# CHANGES IN SURFACE COLOUR AND OTHER RELATED QUALITY CHARACTERISTICS OF CARAMBOLA (*AVERRHOA CARAMBOLA* L.) AT DIFFERENT STAGES OF MATURITY

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## Introduction

Surface colour can determine the stage of maturity of carambola (Campbell et al. 1985) and is an important quality attribute influencing consumer acceptability. Colour assessment during grading is done by matching the fruit with a colour chart consisting of six colour indices (FAMA, 1992). This colour chart does not always match actual fruit colour since actual colour consists of a wider spectrum of colours. Accurate measurement of colour can now be expressed in CIELAB scales using the chromometer (McGuire, 1992; Voss, 1992). The objective of this study was to determine surface colour and related quality characteristics of carambola at different stages of maturity.

## Materials and Methods

Carambola of variety 'B10' were tagged at anthesis to determine age of fruit for harvesting at different stages of maturity. *Experiment I*: Fruits were harvested at three days interval starting from 57 to 93 days after anthesis. Surface colour at the distal, middle and basal end of each fruit was evaluated using CIELAB L*, a*, b* colour space coordinates obtained with a chromometer (Model CR-300, Minolta, Japan). *Experiment II*: Fruit from 10 stages of maturity as determined in Experiment I were further evaluated for flesh firmness using the penetrometer and soluble solids concentration in % brix using the refractometer. Measurements of sucrose, fructose and glucose were determined with a Spectra P1000 HPLC equipped with a refractive index detector and Nucleosil $5NH_2$ column heated to 30°C. Malic, citric and oxalic acids were quantified with a Shimadzu SPD-6A HPLC equipped with an ultra-violet detector (210 nm) and Aminex HPX-87H column heated to 35°C, while ascorbic acid content was determined by 2,6-dichloroindophenol method.

## Results and Discussion

*Experiment I:* There was a linear increase in a* and b* values indicating that skin colour of carambola had significantly lost the greenness and was turning yellow as maturity increased. The linear decrease in h° and linear increase in a*/b* values indicated that carambola had changed from green to yellow and yellowish orange. L* value which represents lightness level was linearly increased with increasing maturity indicating that skin had become intense yellow and yellowish orange. The h° was the most accurate colour measurement predicted by maturity stages giving the highest coefficient of determination compared to other parameters. The maturity stages of carambola could be categorised into nine colour indices based on h° value. Carotenoid pigment was present even before chlorophyll was degraded and it continued to increase with increasing fruit maturity. Total chlorophyll pigment decreased with increasing fruit maturity. Chlorophyll and carotenoid pigment contents were significantly correlated with each of the parameters used to measure skin colour. *Experiment II:* There was a significant linear increase in soluble solids concentration as fruit matured. Significant linear increases were also found in sugar and ascorbic acid contents with increasing fruit maturity. Organic acid contents were positively correlated with flesh firmness. Soluble solids concentration showed positive correlation with the sugar and ascorbic acid contents but were negatively correlated with the organic acids. The respiration and ethylene production patterns classified the carambola as a non-climacteric fruit with no upsurge in $CO_2$ production during ripening.

## Conclusions

Carambola should be allowed to ripen on the tree before being harvested to obtain optimum eating quality. The CIELab values can be used to develop a colour chart for carambola.

## References

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