Incorporating wood quality traits into tree breeding programs: Usability of Fractometer for the purpose of a preliminary assessment of wood strength and density of *Pinus brutia* (Turkish red pine)

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Abstract: In tree breeding programs there is a need to assess large numbers of trees and families for traits of economic importance. However, traditional methods of assessment for wood strength and density are expensive and restrict the numbers of samples that can be processed. In addition, traditional strength measurement methods involve cutting of the sample trees. There is an increasing interest in developing and using cost-effective non-destructive/semi-destructive technologies to evaluate the strength of standing trees all around the World. The Fractometer is a device that breaks increment core (5mm in diameter) to measure fracture strength. The advantages of the device are that it is relatively fast, easy to use in the field, and it can perform direct strength measurements using small diameter cores. The main purpose of the study (Project No: TUBITAK 110-O-560) was to evaluate the usability of Fractometer as a preliminary evaluation tool for the wood quality of standing trees. Relationship between density and bending strength values were evaluated to determine the possibility of using the device in predicting density. X-ray densitometry technique used for density measurements. Depending on high correlation between two traits, a model was built using linear regression. Fifty tree sampled for building up statistical model (r^2: 0.74), and fifty trees used to test the model. The density value obtained from the model was 0.546 g / cm^3, and the density value averaged by the x-ray method for the same group was 0.543 g / cm^3. In terms of mean values, the model seems to have made a successful prediction. Depending on our experience and research results some trees have superior growth, stem form and wood quality traits and breeding from these trees could offer gains in timber production and performance for Pinus brutia. Therefore, Fractometer can be used for Turkish red pine tree breeding program for the purpose of a preliminary assessment of wood strength and density performance in the field. Required sample for the device also give a chance to see and compare growing performance of the investigated trees. Consequently, by adopting this technique in a tree improvement program, it is possible to select plus-trees, superior populations to achieve the highest gains in productivity and timber quality.

Keywords: Pinus brutia, Fractometer, NDT, Wood density