Using Differential Calculus to Optimize the Urea and Potassium Sulfate Fertilizer Concentrations to Maximize Plant Growth

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Underuse or Overuse of fertilizers is a common problem in agriculture and the inappropriate use can have several implications on agro-ecosystem and soil health. It is imperative to find out the optimum concentration of fertilizers required for the growth and nutrient enhancement of the crop in question. The present study was carried out with the aim of maximizing Chlorophyll content in V.radiata plants that were grown in a soilless cotton medium. This species was chosen as it is grown primarily in the Subcontinent of India and is a rich source of Carbohydrates and Proteins for the native population. 9 different cups with 3 seeds each were used. Fertilizer treatments of $CO(NH_2)_2$ (with concentrations: 0.10g/cm3, 0.20g/cm3, 0.40g/cm3 and 0.60g/cm3) and K_2SO_4 (with concentrations: 0.02g/cm3, 0.06g/cm3, 0.10g/cm3 and 0.14g/cm3) were done. The remaining set was treated with distilled water as a control. After a germination period of 7 days and a fertilizer application period of 3 days, tissue samples were crushed and Chlorophyll content was measured with a Colorimeter, at 430 nm wavelength, through 80% acetone-based method. Post plotting Chlorophyll Absorbance against individual fertilizer concentrations, a downwards shaping parabola was obtained with an equation of a quadratic form. The derivative of this equation was set to 0 to determine the optimum concentrations of the fertilizers. The average values of optimum concentrations were 0.328 g/cm3 Urea and 0.064 g/cm3 Potassium sulfate with a standard deviation of 7% and 2.8% respectively. The study achieved its purpose in analyzing and optimizing the Potassium Sulfate and Urea impact on Chlorophyll content in Vigna radiata and the takeaway is that such spectrophotometric analysis can revolutionize agricultural methods.

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