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Characterization of Nitrate Uptake Mediated by Soil Bacterial Strains

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Salt accumulation in agricultural soils reduces the growth and productivity of crops. Although scientists have been studied the impacts of salinity on plants, the physiological mechanism of adaptation to salinity has not been well understood. Practically, salinity in irrigated soil of green and glass houses keeps increasing in Korea by the massive application of nitrogen fertilizer. Majority of the salinity is nitrate and the nitrate accumulation leads to a number of deleterious effects to the environments, such as inhibition of plant growth, abnormal nitrate accumulation in vegetables, and excess content of nitrate in surface and ground water. There are many ways to remove soil nitrate; however, most of these are not efficiently applicable to the soils of green and glass houses. In this study, we isolated various microbes in order to eliminate excess soil nitrate. Bacterial strains were isolated from 15 different soils obtained from green and glass houses located at various counties in Chungbuk province. When the rate of nitrate uptake was measured, one strain, E0461, showed high activity of nitrate uptake. The growth and nitrate uptake of E0461 were dependent on the composition of culture media. In the presence of tryptone and peptone, the nitrate uptake as well as the growth increased. Interestingly, in the absence of nitrogen source, the E0461 was able to grow; however, it did not uptake nitrate from culture media. When the dependence of bacterial growth on the concentration of nitrate was measured, the growth was increased by increasing the concentration of nitrate. For the kinetic analysis of nitrate uptake, time-dependent nitrate uptakes were measured at the presence of various concentration of nitrate. Single exponential function was fitted to the data obtained from time-dependence of nitrate uptake versus the concentration of nitrate. These results imply that there is only one major factor on the nitrate uptake that is probably a nitrate-transporting enzyme.