# The Measurement of Brown planthopper by Image Processing

Nutchuda Mongkolchart, and Mahasak Ketcham

***Abstract*—** Rice is one of the most essential economic crops in Thailand and contributes to high ratio of Gross Domestic Product (GDP) of country. Generally the farmers grow rice as a single plant and repeat annually for long time. The repetition of growing rice many times per year is considered to be the productive way of getting higher income as more production signifying more quantities of rice. This pattern intensifies outbreaks and cause long life cycle of the brown planthopper while it further brings damage to agricultural sector. An automatic measurement system for identifying the population of brown planthopper is employed to detect and count the number of brown planthopper. This system uses *'Image Processing Technique'* to monitor and perform surveillance a brown planthopper and eliminate them before the violence outbreak. This method is very useful for the farmers and agricultural sector. The results of the experiment, the population of brown planthopper which has been detected in this research, based on the assumption indicated the detection of brown planthopper at average of 69.76 % of all insects.

***Keywords*—** Rice, brown planthopper, Images Processing

## I. Introduction

MODERN technology is a significant role in agriculture's development to increase productivity, such as genetic engineering and tissue culture to develop crop varieties with improved features, agriculture's technology to protect crops suitable harvest, developed tools and terrain suit equipment and also use of technology such as digital signal processing such as signal processing a remote Sensing to estimate productivity advance [1], [2] or to calculate the area under cultivation [3],[4]

Thailand has the resources to cultivation over the year but agriculture is not developed as it should. Because they are used fertilizers and pesticides than is necessary and inefficiency, caused disadvantage in the long term. And pests are a major problem that farmers' incomes decreased, damage caused by in national level. There are statistics and probability used to eliminate pests plan for reduce chemicals used but the retention of insects will be counted and identified adult insects is a time-consuming task.

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Therefore, the application of image processing, such as forest plant analysis (forest plant) and insect based on the different color space with RGB color image histogram equalization. [5], to detect insects in rice, that correlated linearly with Isotropic Masks sized 7x7 [6], recognize stored-grain insects by analyzing texture of the insects with Hidden Markov model (HMM), which develope from K-mean method and the study of Insect behavioral studies; parasitoid species, especially insects especially the larva which is elastomeric in nature, which are used for biological control programs. Therefore, the estimated number of insects to be able to calculate and predict the spread of insects for warning farmers to prevent and eliminate pests. Including to estimated loss of productivity, if not wasted, insecticides. In this research, the image processing technique to detect brown planthopper, that is an insect pest of rice

## II. Review Of Literature

Image processing technique is used in the field, especially in the field of agriculture in the automated image analysis texture and color information is a useful feature for texture image classification using Multilayer perceptrons (MLP) to identify effective features for its grain, which is important in the food industry.[7] and the automatic classification method based on RGB color features to classification rice seed are identified correctly, which correct classification rates rice seeds 'Jasmine'96.34% and sticky rice seeds 100%. [8]

The small UAV and hyperspectral sensor system analyze the characterization of Rice Paddies. Results demonstrate that can be estimated chlorophyll densities with high accuracy.[9]

The use of image processing technique has been used in agricultural sector particularly rice farming. Different types of image processing techniques-Morphological Operation, Shape and Size Estimation and Statistical Feature Extraction, were employed to analyze defects on rice kernel regarding Rice Signature, Purity and Damaged kernels. Differentiate of image processing between the dead and damage rice kernels has been derived by using color image processing. These techniques provide favourable outcome in identifying defective rice. [10]

Studying of rice leaf disease by using digital image processing for diagnosis brown spot is very useful for research on rice quality and yield. The combination of BP neural network classifier and digital image processing gave good result for detection of brown spot and other types of rice leaf disease. [11]

Generally the color of rice is very essential factor which reflects rice grade and quality of rice. The rice color

inspection has been done by using Image Processing Technique and two types of color model – RGB and HIS model. The color of rice is not only indicate the status of defective rice grain but also the maturity degree, preservation state and grade of rice as well. The image processing technique used scanner to acquire the image and keep the result in the BMP image format. The experiment showed that the method is accurate; therefore, it is also useful in supervising rice color during harvesting season. [12]

The segmentation of rice seedlings by taking multispectral image of paddy field helps to measure the forecasting yield, nutrition in crops, supervising diseases and insect pest, etc. Although it is intricate to perform image segmentation of crop from the background as there are various factors affecting the outcome such as light condition, water reflection, complex environment and background. This research used 'Difference Vegetation Index – DVI' image to reduce noise for identifying seedling using the spectral characteristics of the objects in near infrared, red and green wavebands. The high resolution multispectral camera plays an important role in this research. The segmentation was highly accurate which achieved over 99% whereas the segmentation method processed fast and gave well output. [13]

The inspection of rice appearance qualities was performed by detecting concave corner points of touching grains regions. The research employed an automatic segmentation algorithm of touching rice grains image which was evaluated as effective method to differentiate or segment touching long and round rice grains and reached high accuracy. In addition this method can be used to inspect other types of rice appearance characteristics, for example, grain shape, grain chalkiness and counting as well. [14]

The project of Japanese government for measuring paddy rice planted area was carried out to perform production control. This research detected filled water area by employing the technique of microwave of SAT occur specular reflection for smooth or water ground. The project used ALOS/PALSAR (Advance Land Observation Satellite, Phased Array type L-band Synthetic Aperture Radar). The detection's average accuracy was approximately 70%. The spatial resolution of ALOS/PALSAR is not adequate whereas the revisit time of PALSAR is considerably long for observation in agricultural sector; therefore, the ALOS-2 sensor is required. [15]

## III. METHODOLOGY

For the measurement of brown planthopper by image processing, we input RGB images to convert to grayscale using the gaussian blur function. Afterwards, the gray scale image transformed into two levels of black and white for detection brown planthoppers. The block diagram of the measurement of brown planthoppers is given in Figure 1.

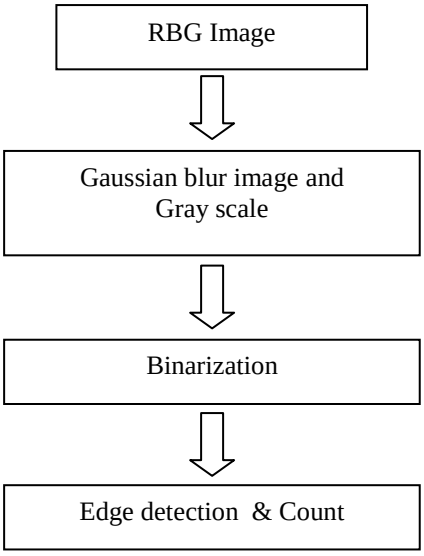
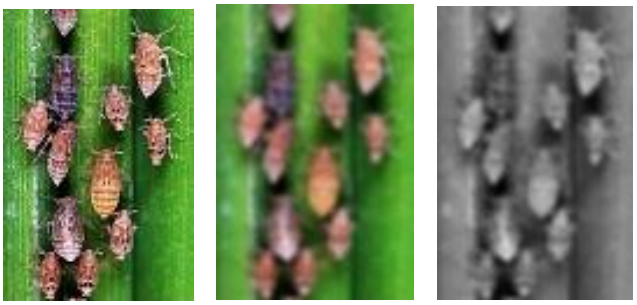



Fig. 1 The diagram of measurement of BPH

### A. *Image Processing*

RGB color images were adjusted for the image by using function gaussian blur; therefore the weight of pixel image will not be equal. The weight was decreased from the center to the edges of the filter as a bell curve. Effect of blur filter is a combination of the number of pixels and is increased until the bell curve and blur image is dense in the center causing sparse in the edges and it has been converted to gray scale. [16] Figure 2.



(a) (b) (c)

Fig. 2 Image processing : (a) original (b) gaussian blur (c) gray scale

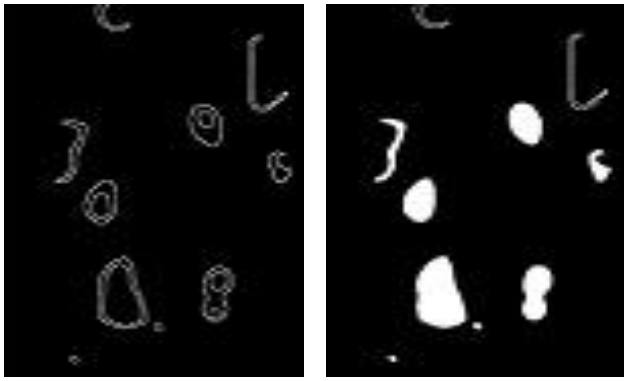
### B. *Binarization*

The gray scale image transforms into two levels of black and white which is called binary image. Then the output gives brightness in two levels which is 2 values (1,0). The threshold for determining the level of white or black is simple and easy allowing the analysis of images and calculation. Figure 3.

Fig. 3 Binary image

### C. Egde Detection

Edge is a portion of data which represents the layout of objects within the image, can be used to identify the size of the objects in the image or identifying objects within the image. Edge detection will change of levels of low intensity to high intensity of grey. Then it will create the edge and extract the Brown planthoppers from the background. After that, it continues to fill the inner edges of the image and indicate the shape of Brown planthoppers. After that, it continues to fill the space inside the edges of the image showing the shape of Brown planthopper. Figure 4.



(a) (b)

Fig. 4 Egde detection: (a) candy (b) fills holes in the binary image

## IV. Experimental Results

This paper focuses on using image processing techniques to detect the Brown planthoppers. The testing of the samples with Brown planthoppers on rice to 20 images, can detect Brown planthoppers at the rate of 69.76% of accuracy. Because the preview of the experiments is mainly adult insects thus this method cannot detect the larvae of insects.

TABLE I.
RESULTS OF DETECTION BPH

| Detection of BPH | Number of BPH | Percent |
|---|---|---|
| 1. Detection accuracy | 90 | 69.76 |
| 2. Error detection | 6 | 4.65 |
| 3. No detection | 33 | 26.58 |
| Total | 129 | 100 |

## V. Conclusion

The detection of brown planthoppers is based on image processing techniques for detecting adult insects, but cannot detect larvae and overcrowded group of Brown planthoppers. This research is in the initial trial and it still needs improving methods to detect and count the number of eggs or larvae of Brown planthoppers for achieving higher accuracy.

## References


[1] Qulin Tan, Jiping Hu , Siwen Bi and Zhengjun Liu, "A Study on Rice Field Edge Extraction in Radarsat SAR Images", IEEE International , vol.6, pp. 4239 - 4242, September 2004.

[2] W. Romans, B. Poore, and J. Mutziger, "Advance Instrumentation for Agricultural Equipment", IEEE Instrum Meas. Magazine, vol.3, no.1, pp. 26-29, March 2000. http://dx.doi.org/10.1109/5289.823820

[3] WANG Suxia, MAO Enrong, YANG Bangjie and SONG Zhenghe, "A Statistic Method of Crop Acreage Based on Image Recognition", IEEE International, vol.2, pp. 418 - 422, October 2006.

[4] Yanfang Dong, Yong Pang, Guoqing Sun and Zhongjun Zhang ," Radar backscatter of rice fields from ASAR data and modeling", IEEE International , vol.6, pp. 4332 - 4335, September 2004.

[5] Yanfang Dong, Yong Pang, Guoqing Sun and Zhongjun Zhang," A new method of the forest dynamic inspection color image sharpening process", IEEE International , vol.4, pp. V4-211 - V4-214, August 2010.

[6] B.Colpitts, D.Luke and G.Boiteau, "Harmonic Radar Identification Tag for Insect Tracking", IEEE Canadian Conference, vol.2, pp. 602-605, 1999.

[7] Sanyal P., Bhattacharya U., Parui S.K, Bandyopadhyay S.K. and Patel S, "Color Texture Analysis of Rice Leaves Diagnosing Deficiency in the Balance of Mineral Levels towards Improvement of Crop Productivity", IEEE International , vol.6, pp. 4239 - 4242, December 2007.

[8] Papol Punthumast, Yingrak Auttawaitkul, Werapon Chiracharit and Kosin Chamnongthai," Non-destructive Identification of Unmilled Rice Using Digital Image Analysis", IEEE International , pp. 1- 4, May 2012.

[9] Kuniaki Uto, Haruyuki Seki, Genya Saito, and Yukio Kosugi, "Characterization of Rice Paddies by a UAV-Mounted Miniature Hyperspectral Sensor System", IEEE International, vol.6, pp. 851- 860, April 2013.

[10] Jayanta K. Chandra, Aritra Barman and Arnab Ghosh," Classification of defects in rice kernels by using image processing techniques", IEEE International , pp. 1- 5, May 2007.

[11] Libo Liu and Guomin Zhou, "Extraction of the Rice Leaf Disease Image Based on BP Neural Network", IEEE International , pp. 1 - 3, 2009.

[12] Liu Guang-rong, "Rice Color Inspection Based on Image Processing Technique", IEEE International , pp. 134 - 137, 2010.

[13] Long Qi, Xu Ma, Yanjun Zuo , Xinglong Liao and Hongjiang Guo, "Multispectral Image Segmentation of Rice Seedlings in Paddy Fields by Fuzzy C-means Clustering", IEEE International , pp. 1427 - 1430, 2010.

[14] Qing Yao, Yingfeng Zhou and Jiangning Wang, "An Automatic Segmentation Algorithm for Touching Rice Grains Images, pp. 802 - 805, 2010.

[15] Qing Yao, Yingfeng Zhou and Jiangning Wang, "An Automatic Segmentation Algorithm for Touching Rice Grains Images, pp. 802 - 805, 2010.
[16] Hobson D.M., Carter R.M., and Yan Y.,"Characterisation and Identification of Rice Grains through Digital Image Analysis", IEEE International , pp. 1- 5, May 2007.