Finger Millet Growth and Nutrient Uptake Is Improved in Intercropping With Pigeon Pea Through ”Biofertilization” and ”Bioirrigation” Mediated by Arbuscular Mycorrhizal-Fungi and Plant Growth Promoting Rhizobacteria

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Legume-cereal intercropping is well known in traditional dry land agriculture. Here, we tested whether finger millet, a shallow-rooted cereal, can profit from neighboring pigeon pea, a deep-rooted legume, in the presence of ”biofertilization” with arbuscular mycorrhizal fungi (AMF) and plant growth-promoting rhizobacteria (PGPR), under drought conditions. We conducted a greenhouse experiment using compartmented microcosms. Pigeon pea was grown in a deep compartment with access to a moist substrate layer at the bottom, whereas finger millet was grown in a neighboring shallow compartment, separated by 25-mu m nylon mesh, without access to the moist substrate layer. In the presence of a common mycorrhizal network (CMN), with or without PGPR, a drought condition had little negative effect on the biomass production of the finger millet plant whereas in absence of biofertilization, finger millet biomass production was less than half compared to well-watered condition. Biofertilization strongly increased nitrogen and phosphorus uptake by both plants, both under well-watered and drought conditions. In the presence of AMF, both plants also acquired N-15 and P-33, offered in a labeling compartment accessible to fungal hyphae but not to roots. Our results show that ”biofertilization” with AMF alleviates the negative effects of drought condition on finger millet, indicating that the CMN connecting pigeon pea and finger millet exert clearly a positive influence in this simulated intercropping system.
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