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Effect of low molecular humic substances on tomato root plants under different phosphorus supplies in nutrient solution system

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Plants involve different strategies to take up Phosphate (Pi) under varying conditions. Tomato plants are known as a low efficiency plants in Pi acquisition and therefore involve different root modifications to absorb phosphate. Previous studies showed that the presence of low molecular humic substances (LMHS) have different effects on root to improve nutrients uptake. Here, we studied the morphological characteristics of roots of four weeks old tomato plants hydroponically grown under deficient and optimum supply of Pi and LMHS treatments. The aim was to detect the root morphological modifications that improves Pi uptake under different condition. Under Pi deficiency, root hair density (RHD) and root hair length (RHL), total root length (TRL), root volume, specific root length (SRL) and root to shoot ratio increased. In other hand, LMHS treatments increased only RHD and RHL in both sufficient and deficient of Pi treatments. Pi stress also significantly affected the micronutrients uptake in the roots while it was not significant for macronutrients. Under Pi deficiency; presence of LMHS decreased TRL while its presence increased RHD, SRL, RHL and root volume. In optimum Pi condition, LMHS increased total root weight, TRL, weight/volume root ratio of tomato plants. Supply of Pi accelerated root biomass and growth with or without LMHS treatment. LMHS significantly altered sharply root hairs growth but it was not significant for main roots. Both LMHS and Pi modified significantly root hairs. root hair growth and intensity increased 64% in Pi deficient plants by LMHS where it was 44% for Pi sufficient plants. In conclusion, both Pi stress and LMHS induced morphological changes which increased specific root area by root hairs modifications. LMHS did not increase root dry-mass in Pi supplied plants.
Keywords: Low humic substances, Root morphology, Phosphorous, Tomato plant