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The cocoasoils core trials: early yields and pod counts

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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 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 cocoa bean yield data from the first five years after trial establishment. Results of the first five years following trial establishment indicate that nitrogen is the most consistent driver of yield. However, once 50 % of the modelled nitrogen off-take was reached, yields tended to plateau or decline, suggesting diminishing returns at higher nitrogen rates. Responses to potassium and phosphorus were site-specific. Phosphorus-limited sites showed linear yield responses to increasing phosphorus rates, whereas high potassium rates negatively affected yields in sites responsive to potassium. The timing of nutrient application also influenced yield responses: potassium predominantly affected early harvests (years 1 to 3), while phosphorus effects were more pronounced in later harvests (years 3 to 5). During the first four years after establishment, site characteristics exerted a stronger influence on dry bean yield than N, P, or K application. These site effects were associated with early vegetative vigour, which emerged as a strong predictor of subsequent reproductive development. In conclusion, we observed strong but plateauing yield responses to N and site-specific responses to P and K. Early

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growth traits appear as useful indicators of future productivity. With the available data, we can generate site-specific fertiliser recommendations for P and K application, and general recommendations for N application in the first five years after cocoa establishment.

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