DISTRIBUTION OF SOME SELECTED SOIL PROPERTIES UNDER AGROFORESTRY AND AGRICULTURAL CROPS

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Abstract

Field and laboratory investigations were made to study the distribution of some soil properties under agro-forestry (Eucalyptus + wheat) and agricultural crops (wheat). Eighteen soil samples were collected at a regular grid spacing of 15 m x 25 m and 15 m x 20 m from two depths (0-15, 15-45 cm) under agro-forestry and agricultural crops, respectively from D.I.Khan. Soil samples collected were analyzed for soil pH (1:5), electrical conductivity (1:5), organic matter, lime, mineral N, and AB-DTPA extractable P and K. The total number of plants were 410 in agro-forestry field and were about 5 years old. Data collected on soil properties were statistically analyzed. In the field of agro-forestry, the percent co-efficient of variation (% CV) for EC (1:5) and P were 57.4 and 35.2 for surface soil and 49.8 and 72.7% for sub soil, respectively. Based on critical level for soil P, all the soil samples in both the depths were deficient, except one sample which was medium in subsoil. About 83% in the surface soil and 94% in the subsoil of the samples were found low (<1%) in organic matter. Soil K was found in adequate amount with low variability having CV=6.81% and 6.43% in surface and sub-surface soil, respectively. In the field of agricultural crops (wheat) the CV values for EC and P were 34.9 and 49.98% for surface and 32.02 and 29.48% for sub soil, respectively. Based on critical level, soil P was deficient in 27%, medium in 40% in surface soil while deficient in all the sub soil samples. Variation was also observed in mineral N (25.4 and 31.13%) organic matter (22.57 and 25.61%) in both the depths and in subsoil K (21.41%). Twenty eight percent samples were deficient, 72% medium in organic matter in the surface soil and 94% were deficient in the subsoil. In the surface soil, organic matter, mineral N and soil P were significantly ($P<0.01$) lower under agro-forestry than under agricultural crops because eucalyptus is evergreen and shed little leaves and also utilize the soil nutrients. In the subsoil, soil pH, EC, soil P and K significantly differed between the two systems. Geostatistical analysis of data showed that EC and soil P were spatially distributed in the surface soil while only EC in subsoil under agro-forestry. While organic matter and mineral N in the surface soil and EC, organic matter, lime and soil P in the subsoil were spatially distributed under agricultural crops. Maps of soil properties were prepared using geostatistical technique of kriging. Almost all of the maps showed spatial distribution of soil properties.

Introduction

Due to high land pressure because of increased population rate in Pakistan, there is a continuous process of land degradation. Land degradation is the result of

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accelerated soil erosion or salinity/sodicity problem. Quality land has been converted into poor quality land i.e., marginal lands.

The need for agricultural land to feed growing populations makes it unlikely that high quality land will be used for planting trees. There are several options for increasing the production of fuel and fodder - for example improving cultural practices in existing forests, growing forest trees with other crops (agroforestry), range management, and utilizing marginal lands.

Tree plantation activities under Social Forestry Project have been enhanced in various irrigated arid zones. Different plant species have been introduced in these areas. Trees are planted by individual farmers in agroforestry setting along roads or field boundaries, in small areas or with agricultural crops. Trees might have profound effect on soil properties. In forest ecosystems individual trees and different species of trees affect the chemical properties of that soil in the vicinity. Some of the researchers have reported the effects of tree plantations on soil properties. (Varma et al., 1986).

Some tree species like Eucalyptus can also be grown on salt affected soils (Malik and Sheikh, 1983; Muthana et al., 1983). There has been a lot of research on the reclamation and utilization of slat affected soil using different practices including use of gypsum (Bhatti and Nawaz. 1983; Bhatti and Bakhsh, 1995). Eucalyptus trees are reported to have deteriorating effect on soil properties, while Bargali et al. (1993) compared properties of the top 30 cm soil under plantation of 1 to 8 year old *Eucalyptus tereticornis* and in adjacent natural mixed broad leaved forest in the subtropical zone in Uttar Pardesh. Several soil physical properties (water holding capacity, porosity and water content) decreased with increasing age, while bulk density increased; soil chemical properties, notably organic carbon, total N, P and K decreased as a result of reforestation with *Eucalyptus tereticornis* and further decreased with increasing age of the plantation.

Very limited or no research work has been done on analysis of agroforestry systems such as nutrient accumulation, nutrient cycling and other soil chemical properties. Moreover, the economics of agroforestry has not been compared with the other land use systems in addition to their effects on soil properties.

The present project was undertaken to compare the distribution of various soil properties under agroforestry and agricultural crops.

Materials and Methods

Site Selection

To compare the distribution of some soil properties under two farming systems (agro-forestry and agricultural crops), one field each under agro-forestry