## **Sustainable integrated fertiliser management in Ghanaian cocoa production systems**

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Cocoa production is the livelihood of about 800,000 smallholder farmers in Ghana. Soil fertility declines after 15-20 years of cropping, making production heavily dependent on inorganic fertilisers.

For over forty years, research to improve the fertility of cocoa soils in Ghana has focused on getting the right combination of mineral fertilisers and application rates to increase yield without considering the long-term maintenance of soil health. A blanket fertiliser formulation and rate is therefore recommended. Cocoa pod husks are currently discarded as a waste, but could be major source of organic matter and soil nutrients. They contain 1000 mg N kg<sup>-1</sup>, 3000 mg P kg<sup>-1</sup>, and 48571 mg K kg<sup>-1</sup>.

This study sought to investigate i) if blanket nutrient management practices improve long term soil fertility, ii) if the combined benefits of cocoa pod husk compost and mineral fertilisers provide benefits to soil functions that are greater than the sum of the parts, and iii) if nutrient use efficiency, seedling growth, and overall soil health are improved by applying enriched cocoa pod husk compost as a soil amendment.

Soil nutrient levels were compared between plots that adopted blanket fertiliser recommendations to low-input plots managed individually by farmers to assess whether the nutrient requirement of cocoa trees are met by either approach. Results showed that cocoa soils are inherently acidic and low in nutrients, particularly N, P and K, and there were no significant differences in soil nutrients between blanket fertiliser plots and farmer managed plots.

Cocoa pod husks were composted with different rates of NPK mineral fertiliser (equivalent to 0%, 25%, 50% and 100% of the recommended rate of N50P100K50) using laboratory reactors. Atmospheric gases (CO<sub>2</sub> and N<sub>2</sub>O) and leachate were measured to monitor the progress and quantify losses. Cocoa pod husks composted with N50P100K50 at 100% of the recommended rate of mineral fertiliser had a significantly higher available N and P compared to those composted with 0%, 25%, or 50% of the recommended rate. There were no differences in available K between any treatments.

The composts were then applied to cocoa seedlings to compare nutrient use efficiency, seedling growth, and overall soil health among plants amended with CPH compost alone, NPK enriched CPH compost, CPH compost applied with NPK, NPK alone and a control (no fertiliser).

Findings indicate that (i) cocoa soils are inherently low in nutrients, (ii) blanket fertiliser recommendations do not improve soil fertility, and (iii) cocoa pod husks, composted with mineral fertiliser, are a promising soil amendment for increasing the health and fertility of Ghanaian cocoa soils.

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