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Influence of water availability on isotopic characterization of eucalyptus wood

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1. Introduction

Forest products are the most used inedible renewable resources in the world, but these resources are unique and therefore must be protected. Although there is legislation and enforcement in many countries to regulate the timber trade, it is difficult to know which species of trees are being used as commercial timber and what their true origin is.

The economic value of wood is often imprecise and there is a high illegal trade in wood products that can only be quantified when the seizure occurs. This apprehension is complicated by supply chains: trees are harvested in one location and transported to different countries before being processed into manufactured products, and then the final products are exported to consumers in different countries. Therefore, only current certification methods and documents are unfeasible, as the two fundamental attributes of wood conformity can remain uncertain and even invisible – origin and species (Gasson et al., 2020).

Researches foresee a possible global collapse later this century, as a result of drastic climate changes, such as the possible lack of rain (IPCC, 2021[1]). Thus, there is a need for studies that observe a possible behavior of trees within this panorama.

The main objective of this research is to determine the mean isotopic values of $\delta^{13}C$, $\delta^{2}H$ and $\delta^{18}O$, under water restriction, in eucalyptus clones and seminals in the Botucatu region.

2. Methodology

For the study, 20 trees of the species *Eucalyptus grandis* were used, being 10 clonal trees and 10 seminal trees, from a commercial plantation of six years of the experimental station of forest sciences in the city of Itatinga-SP.

Half of the trees were subjected to water restriction of 1/3 of the rainwater. A disk 130 cm above the ground was sawn from each tree. The samples were extracted with a bench drill along the radial direction, starting from the pith and dried at 40ºC under vacuum for 48 h.

A 0.20 mg aliquot of each sample was weighed into silver capsules and analyzed in a CF-IRMS continuous flow isotope ratio mass spectrometry system. Elemental high temperature conversion analyzer (TC/EA, Thermo Scientific) coupled to IRMS (Delta V, Thermo Scientific) was used. The values of the isotope ratios ($^{13}C/^{12}C$, $^{2}H/^{1}H$ e $^{18}O/^{16}O$) were expressed as δ-values ($\delta^{13}C$, $\delta^{2}H$ e $\delta^{18}O$).

3. Results and Discussion

The mean isotopic value of $\delta^{13}C$ = -26,94 ±0,83 mUr, $\delta^{2}H$ = -102,02 ±19,3 mUr e $\delta^{18}O$ = 23,76 ±2,25 mUr was found for the samples.

The value of $\delta^{13}C$ was expected for eucalyptus as it is a C3 plant (QI et al., 2016[3]) and the values of $\delta^{2}H$ and $\delta^{18}O$ reflect the geographic region of tree planting (GASSON et al., 2020[4]) inside of of the State of São Paulo. However, the variation was greater for $\delta^{2}H$ and $\delta^{18}O$ as it is a sensitive isotopic analysis, with greater uncertainty in the measurement.

The results also showed that there was no statistical difference between clonal and seminal treatments, with and without water restriction.

Despite the smaller volume of biomass of trees with water restriction, this did not influence the isotopic values, showing that water restrictions from dry rains will not influence the isotopic value of the eucalyptus species planted in a given region.

4. Conclusions

Thus, the isotopic values found can be used to determine the species and origin of eucalyptus wood. Now it remains to be seen the geographic range that these values remain. Thus, it is necessary to characterize eucalyptus in other regions of Brazil and the world.

Acknowledgements

References

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