

# Modeling of Interactive Effects of Rainfall, Evaporation, Soil Temperature, and Soil Fertility for Sustainable Productivity of Sorghum + Cowpea and Cotton + Black Gram Intercrops under Rotation Trials in a Rain-Fed Semi-arid Vertisol

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*Long-term effects of the different combinations of nutrient-management treatments were studied on crop yields of sorghum + cowpea in rotation with cotton + black gram. The effects of rainfall, soil temperature, and evaporation on the status of soil fertility and productivity of crops were also modeled and evaluated using a multivariate regression technique. The study was conducted on a permanent experimental site of rain-fed semi-arid Vertisol at the All-India Coordinated Research Project on Dryland Agriculture, Kovilpatti Centre, India, during 1995 to 2007 using 13 combinations of nutrient-management treatments. Application of 20 kg nitrogen (N) (urea) + 20 kg N [farmyard manure (FYM)] + 20 kg phosphorus (P) ha<sup>-1</sup> gave the greatest mean grain yield (2146 kg ha<sup>-1</sup>) of sorghum and the fourth greatest mean yield (76 kg ha<sup>-1</sup>) of cowpea under sorghum + cowpea system. The same treatment maintained the greatest mean yield of cotton (546 kg ha<sup>-1</sup>) and black gram (236 kg ha<sup>-1</sup>) under a cotton + cowpea system. When soil fertility was monitored, this treatment maintained the greatest mean soil organic carbon (4.4 g kg<sup>-1</sup>), available soil P (10.9 kg ha<sup>-1</sup>), and available soil potassium (K) (411 kg ha<sup>-1</sup>), and the second greatest level of mean available soil N (135 kg ha<sup>-1</sup>) after the 13-year study. The treatments differed significantly from each other in influencing soil organic carbon (C); available soil N, P, and K; and yield of crops attained under sorghum + cowpea and cotton + black gram rotations. Soil temperature at different soil depths at 07:20 h and rainfall had a significant influence on the status of soil organic C. Based on the prediction models developed between long-term*