



Soil Health Monitoring Technologies in Sustainable Crop Management: An Intervention Study in Indian River, Madagascar 2001

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Abstract

Agricultural productivity in Indian River, Madagascar is hindered by poor soil health, limiting crop yields and sustainability. The study employed a randomized controlled trial (RCT) design with four treatment groups: traditional farming methods, precision agriculture sensors, satellite imaging, and a combination of both. Soil samples were collected for analysis at regular intervals over one year to assess changes in soil health indicators such as pH levels, organic matter content, and nutrient availability. Significant improvements in soil health parameters were observed when using combination technology compared to traditional methods ($p < 0.05$), with a mean increase in organic matter content of 12% across all monitored plots. Combination soil health monitoring technologies significantly enhanced crop yields and environmental sustainability in Indian River, Madagascar, warranting their adoption by local farmers. Local extension services should be equipped to provide training on the use of these advanced tools and support for implementing sustainable farming practices. Soil Health Monitoring, Precision Agriculture, Sustainable Crop Management, Indian River, Madagascar The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Geographical Indicators of Tropical Agriculture, Soil Health Indices, Precision Agriculture, Randomized Controlled Trials, Sustainable Intensification, Remote Sensing, Conservation Tillage*

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