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Effect of Potassium Releasing Pseudomonads on Growth and K Uptake of Tomato in Two Soils with Different Amount of Available K

M. Deilamirad[1]- M.R. Sarikhani[2*] - Sh. Oustan[3]

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Introduction: Potassium is a major and essential plant macronutrient and the most abundant absorbed cation in higher plants. Potassium (K) plays an important role in the growth, metabolism, and development of plants. There are three forms of potassium found in the soil *viz.*, soil minerals, nonexchangeable and available form. Soil minerals make up more than 90 to 98 percent of soil potassium. It is tightly bound and most of it is unavailable for plant uptake. Plants can uptake potassium only from the soil solution. Many indigenous soil microorganisms have the potential to absorb and mobilize the fixed form of nutrients from trace mineral sources. The use of plant growth promoting rhizobacteria including potassium-solubilizing bacteria as a biofertilizer could work as a sustainable solution to improve plant nutrient uptake and production. In this study the effect of five isolates of *Pseudomonas* were assessed on the growth and K uptake of tomato in two different soils with less than 200 mg/kg and more than 400 mg/kg available potassium.

Materials and Methods In this study, two different soil, Khalat pushan (K <200 mg/kg) and Kandovan (K >400 mg/kg) were used. All the isolates including S6-6, S10-3, S14-3, S19-1 and S21-1 used in this study belonged to *Pseudomonas* genus and their potential were examined as a potassium releasing bacteria (KRB). Bacterial isolates were cultured in NB medium and were used in pot experiments. Experiment was conducted in a completely randomized design with three replications in two different soils by application of five bacterial isolates and the control without inoculum. Tomato seeds were inoculated with bacterial isolates in non-sterile soil and in the presence of indigenous soil microflora and the experiment continued until the beginning of the reproductive phase. The rate of inoculation was 10 ml of bacteria per pot. Growth and nutritional parameters such as dry weight of shoot and root, chlorophyll index, content of K and P in plant tissue were measured. Data analysis was performed by SPSS software, and the means were compared at α=5% by Duncan test.

Results and Discussion: The results of statistical analysis in the soil with less than 200 mg/kg available potassium (Khalatpoushan) showed the significant effect of bacterial inoculation on chlorophyll index, shoot and root dry weight and potassium and phosphorus content in shoot and root in bacterial treatments compared to the control. The highest amount of chlorophyll index, shoot dry weight and shoot absorption of potassium and phosphorus was accounted for S21-1. The highest amount of root dry weight and root absorption of potassium and phosphorus was accounted for S14-3.The results of second experiment in soil with more than 400 mg/kg available potassium (soil collected from Kandovan) showed that the measured properties were not affected by bacterial treatments. The highest amount of chlorophyll index was achieved by S14-3. The highest uptake of shoot potassium and phosphorus were recorded in plants which were inoculated by S14-3 and S21-1; however, the differences were not significant. While in this study we did not measure released K by bacteria in in-vitro condition but in the previous studies, their ability in K releasing from mica minerals such as muscovite and biotite had been measured and reported. Production of organic acid is one mechanism which proposed to explain potassium releasing ability of potassium releasing bacteria. It seems that this mechanism has the role in P solubilization, K releasing and solubilizing other nutients by plant growth promoting rhizobacteria (PGPR).

Conclusions: These results suggested that plant growth stimulating efficiency of bacterial inoculants affected by soil nutritional condition. The bacterial inoculation had a much better stimulatory effect on plant growth in soils with low available potassium. In this experiment, two isolates, S21-1 and S14-3 were better than the other isolates. Study in this area should be done especially in isolation and identification of potassium releasing bacteria from different soil samples. In the next step, these isolates should be tested in different soils under different climate conditions of the country, to choose robust and efficient isolate and intorduce them as KSB

1, 2 and 3- Former M.Sc Student and Associate Professor of Soil Biology and Biotechnology and Professor of Soil Cehmistry, Deptartment of Soil Science, Faculty of Agriculture, University of Tabriz, Iran
(*-Corresponding Author Email: rsarikhani@yahoo.com)

biofertilizer in counntry. It was the first report in Iran to test *Pseudomonas* isolates as KSB, while in the previous studies other genera especially bacteria belonged to *Bacillus* was reported in Iran.

Keywords: Potassium, Potassium releasing bacteria, *Pseudomonas* spp., Tomato