

SPATIAL VARIABILITY OF SOIL PROPERTIES IN FIELD EXPERIMENTS-AN IMPORTANT ASPECT AND A CAUSE OF VIOLATION OF ASSUMPTION OF INDEPENDENCE OF ERRORS

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ABSTRACT

Spatial variability of soil properties in field experiments introduces an extra source of variation and inflates experimental error, thus masking true treatment effects. Data from a field experiment in which the results were non-significant but with wide visual differences among treatments were used to study the cause of these non-significant results. Semivariograms and trend analysis were used to identify the magnitude and structure of spatial patterns in soil properties in a fertilizer field trial conducted in Spokane County, Washington State, U.S.A. Significant quadratic trends were identified for soil properties including soil pH, acetate and bicarbonate extractable phosphorus. Coefficient of variation values were also higher for both acetate and bicarbonate extractable phosphorus. Semivariogram models for extractable P and Ca exhibited strong periodic structure while extractable K exhibited strong spherical structure. These models had a range of influence from 15 to 35 m. Soil analysis of treatment plots in field experiments is needed to support the findings of the experiments and for drawing meaningful conclusions.

INTRODUCTION

Researchers conduct field experiments to evaluate effects of different factors individually or in combination on yield of various crops. Researchers face problems in interpreting field experiments they encounter with situations when treatment differences in the experiments often statistically non-significant but there are remarkable visual treatment differences (Trangmar et al., 1987; Bhatti et al., 1991; Mulla et

No enough research has been done in the past to study spatial patterns of soil properties which masks true treatment effects in field experiments. The objective of present study was to determine spatial structure of soil properties in a field experiment where the results were not significant in spite of low fertility status.

MATERIALS AND METHODS

Field Procedures:

The field experiment was conducted in Spokane County, Washington, U.S.A. in 1968 to determine the effect of different phosphatic fertilizers applied @15 and 30 kg P ha⁻¹ on the yield of winter wheat. The details of the experiment are given elsewhere (Bhatti et al., 1991).

Soil Sampling and Laboratory Procedures:

Soil samples were collected at a separation distance of 2.4 m from an area of 360 m in each replication. Total number of soil samples thus collected was 24. These soil samples were brought to the laboratory, air-dried, and sieved through 2 mm sieve, and analyzed for soil pH, organic matter content, acetate and bicarbonate extractable P and K, and acetate extractable Ca according to the standard procedures (Black, 1965).

Statistical Analysis of Soil Data:

Trend surface models were fit to soil