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Effect of soil compaction by livestock on tree roots in a silvopastoral system

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Abstract

This thesis provides an understanding of ecophysiological effect of livestock integration in agroforestry systems. Integration of livestock with trees and pastures referred to as “silvopastoral” has been identified as a suitable candidate for sustainable ecosystem balanced natural resources management. In order to identify the long term impact of livestock integration in silvopastoral system, a research was conducted in an established university of Wales, Bangor silvopastoral network research site at Henfaes, to determine the effect of soil compaction by livestock on tree roots.

Two multipurpose tree genotype (sycamore and alder) were measured to determine the extent of soil compaction and root development at three distance (0.5 m, 1.0 m and 2.5 m) in north and west directions from sample trees. Sampling was carried out from a single randomly selected tree per plot in sycamore 100, sycamore 400, alder 400, sycamore (clump 400) densities in 3 replications. In sycamore 2500 and alder 2500 forestry control treatments, measurements were made only at two distance and direction, measurements of soil compaction (use of penetrometer) and root development (use of soil corer) was carried out to depth of 30 cm horizons, sub sampled to (0–10, 10–20 and 20–30 cm respectively). Results on root development indicated a significant interaction between tree density and distance from tree in terms of root length, number of root tips, and forks. Lowest density (sycamore 100) recorded the lowest mean value of root length (11.51vm), number of roots tips (12), and number of root folks (9) at 2.5 m distance across replications. When compared with sycamore 400 root length (15.25 cm), tips (17), and forks (13); alder 400 root length (16.27 cm), tips (21), and forks (14); Sycamore clump 400 root length (16.64 cm), tips (18), and forks (15), there was statistically significant difference. With the inclusion of forestry control (2500 densities), distance from tree up to 1.0 meters did not make any difference in root parameters among treatments. On the other hand, penetrometer pressure test for soil compaction has shown higher-pressure requirement up to (152.67LB north and 161.0 LB west) at 2.5 meters distance in the sycamore 100 density.

Keywords: Agroforestry, ecophysiological effect, silvopastoral system