CURRICULUM VITAE

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EDUCATION

Federal University of Viçosa	B.A. 1990	Agronomy
Federal University of Viçosa	M.Sc. 1995	Soil Science and Plant Nutrition
Cornell University	Ph.D. 2002	Field Crop Science (concentration in Plant Genetics and Plant Breeding)

Visiting Scientist, Cold Spring Harbor Laboratory - Collaboration with Drs. Rob Martienssen, Doreen Ware and Leon Kochian on epigenomics of abiotic stress tolerance focusing on root system architecture, 2015

Faculty member in the Graduate Program in Genetics, Federal University of Minas Gerais, 2010 – present

CURRENT POSITION

Research Scientist, Molecular Genetics, Embrapa Maize and Sorghum (2002 to date)

RESEARCH PROGRAM

My research program is focused on the molecular and quantitative genetics of abiotic stress tolerance primarily in sorghum and maize and includes comparative genomics with other staple food crop species. More specifically, my research addresses the role of root biology in crop adaptation to soil-based stresses including drought, insufficient mineral nutrients, and toxic metals. Because acid soils limit crop production in the tropics and sub-tropics where many developing countries reside, a major emphasis of my research has been on the molecular, genetic and physiological mechanisms that allow crops to maintain high yields on acid soils, where crop production is limited by aluminum (Al) toxicity and low phosphorous availability. On these highly acid soils (pH < 5), the rhizotoxic form of aluminum, Al^{3+}, is solubilized into the soil solution, resulting in a damaged and stunted root system and reduced crop yields due to drought and nutrient deficiencies. Our research efforts led to the isolation by positional cloning of one of the first plant Al tolerance genes, SbMATE, which encodes an Al-activated root citrate efflux transporter that confers sorghum Al tolerance via chelation of toxic Al^{3+} ions in the rhizosphere. We have recently shown that SbMATE increases sorghum yield on acid soils by 0.6 ton ha^{-1}. Furthermore, from an evolutionary point of view, we are using molecular-genetic approaches including association genetics to uncover useful genetic variation for Al tolerance in crop species to unravel the fine structure of the SbMATE gene. We are using a combined strategy integrating GWAS, QTL and expression QTL mapping, allele-specific expression assays and transactivation assays to define the molecular nature of regulatory elements affecting Al tolerance gene expression for deployment into sorghum molecular breeding programs.

Additionally, candidate gene-based and genome-wide association mapping are being used to identify other genes underlying abiotic stress tolerance in sorghum, within a framework that emphasizes root traits related to agronomic performance under stress in the field and root system architecture traits assessed in controlled conditions. This work led to the recent discovery that multiple sorghum homologs of rice Pstol1 (for phosphorus starvation tolerance), which encodes a putative cell wall-associated protein kinase, work together to increase root proliferation and root surface area, leading to enhanced phosphorus uptake and grain yield on low-P soils (enhanced P efficiency). Other research activities involve the application of whole genome scans based on high density SNP data targeting P efficiency, and drought and Al tolerance in sorghum. A more recent development in my research program involves the relationships between epigenetic changes and abiotic stress tolerance, with a focus on sorghum root system architecture, which was initiated in 2015 during a sabbatical at the Cold Spring Harbor Laboratory with Drs. Doreen Ware, Rob Martienssen and Leon Kochian (at the Robert Holley Center at Cornell

University). We are taking this translational genomics approach to determine the contribution of the epigenome in enhancing crop performance on soils prone to reduced crop yields due to abiotic stresses.

SELECTED PUBLICATIONS

Hufnagel B, Guimaraes CT, Craft EJ, Shaff JE, Schaffert RE, Kochian LV, Magalhaes JV. 2018. Exploiting sorghum genetic diversity for enhanced aluminum tolerance: Allele mining based on the *Alt$_{SB}$* locus. Scientific Reports, 8:1-13.

Magalhaes JV, Piñeros MA, Maciel LS, Kochian LV. 2018. Emerging Pleiotropic Mechanisms Underlying Aluminum Resistance and Phosphorus Acquisition on Acidic Soils. Frontiers in Plant Science 9:1420.

Carvalho Jr G, Schaffert RE, Malosetti M, Viana JHM, Menezes CB, Silva LA, Guimaraes CT, Coelho AM, Kochian LV, van Eeuwijk FAL, Magalhaes JV. 2015. Back to Acid Soil Fields: The citrate transporter SbMATE is a major asset for sustainable grain yield for sorghum cultivated on acid soils. G3: Genes|Genomes| Genetics, 6:475-84.

Kochian LV, Piñeros MA, Liu J, Magalhaes JV. 2015. Plant adaptation to acid soils: the molecular basis for crop aluminum resistance. Ann Rev of Plant Biol 66: 571-598

Hufnagel B, Sousa SM, Assis L, Guimaraes CT, Leiser W, Corradi G, Negri B, Larson BG, Shaff JE, Pastina MM, Barros BA, Weltzien E, Rattunde HFW, Viana JH, Clark RT, Falcão A, Gazaffi R, Garcia AAF, Schaffert RE, Kochian LV, Magalhaes JV. 2014. Duplicate and conquer: multiple homologs of phosphorus-starvation tolerance 1 enhance phosphorus acquisition and sorghum performance on low-P soils. Plant Physiology 166: 659-677.

Leiser WL, Rattunde Henry,Weltzien E, Cisse N, Abdou M, Diallo A, Tourè AO, Magalhaes JV, Haussmann B. 2014. Two in one sweep: aluminum tolerance and grain yield in P-limited soils are associated to the same genomic region in West African Sorghum. BMC Plant Biology (Online) 14: 206

Caniato FF, Hamblin MT, Guimaraes CT, Zhang Z, Schaffert RE, Kochian LV, Magalhaes JV. 2014. Association mapping provides insights into the origin and the fine structure of the sorghum aluminum tolerance locus, *Alt$_{SB}$*. Plos One9: e87438

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Liu J, Luo X, Shaff J, Liang C, Jia X, Li Z, Magalhaes JV, Kochian LV. 2012. A promoter swap strategy between the AtALMT and AtMATE genes increased Arabidopsis aluminum resistance and improved carbon use efficiency for aluminum resistance. The Plant Journal, 71: 327-337

Sabadin P, Malosetti M, Boer M, Tardin F, Santos F, Guimarães C, Gomide R, Camilo A, Albuquerque P, Caniato F, Mollinari M, Margarido G, Oliveira B, Schaffert R, Garcia A, Eeuwijk F, Magalhaes JV. 2012. Studying the genetic basis of drought tolerance in sorghum by managed stress trials and adjustments for phenological and plant height differences. Theoretical and Applied Genetics, 124: 1389-1402

Caniato FF, Guimarães CT, Hamblin M, Billot C, Rami J-F, Hufnagel B, Kochian LV, Liu J, Garcia AAF, Hash CT, Ramu P, Mitchell S, Kresovich S, Oliveira AC, Avellar G, Borém A, Glaszmann J-C, Schaffert RE, Magalhaes JV. 2011. The relationship between population structure and aluminum tolerance in cultivated sorghum. PloS One. 6: e20830

Liu J, Magalhaes JV, Schaff JE, Kochian L. 2008. Aluminum-activated citrate and malate transporters from the MATE and ALMT families function independently to confer Arabidopsis Aluminum Tolerance. Plant J. 57:389-399

Magalhaes JV, Liu J, Guimarães CT, Lana UGP, Alves VMC, Wang Y-H, Schaffert RE, Hoekenga OA, Piñeros MA, Shaff JE, Klein PE, Carneiro NP, Coelho CM, Trick HN, Kochian LV. 2007. A member of the multidrug and toxic compound extrusion 'MATE' family is a major gene that confers aluminum tolerance in sorghum. Nat. Genet. 39:1156-1161.

Caniato FF, Guimarães CT, Schaffert RE, Alves VMC, Kochian LV, Borém A, Klein PE, Magalhaes JV. 2006. Genetic diversity for aluminum tolerance in sorghum Theor. Appl. Genet. 114:863-876.

Magalhaes JV. 2006. Aluminum tolerance genes are conserved between monocots and dicots. PNAS 103:9749-9750.

Magalhaes JV, Garvin DF, Wang Y, Sorrells ME, Klein PE, Schaffert RE, Li L., Kochian LV. 2004. Comparative Mapping of a Major Aluminum Tolerance Gene in Sorghum and Other Species in the Poaceae. Genetics 167: 1905-1914.