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The cocoasoils core trials: setup and early growth in 10 large-scale on-station cocoa nutrient response trials

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Abstract

Cocoa is a key source of income for millions of farmers in West Africa, Latin America and South-East Asia. Dry cocoa bean yields of up to 4 t ha⁻¹ are achievable, but actual yields in major producing regions are often far less due to weather, pests and diseases, aging plantations, and poor farm management practices such as insufficient or imbalanced nutrient application. Quantifying the nutrient requirements in perennials such as cocoa is challenging, and requires long-term large-scale experiments. The CocoaSoils programme (www.cocoasoils.org) brought together the major actors from the local to global cocoa supply chain (national and international research institutes, universities, cocoa traders and processors, and fertiliser suppliers) to set up a network of 10 large-scale long-term cocoa nutrient response trials (Core Trials) in six countries (Cameroon, Côte d'Ivoire, Ecuador, Ghana, Indonesia and Nigeria). Here, we present the set-up of the trials and the key findings from the first four years of trial implementation. The Core Trials are NPK response trials with a reduced factorial design and four nutrient rates (0 %, 50 %, 100 %, 150 % of the estimated nutrient requirement). They were planted between 2019 and 2022 using the best available planting material, on suitable sites with slight slopes. Trees and plots were barcoded, to facilitate the collection of data on vegetative growth and yield using ODK. The data are collected in an online database, with the dataset now including >180000 data points. Cocoa trees responded to the application of N from the first year after application onwards by increased vegetative growth (basal area and height), irrespective of the availability of P and K. Vegetative growth increased in response to K application in some of the trials, yet not in the majority. We did not observe a response to P in any of the trials. There was an inflection point (at 50 to 100 % N and K rates) after which responses decreased, indicating economic fertiliser rates. We observed a strong negative relationship

between elevation and vegetative growth in most trials, even when elevation ranges were small, suggesting strong effects of soil and water on cocoa tree growth.

Keywords: Elevation, integrated soil fertility management, trial design, vegetative growth