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Rapid Nitrogen Determination of Soybean Leaves Using Mobile Application

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Abstract—Nitrogen is one of the important nutrients elements for the growth of soybean plants. In this paper we propose mobile application that can be used nondestructively to estimate the nitrogen content of soybean leaves. We named this software "Mata Daun". The primary concept of this software is to relate the RGB (Red, Green, Blue) value of the captured soybean image with its nitrogen content. Furthermore, the captured image is processed into Enhanced Color Visibility (ECV) index using digital image processing method for the ease of software algorithm process. Calibration process and field trial were conducted to found the relation between ECV index and soybean leaves nitrogen content. The calibration result showed that the nitrogen readings by this application had a fairly strong relationship ($R^2=0.70$) with the soybean leaves nitrogen content (Agriexpert CCN-6000 readings). The field test result also gave the same strong positive relationship between predicted and real soybean leaves nitrogen content ($R^2=0.63$).

Keywords—nitrogen; soybean; RGB; image processing; mobile application (key words)

I. INTRODUCTION

Nutrients deficiency, particularly nitrogen, can lead to a physiological imbalance in soybean plants. One of the impact is a reduction in yield during harvest [1,2]. Addition of fertilizer is needed to fulfill the shortage of necessary nutrients on plants. Prior to fertilizer application, information about the levels of nitrogen in plant is required to avoid excessive nitrogen fertilizer application. High amount of nitrogen in plant tissue can increase the attack from pests and diseases and also can harm the plant if the dose is high [3,4,5]. The most

accurate method to determine levels of nitrogen in plant tissue is laboratory test. The laboratory test result requires longer time due to the complexity of sample preparation. Usually, it needs 3-7 days from sample preparation to the result. The complexity of laboratory testing process is one of the barriers for farmer to check nitrogen level of plant leaves at the beginning of the growing season. The lack of farmer's knowledge about nitrogen status of their plant can drive to excessive use of fertilizer that can be harmful to their plant and surrounding environment. In this paper we propose a mobile application called "Mata Daun". This mobile application is intended to help soybean farmers in determining real time plant nutrient status at low cost. With the ability to estimate the nitrogen content of soybean leaves nondestructively and rapidly, we hope this mobile application can improve the farmer's knowledge about their soybean plant nutrient condition.

II. METHODS

A. Hardware

Samsung smart mobile phone type Wonder I8150 was used to conduct all the mobile application experiment. This mobile phone embedded with 1.2 Gigahertz processor, 2 Gigabyte Read Only Memory, 5 megapixel camera and 2.3.5 Ginger Bread Android operating system. The white paper background reference was a sheet of 80 gram A4 size white paper.

B. Software

Mobile application was developed based on JAVA language. It is compatible with Android version 2.2 up to 4.0.

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