Satellite remote sensing indices based field level soil quality evaluation for site specific agriculture

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Abstract

Soil is an important non-renewable resource and whole life depends on it. It is heterogeneous medium in nature and its properties vary from one point to other due to nature of parent material, vegetation, topography and climate. Soil productivity is correlated with status of soil nutrients and physico-chemical properties of soil. As land area is limited, so soil fertility should be managed by adapting different management techniques, in order to enhance the agricultural production to feed the increasing population of globe. In site specific agriculture, management is adapted on variable areas rather than whole field and it require the study of spatial variability of soil properties at field level by using geological information system (GIS) and remote sensing (RS). The study was conducted with the objective to find out the spatial variability of soil macro nutrients, to search relationships between these parameters and plant production by relating spatial variability of macronutrients to normalized difference vegetation index (NDVI) and preparation of digital maps to delineate the area into various categories on basis of status of macro nutrients. The study was conducted at University Research Farm, Koont, Chakwal, having an area of about 100 ha. Soil sampling was done by grid sampling technique, with a specific grid size of 30m. Total number of samples was 842 and location of each sample was recorded by Global Positiong System (GPS). All samples were subjected to analytical procedures to estimate the nutrient concentrations nitrate-nitrogen, available phosphorus, extractable potassium and sulfate sulfur by using standard procedures. Geo-statistical analysis such as kriging and interpolation was used for spatial prediction and digital mapping of soil nutrients. The results were subjected to statistical analysis to find out the correlation of macronutrient status and NDVI. The results showed that the average values of NO3-N, P and K were 7.79 mgKg-1, 7.27 mgKg-1, and 146.0 mgKg-1,respectively. Krigged maps showed that the NO3-N was low in almost all the area but some area has moderate concentration, available P was found deficient but in north eastern areas of farm it was marginal and adequate, K was satisfactory in most of area but it was marginal at north eastern side. It is concluded that all nutrients vary spatially in fields, and are strongly co-related with crop intensity which was shown by comparison of nutrient maps and NDVI map. It is recommended that site specific agriculture should be adapted in order to reduce the cost of production and increase the production.