

# Effects of Phosphorus Sources and Starter Nitrogen on Soybean Yield and Selected Soil Properties in Tharaka Nithi and Meru Counties of Kenya

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## **Abstract:**

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Integration of legumes into farming systems is one of the Integrated Soil Fertility Management (ISFM) options for improving soil fertility. Farmers can save their cost of production by using legumes, which, in association with rhizobia, can fix atmospheric nitrogen. Soybean is an important legume compatible with the smallholder farming systems in Tharaka Nithi and Meru counties. However, low P and N, a situation prevalent in the two counties can limit its performance. The study was carried out in Kigogo in Tharaka Nithi County and Kamujine in Meru County. Sources of P, with or without starter N application were evaluated while pursuing the following objectives: (1) to determine the effects of different phosphorus sources and starter N on soybean yield and selected soil chemical properties, (2) to evaluate the effects of different phosphorus sources and starter N on nodule numbers and soybean growth parameters. Finally, the study assessed the effects of different phosphorus sources and starter N on the amount of N fixed by soybean and their economic suitability. A trial was laid out in a randomized complete block design (RCBD), having 13 treatments with four replications each on a 4.0 m by 4.5 m plot size. The P sources were Triple Super Phosphate (TSP), Minjingu rock phosphate, Mavuno fertilizer, diammonium phosphate (DAP), animal manure and fortified manure (animal manure with Minjingu fertilizer at 1:1 ratio) all providing 30 kg P ha<sup>-1</sup>. Diammonium phosphate (DAP) was reference input as it has both P and N and was the farmers' choice in the study area. Data collected were soybean growth parameters, biomass and grain yields, soil chemical characteristics and soybean and fertilizer market prices. Data was analyzed using analysis of variance (ANOVA) and means separated using t-test and Least Significant Difference (LSD) ( $P < 0.05$ ). The use of Mavuno fertilizer in combination with CAN as nitrogen source significantly ( $P < 0.01$ ) improved soybean yield and significantly ( $P < 0.05$ ) enhanced BNF compared to the control and ranked higher than TSP, DAP, Minjingu and animal manure. Addition of CAN alone as starter N restricted BNF in N rich Kigogo but enhanced it in N deficient Kamujine, giving 56.32 kg ha<sup>-1</sup>yr<sup>-1</sup>. This increase was however not significant. Starter N did not enhance soybean nodulation but increased yield in combination with other P sources by 14.95% in Kamujine and 14.28% in Kigogo. The least costly source of P was DAP and therefore recommended for use in soybean production with consideration for liming to address possible reduction in soil pH. Farmers may also improve soybean yield and enhance their incomes while sustaining their soil fertility by using Mavuno fertilizer supplements or Minjingu phosphate rock.