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Modeling Potassium Phosphite Induced Pathogenic tolerance in Tomato plant to Bacterial Infection and Insect Herbivory

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Human population in the world is continually soaring high and the impact on the environment has led to global warming and food security issues. Innovation and the use smart technology in agricultural production has led to the mitigation food security issues. This advanced production techniques is not limited to genetic modification, but also encompasses mechanical advancement and investment in laboratory trials for improved varieties of propagative materials, high yields and tolerance to environmental stress and pathogens. Mathematical modelling is not left behind, as an invaluable tool that supplements laboratory and field experiments. In this research, a mathematical model was formulated to simulate induced defense mechanism of Tomato plant. This model was formulated using Enzyme-Substrate reaction pathways and simulated using SIMBIOLLOGY software, using eight variables and associated parameters. It was shown that tolerance to Bacterial, Fungal and Viral infection was seen to be significantly high as compared to untreated plants, and white fly herbivory reduced. This induced tolerance was triggered using Potassium Phosphite treatment as an elicitor, to initiate a cascade of Enzyme-Substrate reaction which activated the production of Tomatine, Phytogenesis-Related Proteins, and other Phytoalexins and defense genes. It was shown that treated tomato plants were less susceptible to infecetion, upto $s \leq 0.15$, while untreated tomato plants were highly susceptible up to over $s \leq 0.69$. The production of growth inhibitors was significantly reduced for treated plants and eventually the yield of treated plants increased by $y \geq 57\%$. The results can also be applied to induce Systemic Acquired Resistance of crops to Insect herbivory, especially on desert Locust (Schistocerca gregaria) a real devastating factor to crop production.

Author: ROTICH, Titus (Moi University)

Presenter: ROTICH, Titus (Moi University)

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