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Root growth and distribution of gooseberry (*Physalis peruviana*) under field conditions in the Andean soil

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Highlights: A field technology with the computer model called "RACINE" was used to estimate root-length density (RLD) and the root exploration from root count on soil profiles. The results indicated a drastic reduction on root development due to restrictions as low phosphorous and decreasing organic matter. However, *Glomus mosse* can promote the root system, on RLD and root front.

Keywords: root model, *Physalis peruviana*, *Glomus mosse*.

A field technology was used to estimated root-length density (RLD) and the root exploration from root count (grid method) on soil profiles. This method includes a computer model, developed by Chopart and Siband (1999), and called "RACINE"**,** that was calibrated and validated in volcanic soils of South America (Roveda-Hoyos *et al*., 2001). This research was focused on determining the effect of symbiotic association between arbuscular mycorrhizal fungi (AMF) and gooseberry crops on the root-length density and the root exploration under field conditions (Van der Heijden, 2003). The experiments were done in two localities of Boyacá and Cundinamarca departments of Colombia at 2900 and 2050 meter over sea level, respectively. Both soils were classified as Typic Dystrandepts, with low phosphorous available (< 10 mg Kg^{-1}), low macronutrients saturation (N, K, Ca, Mg y S), and acid pH < 5. Both calibration and validation methods carried out using two experimental designs of random complete blocks were used with 3 treatments and 4 repetitions as follows; with two control treatments without inoculation of AMF, without fertilizing (T_0), and 100% of fertilizing (T_{100}) with application of triple superphosphate (TSF), a treatment with 50% fertilizing of TSF and inoculated with AMF, *Glomus mosse* (T_{50+G}), all treatments were fertilized with N (149.5 Kg Ha^{-1}), K (196.9 Kg Ha^{-1}), Ca (46.9 Kg Ha^{-1}), Mg (14.1 Kg Ha^{-1}), S (21.1 Kg Ha^{-1}), and micronutrients (B, Cu). The experimental results demonstrated that all the treatments had a shallow root system (> 90%) of the total root length, after the top soil deep (15 cm), the RLD showed a drastic reduction of *P. peruviana* roots, the soil profiles were evaluated at vegetative and flowering stages (2 and 6 month after planting). This shallow root system of gooseberry plants suggested a chemical restrictions, as low availability phosphorous in the soil profile (<5 mg Kg^{-1}), and decreasing organic matter in a deep soil profile, those proprieties are typical in volcanic ash soils. The principal differences in RLD among treatments in the top soil were due to the effect produced by the application of phosphorous fertilizer (TSF) and the inoculation with *G. mosse*, as follows: The highest values of RLD (14.9 cm cm-3) were found in the inoculated treatment (T50+G) to compare to no inoculated treatments, T100 (12.1 cm cm-3), and T0 (8.0 cm cm-3). There were also differences among these treatments with the maximum rooting deep (root front). The highest root front (35 cm) was observed in inoculated treatment with *G. mosse* (T50+G) to compare with the no inoculated treatments, T100 (30 cm), and T0 (25 cm). The experimental results indicated a drastic reduction on root development on gooseberry plants as limiting factors, such as low available phosphorous (Vance, 2003) and decreasing organic matter in deep soil profile. Nevertheless, the inoculation of AMF (*G. mosse*) can promote the root system of gooseberry, on both RLD and root front.

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