

How leaf (needle) removal affects the density and flexural properties of *Pinus nigra* Arn. (Anatolian black pine) seedlings

Seray Özden^{1*}, Önder Tor¹

¹ Kastamonu University, Faculty of Forestry, Kastamonu, Turkey

* Corresponding author: sozden@kastamonu.edu.tr

Abstract: The leaves are one of the important organs in the tree body due to their physiological and biochemical functions – provide light interception, photosynthesis, transpiration, food storage etc. The leaves found to be in two forms between angiosperms and gymnosperms: angiosperms (deciduous) are trees have flat- or broad-leaves and gymnosperms (conifers or evergreens) are trees have needle-shaped leaves. Those trees have different life strategies in dry season to survive harsh weather, although angiosperms shed their leaves in the autumn, gymnosperms keep their leaves year round. This is because, angiosperms have greater leaf surface area than gymnosperms and this could be a disadvantage in harsh and dry weather; that is when water is scarce particularly in dry seasons, angiosperms should need to limit transpiration in order to grow, and thus they drop their leaves to conserve water and energy during dry seasons. However, gymnosperms have needle-shaped leaves which are narrow and thus they do not have a great deal of surface area and do not need to conserve water. Much research therefore concentrated on the structure of leaves to understand their excellent adaptive strategies to the environmental conditions. However, very little is known about the role of leaves to the mechanical properties when tree species at the seedling stage. The aim of this study was to determine how leaf removal affects the density and mechanical properties of small *Pinus nigra* Arn. (Anatolian black pine) seedlings. The seedlings were subjected to four different leaf removal treatments: 0%, 25%, 50% and 75% removal of the existing needles/leaves in order to understand how the amount of leaf removal treatment influences density and flexural properties of Anatolian black pine seedlings. We used three point bend test to investigate mechanical parameters. The morphological and anatomical properties were also determined. The results showed that shoot diameter was greatest in 25% removal needle sample seedlings than that of three seedlings, and so second moment area (I) was also found to be around 1.2 to 2 times greater than other seedlings. Density was found to be between 0.34 to 0.36 g cm⁻³ and higher in 0% and 25% removal of needles than 50% and 75% removal of needles. 25% removal of needles were also stronger than all other seedling, but no difference found in flexural strength (MOE) values between the amount of needle removal.

Keywords: Density, Flexural properties, Leaf removal, Pine needles