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Modification of root distribution and growth in pot experiments with two tropical earthworm species

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Three greenhouse experiments were performed to assess the role of two common tropical geophagous endogeic earthworm species, *Pontoscolex corethrurus* and *Polypheretima elongata*, on root distribution and biomass of several plant species in two soil types, a clayey Andosol and a sandy Alfisol, from Veracruz, Mexico. The equivalent of about 12 kg dry soil were placed into 20 l plastic pots and 4 or 7 g (60 and 100 g m^{-2}, respectively) earthworms were inoculated to pots planted with common beans (*Phaseolus vulgaris*), *Brachiaria decumbens* pasture grass under four P fertilization regimes (0, 1.6, 8.4 and 10 kg ha^{-1} P) and maize (*Zea mays*) with or without surface residues. At harvest roots and shoots were weighed, the pots cut in half and a transparent plastic sheet (overheads) used to draw root and earthworm structures in vertical and horizontal (every 5 cm) planes. The drawings were scanned, binarized and submitted to image analysis techniques to determine root and worm structure densites. Results showed few effects of earthworms on root biomass, with an increase observed only in beans with *P. elongata* and a decrease in *B. decumbens* with *P. corethrurus* and 10 kg ha^{-1} P. Shoot/root ratios in maize + residues were twice lower in presence than absence of earthworms indicating more relative effort into root production. Root density was generally higher and more evenly distributed both horizontally and vertically in the presence of earthworms. Few relationships were observed between earthworm structure density and plant performance. Root density however, predicted well root biomass in most cases, although few relationships were observed with shoot biomass. These results suggest that earthworms may play a role in enhancing plant resistance to stress, although the induced changes in the root system may not necessarily lead to greater yields. Further studies using both destructive and non-destructive methods are necessary to properly describe the spatial and temporal interactions of earthworm activity and their structures (burrows and casts) with plant roots.