Detection of Leaf Nutrient Imbalance for Early Mitigation of Insidious Fruit Rot in Harumanis Mangoes

Muhammad Ikhwan Mohd Yusof
Faculty of Engineering, Department of Electrical Engineering, Universiti Malaya, Malaysia

Noraisyah Mohamed Shah
Faculty of Engineering, Department of Electrical Engineering, Universiti Malaya, Malaysia

Anis Salwa Mohd Khairuddin
Faculty of Engineering, Department of Electrical Engineering, Universiti Malaya, Malaysia

Fathinul Syahir Ahmad Sa'ad
Faculty of Electrical Engineering and Technology, Universiti Malaysia Perlis (UniMAP), Malaysia

Abstract:

Insidious Fruit Rot (IFR) is a hidden postharvest disorder that severely impacts the quality and market value of Harumanis mangoes—a premium Malaysian fruit. Many farmers face serious losses due to a hidden problem called Insidious Fruit Rot (IFR), where the fruit looks fine on the outside but is spoiled inside. This research aims to help farmers detect and prevent this problem early by using artificial intelligence (AI). The disorder often goes undetected until after harvest, resulting in significant economic losses, especially for micro, small, and medium enterprises (MSMEs) reliant on mango cultivation. Studies have shown that IFR is closely linked to imbalances in leaf nutrients, particularly a high nitrogen-to-calcium (N/Ca) ratio. However, current nutrient monitoring methods are costly, time-consuming, and not easily accessible to small-scale farmers. This research proposes a cost-effective, AI-powered solution that utilizes leaf images to detect nutrient imbalances associated with IFR risk. By training machine learning models on field-collected images of Harumanis mango leaves, the system aims to identify visual indicators of nutrient stress such as discoloration, vein patterns, and texture changes This approach helps protect crops, reduce waste, and support small agricultural businesses.