

NUTRIENT BALANCE AND USE EFFICIENCY BY SOYBEAN IN A NIGERIA

ALFISOL

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ABSTRACT

Field studies were conducted during the 1995 and 1996 growing seasons at Ibadan ($7^{\circ} 56^1$ N; $3^{\circ} 45^1$ E) – a derived savanna in Nigeria, to evaluate the dynamics and balance sheet of soil N and P and measure n and P use efficiency (kg grain per kg available soil N and P) under two N (0 and 60 kg ha⁻¹) and fractional recovery (FR) model calculated P (MP): (0, 15, 30, and 60 kg ha⁻¹) rates, with soybean as a test crop. Mineral N ranged from 46.1 to 57.5 kg ha⁻¹, while P varied between 1.9 and 5.4kg ha⁻¹. The mean N content across all P levels showed 6% decrease by 60 kg N ha⁻¹ (60N) rate over the control (-kg N ha⁻¹), while that of P was 20% less than the control. Addition of 60 kg N ha⁻¹ with MP gave the highest grain and stover yields of 1.77 and 3.62 Mg ha⁻¹ respectively; the grain yield was 18% better than that of the soil P (0 kg P ha⁻¹) rate. Grain N and P uptake was enhanced by applications of N and P fertilizers, with the MP and 60N combinations having the highest amounts of 92.1 kg N ha⁻¹ and 1.9 kg P ha⁻¹ respectively. The amounts of P in the soil have a strong relationship with P uptake, leading to higher grain yield. Mean N and P balances (-121 kg N and -7.7 kg P ha⁻¹) showed (P<0.05) depletion at higher N and P fertilizer levels suggesting those output components (crop uptake, N and P losses from soil) accounted for the negative balances. The MP rate however increase N and P balances by 19 and 14% over the control. PUE of soybean decreased (P<0.05) with increasing rates, suggesting that under low N or P, differences in fertilizer NUE and PUE were due to variation in n and P utilization, whereas at high levels, differences were due mainly to variation in uptake efficiency. The integration of nutrient use efficient legume and balance studies with the MP rate can lead to a better understanding of the fertility of Nigeria Alfisols.

Key words: nutrient balance, efficiency, soybean, Alfisol, fractional recovery, model