Assessing Morphological Responses of Greenhouse Tomatoes to Varying Nitrogen Levels using Manual and Image-Sensing Methods

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Protected agriculture (PA) is a solution for overcoming conventional agriculture issues and thus for feeding the rising world population. Hence soilless culture has become an integral part of PA and managing plant nutrition in PA is important. Therefore, innovative intellective diagnostic systems for diagnosing nutrient deficiency symptoms are a timely need. Hence this experiment was conducted to test the effectiveness of "image sensing" as a diagnostic tool for nitrogen deficiency in a fully intensive greenhouse located in WM2b (Mid-country Wet zone). Study was conducted to detect growth response of tomato, variety 'Sylviana' to varying nitrogen levels using manual and image sensing methods. In this study, five nitrogen fertilization levels were established. Of them, T1 was 200% N of the recommendation, T2 (control) was 100% N, and T3, T4, and T5 with 50%, 25%, and 12.5 % N levels respectively. The results showed that stem thickness, leaf area, plant height, and leaf number were significantly different within treatments ($p<0.05$) after 5th weeks after transplanting (WAP). At 7WAT, the leaf dry weight was significantly different between T2, T3, T4, and T5. For detecting leaf color, leaf images were processed in "ImageJ software" to determine the green color intensity. Image analysis results showed that there was a significant difference among treatments since the 3rd WAT. The option of "use of Leaf color chart" for this purpose was found less effective. According to the results, diagnosis of N deficiency in tomato leaves could be effectively done with the use of image sensing much earlier without waiting for morphological changes. The positive results found with the image sensing method for detection of N deficiency of tomatoes would be used to develop an effective and efficient method for leaf color-based diagnosis of nutrient deficiencies in large-scale cultivations.

Keywords: Image analyzing, Nitrogen deficiency, Plant growth characters, Protected agriculture, Tomato

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