Prediction of *Eucalyptus grandis* chemical compounds in a climate change context using hyperspectral imaging

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The study of wood chemistry to explain the response of trees to climate variation is efficient for retrospective analysis of changes induced in wood during the process of adaptation to seasonal variations. Hyperspectral imaging (HSI) in near infrared could be useful for prediction of several wood chemical components. The objective is understand how water constraints influence wood formation. Wood disks of *E. grandis* clone from six treatments (100% and 65% of rainfall crossed with potassium and sodium fertilizations) were sampled. HSI were obtained on transversal section of the disks using a line scan hyperspectral camera from 1000-2500 nm with a pixel size of 625 x 625 µm. For calibration, were selected 60 wood solid samples from an Eucalyptus collection, which were measured the total extractive values. HSI of these samples were acquired from transversal section with the same camera. We regressed the mean spectra for each sample with extractives values by Partial Least Square Regression. Due to the model, the total extractives for each pixel to produce an image for the wooden disks were predicted. Based on them, the total extractive distribution according to growth conditions were compared, revealing that trees under stress conditions show a higher heterogeneous chemical profile from the pith to bark. Eucalyptus demonstrates sensitive precipitation variations, with rapid growth and considerable increase in DBH during rainy seasons and the reverse in drought. Consequently, is possible to discriminate different patterns of chemical compound distribution according to the growth conditions.

Alternatives for soil nitrous oxide emission reduction associated to nitrogen fertilization in *eucalyptus*

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The aim was to select nitrogen sources with potential for reduce soil nitrous oxide (N_2O) emission under eucalyptus in controlled environment conditions, and from this selection, to evaluate its emission reduction potential under field conditions. Eight nitrogen sources were evaluated in greenhouse over six months. Urea and ammonium sulphate sources with nitrification inhibitor dicyandiamide (U-DCD and AS-DCD, respectively) significantly reduced N_2O emission in relation to conventional source most used in Brazilian forest sector (urea). The same pattern occurred when these sources were evaluated in the field, where U-DCD and AS-DCD had similar cumulative N_2O emission to soil without nitrogen fertilization (2.55 kg $N\text{-}N_2O$ ha^{-1} $year^{-1}$), although U-DCD had emitted 4.1 kg $N\text{-}N_2O$ ha^{-1} $year^{-1}$. Besides that, U-DCD and AS-DCD treatments presented emissions two and three times lower than those without inhibitor, urea and ammonium sulfate, respectively. In this sense, it is concluded that urea and ammonium sulfate sources associated with nitrification inhibitor dicyandiamide have potential for reduce soil N_2O emission from eucalyptus nitrogen fertilization.

Efficiency of biostimulants in promoting *Eucalyptus* sp. growth under water stress

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Despite the adaptability of *Eucalyptus* in the diverse Brazilian edaphoclimatic situations, water limitations can affect its development. In periods of drought, the irrigation in more than one application becomes essential in the implantation of a stand, providing the development of the seedlings. However, this operation considerably increases operating costs. Biostimulants have been an alternative in promoting rooting and improving productivity. In this sense, the objective of this work was to compare different biostimulants and irrigation management in the growth of a planting of *Eucalyptus sp.* The study located in Três Marias, Minas Gerais, under a dystrophic Red-Yellow Latosol, medium sandy texture, was installed in May, the beginning of the dry season. The treatments were two and three irrigations, two irrigations + Fertiactyl Sweet® (FW), two irrigations + KSC PHYT Actyl I® (KP) and two irrigations + Fertiactyl Sweet® + KSC PHYT Actyl I® (FWKP). Three parameters were evaluated: Height (m), uniformity index PV50 (%) and distribution of fine roots at 365 days. FWKP obtained the highest growth in height differing statistically from the others. This was the only one that presented a PV50 above the optimal index of uniformity. In all treatments, the highest root density was observed in the 36 cm layer of the soil, concentration region of at least 47% of the total roots. It was observed that the higher the tree height, the higher the number of roots in the profile. It is concluded that the use of biostimulants promotes the development of Eucalyptus seedlings on water stress.

Value of physiological assessments for monitoring initial development of *Pinus radiata* D. Don young plantations under water stress

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This study compares gas exchange response of six *Pinus radiata* genotypes during a progressive drought period. Experiment was planted in volcanic sands soils in central South Chile. Climate is Mediterranean (Csb) with a mean annual temperature of 14°C and 1300 mm of rainfall. One year old seedlings were submitted to drought by stopping irrigation during maximum atmospheric demand conditions. Weekly gas exchange assessments considering stomatal conductance (g_s), photosynthesis (A), predawn water potential (Ψ_{pd}) and leaf area index (LAI) were measured during a month after drought. Statistical analyses showed significant differences in g_s, A and LAI, and time was only significant for Ψ_{pd}, which was the best variable monitoring increasing water stress. Nonlinear modeling for g_s x Ψ_{pd} showed significant differences by genotype. Our results suggest that specific genotypes decrease g_s in order to avoid water losses. Modeling for A x Ψ_{pd} showed that genotypes maintain A rate even when g_s is decreasing. Nonlinear modeling between g_s and A with LAI showed that genotypes with largest LAI maintain higher values g_s and A. Physiological responses are an effective way to monitor genotypes stress. Use of this information may help on assessing strategies for early management of forest plantations on critical sites.