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Physico-chemical characteristics of soil of semi-arid regions of Haryana experiencing mortality of shisham (*Dalbergia sissoo*)

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ABSTRACT
In order to study the physico-chemical properties of soils under healthy as well as dead trees of *Dalbergia sissoo* six different locations in Chaudhary Charan Singh Haryana Agricultural University and nearby places were selected. Six depth wise soil samples upto 150cm were collected and analyzed for important physico-chemical characteristics i.e pH, $CaCO_3$, Bulk density, Particle density of the soil was found higher in the soils under dead trees as compared to healthy trees of *Dalbergia sissoo.* The paired t-test values showed that the pH, $CaCO_3$, Bulk density in the soil under dead *Dalbergia sissoo* their were significantly higher than in the soils under healthy trees

Key words : Physico-Chemical, Mortality, *Dalbergia sissoo*

INTRODUCTION
Dalbergia sissoo (shisham) belong to family leguminoseae, sub-family papilionaceae. It is one of the most important timber species in India. It attaining a height upto 30m tall and 2.4m girth in favourable localities.

Environment stresses which includes both abiotic (air, water, soil, increase in temperature and erratic rainfall) and biotic stresses (like pests/diseases, over-grazing, more human interferences), edaphic conditions such as soil physical properties (viz., soil air-water balance), and nutrient deficiencies may also contribute to sissoo parching. Adverse hydrological conditions primarily water logging leads to lengthy soil moisture regimes at saturation and sub saturation level which, in turn, influencing the mortality shisham to a great extent. Stagnation of water for a long period creates an anaerobic condition in the root zone of trees and ultimately causes death of the feeder roots due to asphyxiation. Such conditions were more pronounced in Rohtak, Sonipat, Jind and Karnal areas where the large scale mortality of trees in general and shisham is particular were recorded. Therefore, the present study was undertaken to evaluate the possible soil related reasons for the mortality of shisham trees in the CCSHAU, Hisar campus and nearby places.

MATERIALS AND METHODS
Healthy and dead trees of *Dalbergia sissoo* were selected from the campus and nearby places. The distances between healthy and dead trees were about 4-5m. The trees were about 10-15 years of age, their girth varied from 68 to 69cm and height from 8-14m. From each location, two trees one healthy and one dead (which died within 2 to 3 years or so) were selected. From the base of the trees, four points at a distance of 1.5meter in East, West, North and South directions were marked. From these points with the help of an auger, soil sample were drawn at a depth of 0-15, 15-30, 30-60, 60-90, 90-120 and 120-150cm. From all the four directions. All the four samples from each direction and depth were mixed together and one composite sample was drawn. In this way samples were collected from six different locations under dead and healthy trees. Soil sample were air dried, ground with pestle and mortar and passed through 2mm sieve and analyzed of pH, E.C, Bulk density and Particle density and $CaCO_3$ as per Kalra and Maynard,1991.

RESULTS AND DISCUSSION
Soil pH
The soil pH values (1:2 soil water ratio) at different depth and at various locations are presented in Table-1, In general the soil pH values were higher in soils under dead trees as compared to healthy trees at all the locations and depth. Among healthy trees the lowest pH values i.e. 7.5 was recorded at the surface layer of location L3 and highest 9.1 at lowest depth at location L_6. In case of dead trees pH values varied from 7.9 (in surface level at location L_3) to 9.3 in the soil sample at lower most depth at location L_6. In both the cases the pH values increased with the increasing in soil depth.

The low pH values of upper surface layer may be attributed to the higher accumulation of organic matter on surface due to higher litter fall and its subsequent decomposition and formation of organic acid. Subhanu (2002), Nandi *et al*., (1991) and Kumar *et al*., (1998) also reported the lowering of soil pH under *Acacia nilotica,Dalbergia Sissoo* plantations.

The paired t-test value showed that at location L_1, L_3 and L_6 these values under dead trees were significantly higher than the healthy trees, values being 4.401, 2.868 and 3.683 respectively. Sharma *et al*., 1998 reported that the soil pH of dead *Dalbergia sissoo* plantation varied from 7.5 to 9.7 as compared to near neutral pH in healthy localities.

Electrical conductivity (dSm^{-1})
The electrical conductivity of soils increased with depth in case of soils under healthy as well as dead trees of *Dalbergia Sissoo* (Table 2). In general, the EC was higher in the soil under dead trees as compared to healthy trees at all the six locations. Under the healthy trees the EC value varied from 0.30 dSm^{-1} (surface) at location L_3 and L_6 to 0.45 dSm^{-1} (lower most depth) at location L_1. Among the dead trees minimum EC was found on the surface (0.32) at location L_4 and maximum in lower most depth (0.47) at location L_1. It is evident from the data that the trees helped in lowering down the salt concentration in soil. The reduction was maximum under the healthy trees of *Dalbergia sissoo.* The effectiveness of *Dalbergia sissoo* in improving soil by lowering its EC values might be attributed to its relative tolerance under adverse soil conditions, amount of litter fall and its chemical composition. The results are in conformity with the finding of Kumar *et al*., (1998) and Nandi *et al*., (1991) and Subhanu (2002). They also reported the lowering down of EC under *Dalbergia, Eucalyptus* and *Acacia* plantation in arid conditions.

Paired t test value showed was no significant difference in EC values in soils under dead and healthy trees.

Bulk density (gm/cc)
The data presented in Table-3,revealed that the bulk density of the soils in the profile ranged from 1.39 gm/cc on the surface at location L_2 and L_4 to 1.65 gm/cc in the lower most soil depth (120-150cm) at location L_3 in the soil under healthy trees and 1.40 gm/cc on the surface layer at locations L_2 and L_4 and maximum in the lower most soil depth 1.65 gm/cc at locations L_1 and L_6 in case of soils under dead trees. In general, the bulk density increased with increasing soil depth both in the soil of healthy as well as dead trees. On an average the bulk density was found higher in soil under dead trees in comparison to the soils under healthy trees of *Dalbergia sissoo* which

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