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Use of Plant Growth-Promoting Rhizobacteria to Improve Mycorrhisation, Nutrient Acquisition and Plant Health of Tomato Affected by Soilborne Pathogen

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Abstract

Biological strategies to control plant diseases are regarded as environmental friendly alternatives to agrochemicals which may contribute to the development of sustainable cropping systems under humid tropical conditions. Only few studies have investigated the synergistic action of beneficial microorganisms such as *Pseudomonas spp.* and arbuscular mycorrhizal fungi (AMF) to improve the growth and resistance of plants against soilborne diseases. The objective of this study was to test the efficiency of Pseudomonas proradix® (Proradix®, Sourcon Padena, Tübingen, Germany) to improve mycorrhisation, nutrient acquisition and plant health of tomato, an important cash crop in Indonesia, affected by the aggressive root pathogen *Fusarium oxysporum* Schlecht f. sp. *radicis-lycopersici* Jarvis and Shomaker (FORL).

Tomato seeds (*Lycopersicon esculentum* Mill. var. Money Maker) were pre-cultivated in pots containing 50 g loamy clay soil/sand mixture (3:1) with and without Proradix® (1.5×1010 cfu per pot), without and with AMF-inoculum (about 8000 propagules of *Glomus intraradices* strain 510; Mycotec Biotechnik Gbr, Hannover, Germany). Subsequently the three weeks old seedlings were transplanted to pots containing 2 kg soil/sand mixture, fertilised with 100 N, 50 P, 150 K, 50 Mg, 0.06 Fe mg kg^{-1} loamy clay soil. Top and bottom layer of the substrate contained soil/sand mixture only. The middle layer of the substrate was mixed with a spore suspension of FORL strain 11r (provided by Prof. J.C. Tello Marquina, Universidad De Almería, Spain) at a rate of 4.5×107 spores in 10 ml water per 100 mg substrate. As a control, only sterile water was added.

Proradix® significantly improved the root colonisation by AMF and the biomass production of tomato, which was particularly pronounced in the soil with FORL-spores inoculation. Combined application of Proradix® and AMF lowered the disease severity of FORL and enhanced the concentrations of nutritional elements in the shoot tissue of tomato. To a smaller but still significant extent, disease severity was also decreased by single application of Proradix® and AMF. These results suggest that Proradix® functions not only as a mycorrhisation helper bacterium but also as a suitable biocontrol agents to restore plant growth and health when grown in severely FORL infested soils.

Keywords: AMF, biocontrol, FORL, Pseudomonas, soilborne pathogen, tomato

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