Describing the crop response to fertilizers through Bent-Cable models

Iuri Emmanuel de Paula Ferreira [1]

Silvio Sandoval Zocchi [2]

Roseli Aparecida Leandro [2]

Abstract

The modeling of crop response to fertilizer is fundamental for the development of sustainable agriculture. Often, crop models are fitted to the experimental data to provide critical nutrient levels and yield predictions. Model correctness is crucial for determining the optimal application rates of inputs, ensuring high productivity without losses. Based on empirical evidence, many researchers suggested smooth, concave, and limited regression curves, being compatible with the law of diminishing marginal returns. Following this suggestion, we adopted bent-cable models as crop production functions in our study. Bent-cable is a family of smooth piecewise-linear models (SPLMs) with embedded probabilistic interpretations. Here, they provided reliable estimates for critical nutrient levels and other quantities with agronomic interest. We use Paschal and French's data on irrigated-corn-yield to illustrate our methodology.

Keywords: critical nutrient levels; diminishing returns; crop production function; smooth models.

[1] Centro de Ciências da Natureza, UFSCar – *campus* Lagoa do Sino, Buri – iuri@ufscar.br
[2] LCE – Departamento de Ciências Exatas, ESALQ - USP, Piracicaba – [sszocchi@usp.br, raleandr@usp.br]