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Native species of ultramafic massif of Barro Alto, GO, Brazil, can successfully be used to revegetate Ni mine spoil heaps

Leide R. M. de Andrade[1]; Fabiana de G. Aquino[2]; Zenilton de J. G. Miranda[3]; Cícero D. Pereira[2]; Fábio B. dos Reis Jr[2]; Marco Pessoa-Filho[2]; Eduardo C. Oliveira-Filho[2]; Carlos Tadeu C. do Nascimento[4]; Fábio G. Faleiro[2]; Allan K. B. Ramos[2]; Guillaume Echevarria[5]

Embrapa Cerrados, BR 020, Km 18, Planaltina, DF, Z.C. 73310-970, Brazil (leide.andrade@embrapa.br)[1]; Embrapa Cerrados, BR 020, Km 18, Planaltina, DF, Z.C. 73310-970, Brazil[2]; Embrapa Sede, Parque Estação Biológica - PqEB s/nº. Brasília, DF, Z.C. 70770-901, Brazil[3]; Universidade de Brasília (UnB), Campus Planaltina, Planaltina, DF, Brazil[4]; Universite? de Lorraine ? CNRS, Nancy, France[5]

Ultramafic soils of Barro Alto, GO, Brazil, are rich in Fe, Mg and some heavy metals, such as Cr, Ni, and Co, that are potentially toxic to most plants. Despite these limiting conditions, many plant species develop naturally in those areas and are therefore strong candidates for reclamation of environments degraded by Ni mining. After Ni mining, high heaps of sterile materials are generated in the landscape, which are usually re-vegetated using *Brachiaria* (grass) and *Mucuna* and *Crotalaria* (leguminous). Our goal was to develop a protocol to replace those exotic species by native ones, more adapted to these extreme soil conditions. Studies carried out in an area of ??intact vegetation considered that the rusticity of those plant species is associated to the relevant contribution of the rhizosphere-associated microbiota, such as growth promoting bacteria and arbuscular mycorrhizal fungi, and to the physiological mechanisms of adaptation to high levels of metals in soils and plant tissues. Floristic surveys identified about 200 plant species and a seed collection schedule was constructed for most of them. Differences in Ni-bioavailability of the soil affected the distribution of botanical families, and DNA-genomic findings marked significant genetic differences among plants of same species. The elements content in plant tissues growing on Ni-rich soil showed high levels of Mg, Fe, Mn, and some accumulate > 1,000 mg Ni kg^{-1} in D.M. Characterization of soils from mine spoil heaps showed strong chemical and physical heterogeneity, originated from distinct mineralogy. There were negligible contents of O.M., low levels of Ca, P, K and high bioavailability of Mn, and Cr^{6+}, element potentially toxic to the environment. That information was important in the definition of strategies to re-vegetate the spoil heaps and to select Ni-hyperaccumulator plants for use in metal bioremediation processes. About 20 native herbaceous-shrubs species were selected due to their characteristics of great abundance, to the ability to colonize altered environments, and to tolerate or accumulate high amounts of toxic elements. Methodologies were developed for the propagation of the selected species for planting in the field conditions. All of this information made up a satisfactory protocol to re-vegetate mine spoils heaps, using native species in ultramafic soils, allowing the substitution of exotic species commonly present in the seed cocktails used by mining companies in that process.

Keywords: Brazilian ultramafic flora survey; Metallophytes seedling propagation; Ni-hyperaccumulators; permanent green cover; re-vegetation protocol

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