

Development and Characterization of Efficient K-Solubilizing Rhizobacteria and Mesorhizobial Inoculants for Chickpea

Ali Raza Siddiqui¹, Sher Muhammad Shahzad^{1*}, Muhammad Ashraf², Tahira Yaseem³, Rizwana Kausar⁴, Gadah albasher⁵, Saad Alkahtani⁵, Awais Shakoor^{6*}

¹Department of Soil and Environmental Sciences, College of Agriculture, University of Sargodha, Sargodha, Punjab, Pakistan

²Department of Soil Science, Faculty of Agricultural Sciences and Technology, Bahauddin Zakariya University, Multan, Punjab, Pakistan

³Department of Environmental Sciences and Engineering, GC, University Faisalabad, Punjab, Pakistan

⁴Soil and Water Testing Laboratory for Research, Sargodha, Punjab, Pakistan

⁵Department of Zoology, College of Science, King Saud University, Riyadh, Saudi Arabia

⁶Department of Environment and Soil Sciences, University of Lleida, Avinguda Alcalde Rovira Roure 191, 25198, Lleida, Spain

*Corresponding author's email: smshahzad_pk@yahoo.com; awais.shakoor@udl.cat

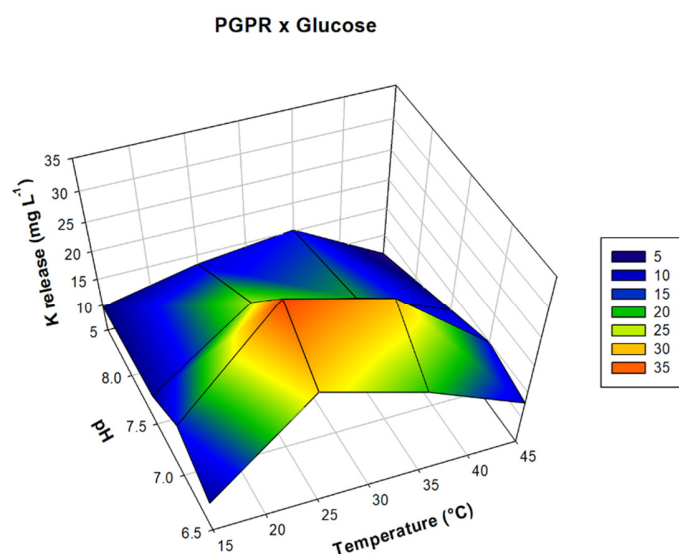


Figure S1. 3D relationship between glucose (C source), temperature (°C), pH and K release from waste mica (WM) powder 3D Stoichiometric relationships = 3D stoichiometric relationships = Glucose and pH: $R^2 = 7730$, $p < 0001$, $n = 0032$; Glucose and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0002$, pH and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0341$

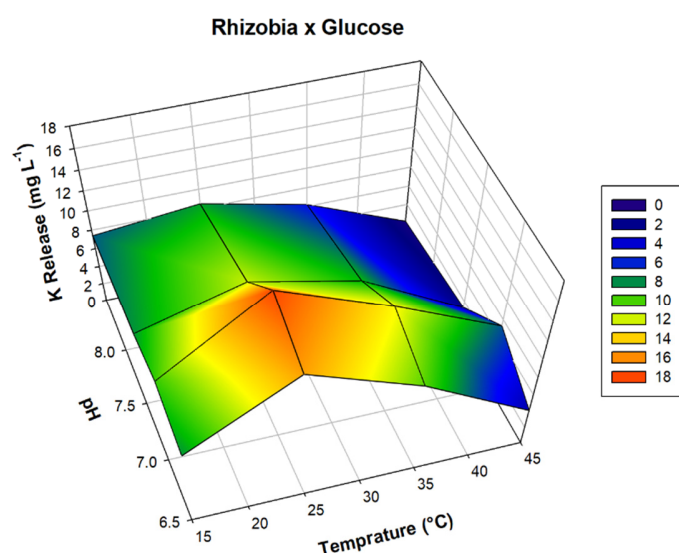


Figure S2. 3D relationship between glucose (C source), temperature (°C), pH and K release from waste mica (WM) powder 3D Stoichiometric relationships = 3D

stoichiometric relationships = Glucose and pH: $R^2 = 7730$, $p < 0001$, $n = 0032$; Glucose and temperature ($^{\circ}\text{C}$): $R^2 = 7730$, $p < 0001$, $n = 0002$, pH and temperature ($^{\circ}\text{C}$): $R^2 = 7730$, $p < 0001$, $n = 0341$

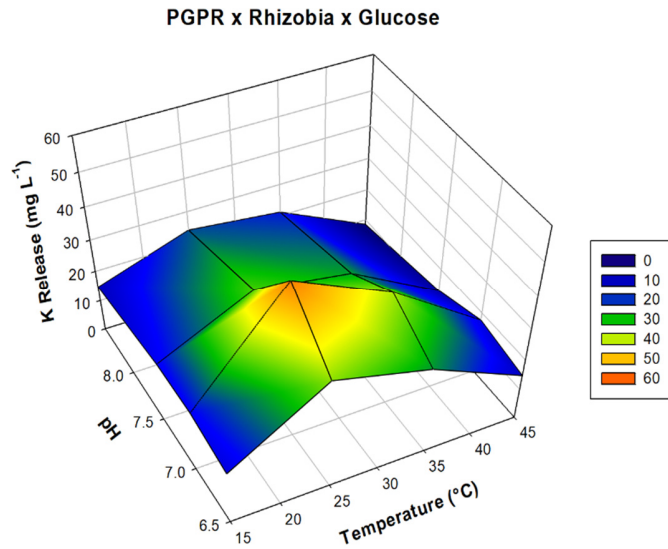


Figure S3. 3D relationship between glucose (C source), temperature ($^{\circ}\text{C}$), pH and K release from waste mica (WM) powder 3D Stoichiometric relationships = 3D stoichiometric relationships = Glucose and pH: $R^2 = 7730$, $p < 0001$, $n = 0032$; Glucose and temperature ($^{\circ}\text{C}$): $R^2 = 7730$, $p < 0001$, $n = 0002$, pH and temperature ($^{\circ}\text{C}$): $R^2 = 7730$, $p < 0001$, $n = 0341$

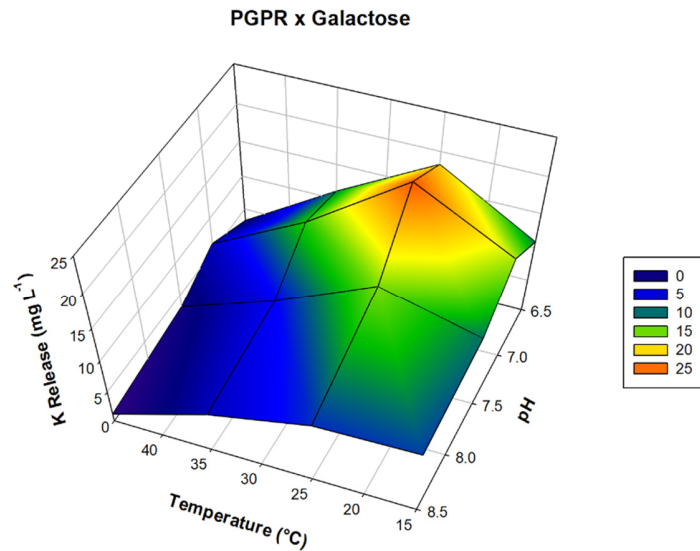


Figure S4. 3D relationship between glucose (C source), temperature (°C), pH and K release from waste mica (WM) powder 3D Stoichiometric relationships = 3D stoichiometric relationships = Glucose and pH: $R^2 = 7730$, $p < 0001$, $n = 0032$; Glucose and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0002$, pH and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0341$

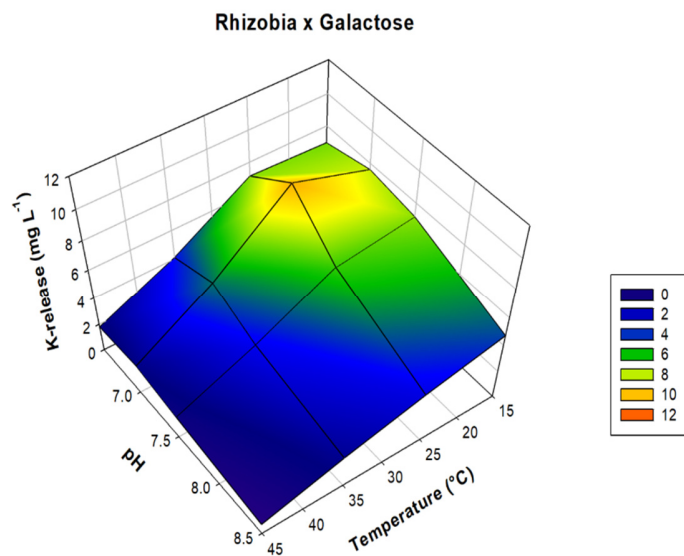


Figure S5. 3D relationship between glucose (C source), temperature (°C), pH and K release from waste mica (WM) powder 3D Stoichiometric relationships = 3D stoichiometric relationships = Glucose and pH: $R^2 = 7730$, $p < 0001$, $n = 0032$; Glucose and

temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0002$, pH and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0341$

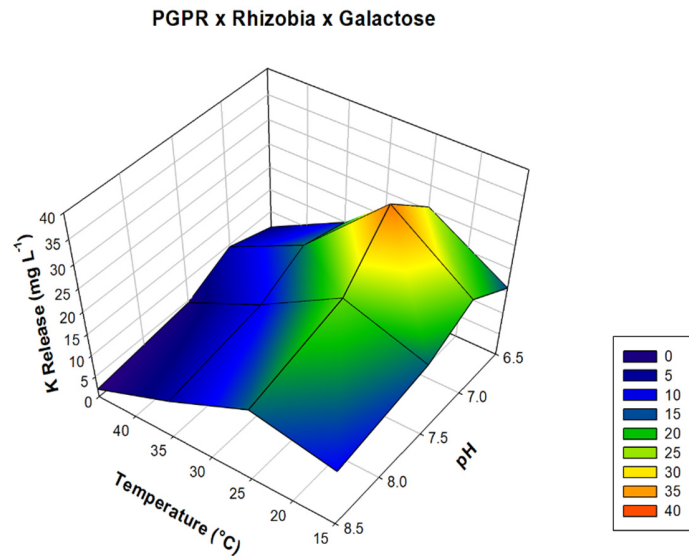


Figure S6. 3D relationship between glucose (C source), temperature (°C), pH and K release from waste mica (WM) powder 3D Stoichiometric relationships = 3D stoichiometric relationships = Glucose and pH: $R^2 = 7730$, $p < 0001$, $n = 0032$; Glucose and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0002$, pH and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0341$

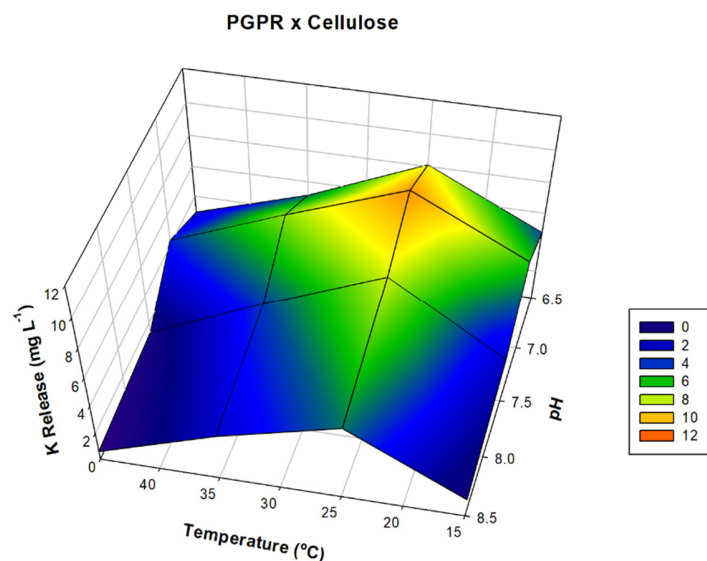


Figure S7. 3D relationship between glucose (C source), temperature (°C), pH and K release from waste mica (WM) powder 3D Stoichiometric relationships = 3D stoichiometric relationships = Glucose and pH: $R^2 = 7730$, $p < 0001$, $n = 0032$; Glucose and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0002$, pH and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0341$

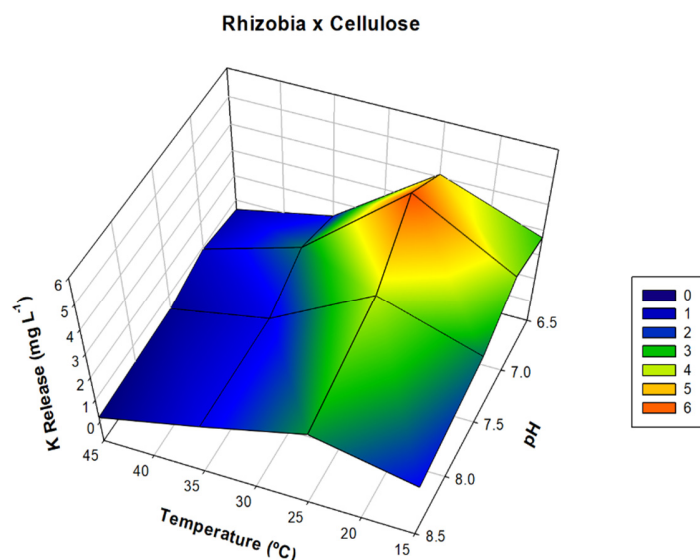


Figure S8. 3D relationship between glucose (C source), temperature (°C), pH and K release from waste mica (WM) powder 3D Stoichiometric relationships = 3D stoichiometric relationships = Glucose and pH: $R^2 = 7730$, $p < 0001$, $n = 0032$; Glucose and

temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0002$, pH and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0341$

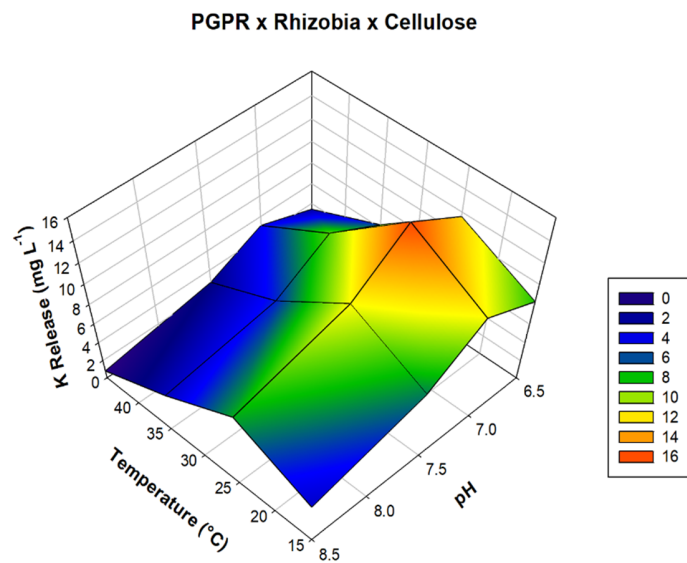


Figure S9. 3D relationship between glucose (C source), temperature (°C), pH and K release from waste mica (WM) powder 3D Stoichiometric relationships = 3D Stoichiometric relationships = Glucose and pH: $R^2 = 7730$, $p < 0001$, $n = 0032$; Glucose and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0002$, pH and temperature (°C): $R^2 = 7730$, $p < 0001$, $n = 0341$