

Spatial Variability in Fertility Status of Surface Soils

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Abstract: Knowledge of spatial variability in soil fertility is important for site specific nutrient management. In this study, spatial variability in properties that influence soil fertility such as soil organic carbon (OC), available N, available P₂O₅ and available K₂O in surface soils of 154 farmers' fields of Karlawad village in Naval Gund taluk of Dharwad district of Karnataka (India) were quantified and the respective thematic maps were prepared on the basis of ratings of nutrients. Soils sampled (0-20 cm depth) at 154 locations in an area of 1032.15 ha were analyzed for their composition. Arc Map 9.0 with spatial analyst function of Arc GIS software was used to prepare soil fertility maps. Interpolation method employed was spline. Soils were moderately alkaline in reaction with normal Electrical Conductivity (EC). The coefficient of variation (CV) values for soil OC, available N and available P₂O₅ were 0.35, 0.32 and 0.30 respectively, in the study area and it was lower (0.16) in case of available K₂O. Organic carbon content in the soils was low in majority of the area (683 ha) while it was medium in the remaining area (350 ha). Available nitrogen content was low in 488 ha and medium in 544 ha. Available phosphorus was medium in 622 ha and low in 256 ha and high in the remaining area of 154 ha. The soils in the study area were high in available potassium status. The observed spatial variability in various soil properties that influence soil fertility will help farmers in making crop management decisions.

Key words: Spatial variability • Soil fertility • Site specific nutrient management • Geographic Information System

INTRODUCTION

The traditional approach to soil fertility management has been to treat fields as homogenous areas and to calculate fertilizer requirements on a whole field basis. However, it has been reported for at least 70 years that fields are not homogeneous and sampling techniques to describe field variability have been recommended [1,2]. Describing the spatial variability across a field has been difficult until new technologies such as Global Positioning Systems (GPS) and Geographic Information Systems (GIS) were introduced. GIS is a powerful set of tools for collecting, storing, retrieving, transforming and displaying spatial data [3]. GIS can be used in producing soil fertility map of an area that helps to understand the status of soil fertility spatially and temporally, which will help in formulating site-specific balanced fertilizer recommendation. These technologies allow fields to be mapped accurately and also allow complex spatial relationships between soil fertility factors to be computed.

This in turn has increased interest in the use of soil-sampling techniques that attempt to describe the variability in soil fertility factors within a field.

In precision farming, the concept of 'management zone' was evolved in response to large variability with the main purpose of achieving efficient utilization of agricultural inputs with respect to spatial variation of soils and its properties. Site-specific management zones are defined as homogeneous sub-regions of a field that have similar yield limiting factors [4,5]. Conceptually, by using a management zone delineation technique, an agricultural field could be classified into management zones that reflect productivity potential. For example, a field may be classified into three zones- high, medium and low productivity potential management zones. Therefore, an appropriate understanding of spatial variability in soil properties is essential at landscape scale. The most important way to gather knowledge in this aspect is to prepare soil maps through spatial interpolation of point-based measurements of soil properties [2].