COMPLETION REPORT

Development of non-destructive evaluation method for melon fruit using image processing

Dr. Usman Ahmad
Lecturer
Department of Mechanical and Biosystem Engineering
Bogor Agricultural University (IPB)

Indonesia has many different tropical fruits grown in various regions throughout the country. Melon is one such fruit, famous for it's sweet and pleasant taste, which is high in demand. As a non-climacteric fruit, melon needs to be harvested when it is already in ripe stage. Human visual perception on color of melon fruit for ripeness judgement is a complex phenomenon that depends on many factors, making the judgement on field is often inaccurate. The objective of this study is to develop an image processing algorithm that can be used for distinguishing ripe melons from unripe ones based on their skin color. The image processing algorithm could then be used as a pre-harvest tool to inform farmers for making decisions about whether the melon is ready for harvest. Four sample groups of Golden Apollo melon were harvested at four different age, with 55 fruits in each group. The relationship between average color values and harvest date are clear that the red component of the RGB color model increased with harvest date, though the incremental declined for late harvesting. The green component shows no clear differences between harvest dates, while the blue component responded opposite to that of the red; decreasing with increase in harvest date. This indicates that the color of melon skin changed from a blueish-green to a reddish-green as harvest date increased. The color distribution as results of the image analysis for the two color models showed the green and blue components of the melons can separate the first two groups from the rest of groups with minimal overlap, but they cannot separate other two groups harvested later. This means that the RGB color distribution cannot be used to distinguish melons at two groups harvested later, because they are all grouped together. The same phenomenon was also observed in the HSI color model, where hue and saturation components could separate the first two groups from the rest of groups with minimal overlap, but not for other two groups harvested later. This also means that HSI color distribution cannot be used to distinguish melons at two groups harvested later, because they all grouped together in one group. From total soluble solid content, Golden Apollo melon fruits started to ripen since 60 days after planting, with total soluble solids increasing slightly after that. Color image analysis of the melons in combination with discriminant analysis could be used to distinguish between harvest dates with an average accuracy of 86%. However, the developed method could not distinguish melons harvested at 60 and 67 days after planting with a high accuracy, as both groups of melons had already entered the ripening stage.

Publication of the Results of Research Project:

Verbal Presentation (Date, Venue, Name of Conference, Title of Presentation, Presenter, etc.) 17-18 November 2015, Sanur Paradise Plaza Hotel Bali – Indonesia, SPIRITS Workshop 2015, Research on Non-destructive Evaluation of Horticultural Products at IPB, Usman Ahmad.
Thesis (Name of Journal and its Date, Title and Author of Thesis, etc.) International Journal of Agricultural and Biological Engineering, The Use of Color Distribution by Image Processing for Ripeness Prediction of Golden Apollo Melon, Usman Ahmad, in progress (submitted on May 16, 2016)
Book (Publisher and Date of the Book, Title and Author of the Book, etc.)