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Normal leaf knowledge on soybean plant based on threshold

*** M.Syahrul Munir, Fetty Tri Anggraeny**
[1]Faculty of computer science, Universitas Pembangunan National "Veteran" Jawa Timur, Indonesia;

ABSTRACT: Soybean plants have become commonly known by the people, especially farmers in Indonesia, how not in today's processed soybean plants vary widely. From the processed start in the form of nuts, processed soy essence, to a variety of other processed foods such as: tofu and tempeh. The high public interest and soybean variety variations so that soy can be regarded as a staple food that can be used as the primary food of some people, especially the Indonesian nation. One way to measure the growth of healthy soybean plants can be done with observations of leaf color changes. Where the function of the leaves is as a place of photosynthesis so as to produce a healthy seed and not easily attacked by pest disease. This study looked at leaves that lacked phosphorus (P) by comparing leaf color values to threshold

Keywords: soybean leaf, phosphorus, threshold

1. INTRODUCTION

Soybeans known in the community are soybeans already in processed form, where rarely people have soybean crops. Soybean plant is one of the plants belonging to the type of plant legumes that grows the land of China that has existed since 2500 BC. In line with the growing trade between countries that occurred in the early 19th century, causing soybean crops also spread to various destination countries such as Japan, Korea, Indonesia, India, Australia, and America. Soybean began to be known in Indonesia since the 16th century.

Beginning of the spread and cultivation of soybeans in Java, then developed to Bali, Nusa Tenggara, and other islands. Soybean plants generally grow upright, shrubs, and is a seasonal plant. The morphology of soybean crop is supported by its main components namely, roots, stems, branches, leaves, flowers and seeds so that the growth can be optimal. Growth of healthy soybean plants with unhealthy ones can easily be observed on the leaves, because through the naked eye on soybean plants is a dominant form that can be observed especially from the color change. Normally grown soybean leaves generally have three-stalk leaves as shown in Figure 1.

Figure 1.Soybean

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Normal leaf color changes in soybean plants are said to have a healthy dark green color followed by the growth of leaves below evenly colored so that in soybean if it grows not normal can be observed from different colors in one plant. The visible color changes in differentiating the leaves under normal conditions and the strain of nutrients is the basis of research on this topic, The number of variables that affect the growth of soybean crop so that in this study will be done only focus on the color changes in the leaves. An experiment was conducted to observe the color change in the leaves by applying a threshold value.

2. METHODOLOGY

The observation research on soybean leaf can be explained in accordance with the diagram below:

2.1 Image

The image used in this research is the image data of soybean leaf. The leaf image taken beforehand has been done some treatment by consultation to expert soybean plant expert, so that soybean plant growth can be controlled. The treatments included the selection of seeds of soybean seeds, selected seedlings taken from BPTP-Malang with the type of arjuno seeds, which is a superior variety that can grow in the region of Java province, especially East Java.

Fertilization treatment is also done with soil control and type of fertilizer given on soybean crop, so that growth can be controlled for data retrieval research.

2.2. Preprocessing

At this stage the image of the leaf is taken by using a Sony lens camera, for shooting done in the afternoon for the consistency of lighting can be uniform, noise improvements in the image is also done by guided by soy expert experts by doing uniform background on the leaves. At this stage is also done grayscale process is the image that each pixel is a single sample, that is information intensity. This type of image is only formed of gray color that has different intensity. To make a full color (RGB) image change into a grayscale image, a commonly used method is:

(R + G + B)/3

where:
R: Red color element
G: The green color element
B: The element of blue color
The value generated from the above equations will be inputted each element of the basic color of the grayscale image.

2.3. Thresholding

In general, the process of thresholding to grayscale image aims to generate binary images, mathematically can be written as follows.

$$g(x,y) = \begin{cases} 1 \; if \; f(x,y) \geq T \\ 0 \; if \; f(x,y) < T \end{cases}$$

With g (x, y) is the binary image of the grayscale image f (x, y), and T denotes the threshold value. The value of T is determined by using global thresholding and local thresholding methods.

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2.3.1 Otsu Method

The purpose of the otsu method is to divide the gray level gristle histogram into two different regions automatically without requiring the user's help to enter the threshold value. The otsu method performs discriminant analysis by determining a variable by distinguishing between two or more groups naturally. The otsu method starts with the normalization of the image histogram as a probability discrete density function as:

$$Pr(rq) = \frac{nq}{n}, q = 0,1,2, \dots, L-1 \dots$$

Where :
n = total number of pixels in image.
nq = number of pixels rq.
L = total number of image intensity levels.

Then determine the value of T in the above equation by maximizing between class variance defined as follows:

$$\boldsymbol{\sigma \frac{2}{B} = \omega_0(\mu_0 - \mu_T)^2 + \omega_1(\mu_1 - \mu_T)^2} \dots.$$

where :

$$\boldsymbol{\omega_0 = \sum_{q=0}^{k-1} P_q(r_q)}$$

$$\boldsymbol{\omega_0 = \sum_{q=k}^{L-1} P_q(r_q)}$$

$$\boldsymbol{\mu_0 = \sum_{q=0}^{k-1} qp_q(r_q)/\omega_0}$$

$$\boldsymbol{\mu_0 = \sum_{q=k}^{L-1} qp_q(r_q)/\omega_1}$$

$$\boldsymbol{\mu_T = \sum_{q=0}^{L-1} qp_q(r_q)}$$

3. RESULT & DISCUSSION

In this study the introduction of nutrient deficiency of Phosphorus (P) can only be identified by soybean experts through observation of leaf morphological changes of leaves, so that observations made by local residents or who do not possess knowledge of soybean crops will be difficult, because morphological color changes are limited on the normal leaf color changes with abnormal and visible form of leaf patches that have patterns. So this research involves otsu method in analyzing spotting pattern by applying difference threshold value on soybean leaf color

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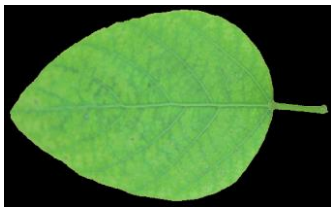

Figure 2. Normal leaves

Before the search for color threshold values on soybean leaves it is necessary to know the soybean leaf that grows normally and all the nutrients are met can be seen leaf body that grow will look young green. The color of this leaf will appear on the entire leaf (leaf body) so that the process of healthy seed formation through photosynthesis can run well. Examples of normal soybean leaves can be seen in Figure 2.

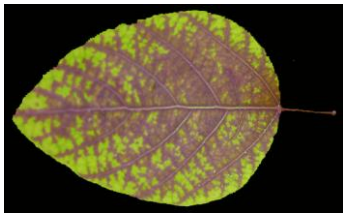

Figure 3. Leaf stricken with phosphorus

The second stage of preprocessing the treatment of soybean leaves that lack of phosphorus is done cleaning the image noise where the background part other than that needed for the research process will be eliminated, this is done in order to get the value of degradation of leaf color that is specific to the leaf body more optimum. In the body part of the leaves affected by phosphor nutrient deficiency can be seen in the brown color that creeps on the leaves so that the normal parts of the leaves are light green to brown as a whole so that when the leaves have been turned into brown whole, the plant can certainly die. An example of soy leaf stricken with phosphorus deficiency can be seen in figure 3

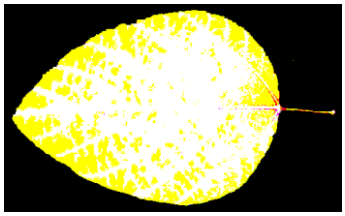

Figure 4. Leaves with the application of otsu

Determination of the color threshold value by using the threshold value of 1 then resulted in 2 parts of color, can be seen in figure 4 on the body of the leaf color white color is representative of the color element that lack of phosphorus nutrients, while the yellow spots are part of healthy leaves. The best threshold value ranges between 63-68 where experiments were performed with 5 leaves that lacked phosphorus nutrients as shown in table 1.

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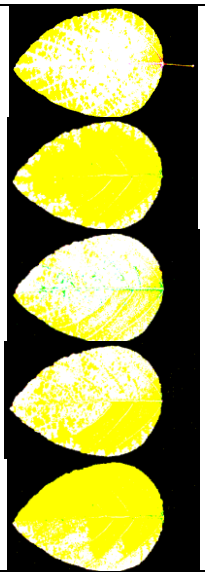
Table 1 Result

Items	0tsu
	63,83
	72,80
	63,67
	68,01
	74,28

4. CONCLUSION

This study using five data leaves of soybean plant lack of phosphorus nutrients that have been consulted on soybean experts expert that changes in brown leaf spot color with green can be distinguished by using otsu method.

5. REFERENCES

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