Identification of Nutrient Nitrogen in the Leaves of Soybean Plants Using *ANFIS* Based On Soybean Leave Colour

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ABSTRACT

The social demand for soybeans increas continously along with the growth of population. Increasing production of soybeans has many obstacles, among others attacked a variety of pests, diseases and nutrient deficiencies. In this research discusses the nutrients nitrogen deficiency symptoms based on soybean leaf colour. An Agricultural expert is needed to determine its cause. However, limited number of Agricultural Experts can not solve the Farmers problem at the same time. Therefore, systems are needed for early identification accurately of nutrient nitrogen in soybean leaves. In this research uses " Adaptive Neuro-Fuzzy Inference System (ANFIS) Methode" which is expected success rate of 80%.

Keywords: *Adaptive Neuro-Fuzzy Inference System (ANFIS), identification, colour, nitrogen, soybean leaves*

1. INTRODUCTION

Soybean is one of the important food crops in Indonesia. Initially soybean known by several botanical names, namely Glycine Soja or soja max. However, in 1984 it has been agreed that the botanical name of which can be received in scientific terms is Glycine max (L). Demand for soybeans is increasing every year, in line with the increasing population growth and development of factory farms. Commodities soybean per capita is now ± 8 kg / capita / year. It is estimated that every year the need for soybeans is ± 1.8 million tons and soybean meal by ± 1.1 million tonnes (Deptan, 2006). And according to estimates needs including soy beans, an increase of 7.6% per year (Suprapto, 1999). To meet the government was forced to import soy intake from outside. Actually it is not necessary if the domestic production can be developed in line with the increasing demands, given the huge potential that exists.

Soil as a growing medium plant has a limited carrying capacity as a source of nutrients as well as a container for subsequent nutrient inputs in the form of fertilizer in addition, each land / soil has considerable diversity levels, depending on the individual plant or variety used. These conditions resulted in the diversity of productivity for each individual plant, therefore the combination of resource processing soil and fertilizer application should be carried out effectively. Besides fertilization is the most important thing in the process of cultivation. Good plant growth depends on environmental factors are balanced and profitable. Some of the factors limiting the growth of plants such as weeds, pests, and diseases that directly reduce production potential. Groups of other factors such as nutrients, density, and angle and leaves can increase the potential yield and quality (Harjadi, 2002). The availability of nutrients can be equipped with fertilizing the addition of material to the ground or crop canopy. In general, compound fertilizer (nitrogen) N (phosphorus) P (potassium) K is given directly by way sown or placed in the hole (drill) without being dissolved beforehand. In this way a compound fertilizer (nitrogen) N (phosphorus) P (potassium) K is not quickly available for plants, because the fertilizer is still shaped grains of crystal and can not be absorbed directly by the roots of plants, it is necessary for fertilization by dissolving the fertilizer (nitrogen) N (phosphorus) P (potassium) K into

the water with a certain dose. Besides given basic fertilizer, plants also require supplementary fertilizers such as compound fertilizers (nitrogen) N (phosphorus) P (potassium) K, especially as we enter the generative phase. It aims to improve the efficiency of nutrient uptake by the plant which is expected to increase soybean production is maximum.

From the above explanation, it is known that the farmers do not know much about plant growth soybean crop, nutrient deficiencies are common, resulting in losses incurred as a result of nutrient deficiencies in plants, which is too late for the diagnosis and has reached the severe and lead to crop failure , any nutrient deficiencies in plants sebernarnya show symptoms of nutrient deficiencies suffered but is still in the early light and still a little bit. But farmers often ignore this because of ignorance and assume the symptoms are quite common in the growing season, a time until symptoms are so severe and widespread that it was too late to be controlled.

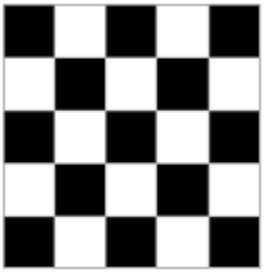
Therefore, in this study will be made of a system to identify each nutrient soybean plants are taken out of the relegation color of the leaves of soybean plants, using *Adaptive Neuro-Fuzzy Inference System* (ANFIS) that the results can provide information on the nutrient soybean crop while providing a solution to overcome, which can later be used to reduce or minimize the risk of damage to the soybean plants.

2. RESEARCH METHOD

Image processing is performed to determine the value of an image. One method of image processing is *Grey Level Co-occurrence Matrix* (GLCM). This method produces some output value obtained from the texture of an image.

Texture is an intrinsic characteristic of an image that is associated with the level of roughness, granularity and regularity structural arrangement of pixels. Texture is commonly known as a key to visualize a person's perception or perspective and regulations is essential to the workings of computer vision. Texture is inherited from objects visible from the face and contains important information on the draft structure of the surface. Texture characterized as spatial distribution of degrees of gray in a set of neighboring pixels. Thus, it can be seen that there is no common definition for texture. It depends on the application being used.

GLCM definition is a tabulation of how often different combinations of pixel brightness values (gray levels) that occur in an image. Here are examples of gray image that will be used as an example in the calculation of the matrix Grey Level Co-occurrence (Purnomo & Puspitodjati, 2009).



(a)

0	255	0	255	0
255	0	255	0	255
0	255	0	255	0
255	0	255	0	255
0	255	0	255	0

(b)

Figure 1. (a) A gray image of a 5x5 pixel with two sizes intensity, (b) Image intensity values of gray (Purnomo & Puspitodjati, 2009)

Using the example in the picture 1, be sought p(0,255;1,0º) is a pair of pixels with intensity value i1 = 0 and i2 = 255, i1 and i2 within one pixel in the direction of 0 degrees. Found there are ten pairs of pixels that meet these criteria, the elements 0,0 matrixs GLCM value 10. for p(255,0;1,0º) found 10 a couple of pixels.

Basically a fuzzy inference system consists of five (5) functional block (block diagram of a fuzzy inference system illustrated in the figure below:

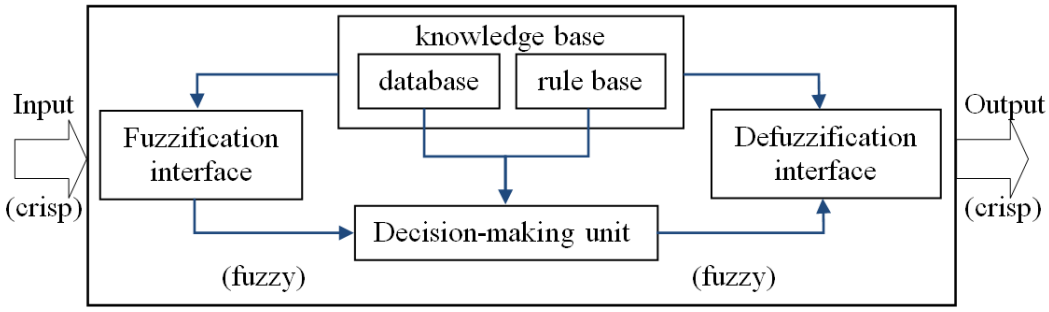


Figure 2. Block Diagram Fuzzy

a. **Rule Base:**
A basic rule (rule base), which contains a number of fuzzy if-then rules.
b. **Database:**
Database that describes the membership functions of fuzzy sets used in the fuzzy rules.
c. **Decision making-unit:**
A unit of decision-making (decision-making unit) performs inference operations (conclusion) of the rules.
d. **Fuzzification:**
An interface fuzzyfication transform inputs degrees crisp / degree of fit with the value of language
e. **Defuzzification:**
An interface defuzzyfication reshaped result of fuzzy inference into a crisp output.

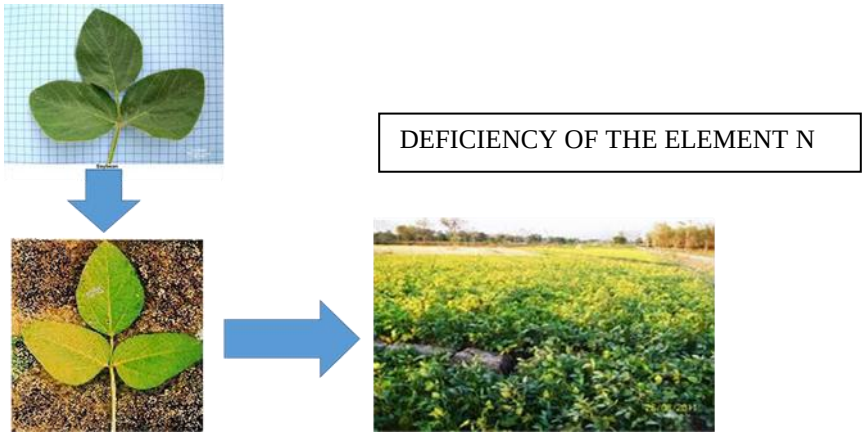


Figure 2. deficiency of Nitrogen in the leaves of soybean

From Figure 2 illustrates that the soybean leaves were experiencing a shortage of nitrogen (N), characterized by the slow and stunted growth of plants, the leaves turn yellow and dry up then the leaves will fall where the leaves are yellowing starting from the bottom leaves, and then followed by the upper leaves.

3. DESIGN SYSTEM

In designing this system there are some processes to be carried out, ranging from data preparation, data normalization, up to classification using the Adaptive Neuro-Fuzzy Inference System (ANFIS), of some of the data entered will be in the pre-processing in advance, which later these data in the training beforehand, in the training of many data calculation from the processing of Grey Level Co-occurence matrix (GLCM) which will produce the contrasts, the correlation value, energy value and the value of homogeneity, which will be an input new for the calculation of ANFIS classification. The system design is illustrated in Figure 3 presented below.

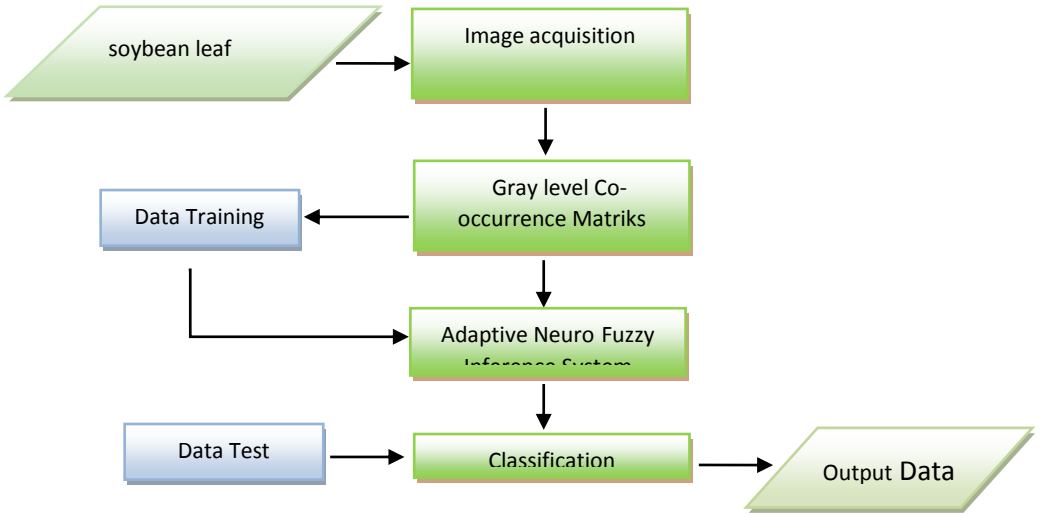


Figure 3. Block Diagram Application Design

At this stage of image aquicition soybean plant leaves image was obtained using a color CCD camera (Nikon D80, the zoom lens 18-200mm, F3.5-5.6, 10.2 mega pixels) of the results of soybean planting types arjuna with treatment-level test Seventy-two samples of each image contained nutrient nitrogen is collected, images are stored in compressed JPEG format.

At this stage of the preparation of the data, carried out various surveys of soybean plants, especially of nutrient nitrogen in the leaves of soybean through the existing literature and also visited agricultural experts in the field of soybean plants, from this stage in doing grouping data about the characteristics of the leaves of soybean were experiencing a shortage of nitrogen , then do image processing for soybean leaves are experiencing a shortage of nutrient nitrogen. The diagram design is illustrated in Figure 4 presented below

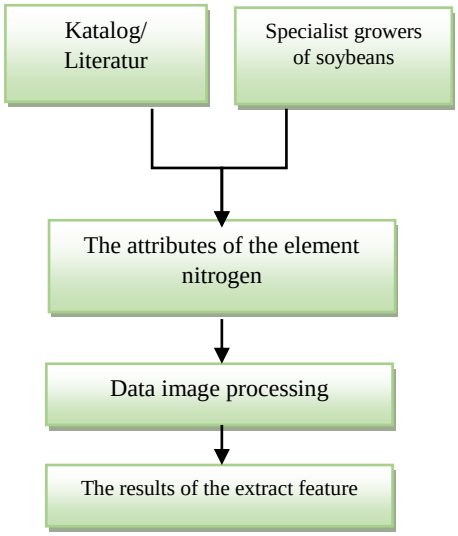


Figure 4. Diagram Data Collection

On the treatment table test level test data, researchers conducted experiments using soybean seed Anjasmoro types in the test with 6 trials, where each test using a different treatment for nutrient composition and its nitrogen fertilizer composition.

Table 3.1. Test Level Test Data Treatment

Unsur Hara Makro Primer	Data treatment plant					
	Pot 1	Pot 2	Pot 3	Pot 4	Pot 5	Pot 6
N (Nitrogen)	0 ppm	50 ppm	150 ppm	200 ppm	250 ppm	300 ppm
	Tanpa pupuk	108.70 mg urea/kg	217.40 mg urea/kg	326.10 mg urea/kg	434.78 mg urea/kg	543.48 mg urea/kg

4. CONCLUSION

The contribution of this study is expected to have a system for accurately early identification of nutrient nitrogen in soybean leaves. In this study using the method of Adaptive Neuro-Fuzzy Inference System (ANFIS) the expected success rate of 80% And able Overcoming Limitations Issues Expert Number of Farms.

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