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Post-harvest quality of 'Mauritius' pineapple and reasons for reduced quality.

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ABSTRACT

Studies were conducted with the objective of assessing the quality of pineapple, as affected by the stage of maturity at harvest and to find out the reasons for poor quality of pineapple available in the market. A survey was conducted using twenty-five pineapple growers in Gampaha district. Stage of maturity at harvest, method of harvesting, method of ripening, method of transport and special handling practices adopted by farmers were compared with those recommended by the Department of Agriculture. Quality comparison between market sample and fruits harvested according to recommended practices was also carried out, to find out the effect of post-harvest handling practices on quality. Quality parameters such as Total soluble solids (TSS), Titratable acidity (TA), pH, Sensory evaluation, Visual quality rating (VQR) and Disease incidence (DI) were considered for this study. The TSS of fully ripe pineapples harvested at recommended stage and farmer practice was 17.3 and 14.7 respectively. In addition, TA of fruits harvested using farmer practice was 0.65% and it was reduced to 0.54% with fruits harvested at the recommended stage of maturity. Similarly, flesh colour was bright yellow in fruits harvested at recommended maturity stage. Sensory evaluation results showed a significant increase in overall acceptability of fruits harvested at recommended stage, compared to those harvested at farmers' practice.

Key words: Harvest maturity, Pineapple, Quality, Sensory evaluation.

INTRODUCTION

Pineapple is a popular fruit in Sri Lanka. The quality of pineapple in the market is lower than those harvested from the field. This may be due to poor post-harvest handling by growers and traders. Pineapple quality depends on the interaction of several factors in the production line.

Pineapple is a non-climacteric fruit. As a non-climacteric fruit, obvious compositional changes after harvest are mostly limited to degreening and decrease in acidity (Kader, 1992). No quality improvement can, therefore, be expected after harvesting. Therefore, harvesting at the correct stage of maturity is essential. Because of the inability to develop quality after harvesting, fruit must be allowed to remain in the plant until they have attained satisfactory eating quality. A non-climacteric fruit harvested when fully mature is immediately edible, and does not undergo comparable ripening process, either on or off the plant (Snowdon 1990). Harvesting time is often determined when base of the fruit has changed from green to yellow or light green. Fruits may be harvested for the local market before striking colour changes have occurred. Acceptable quality may develop before colour changes occur in the shell. Since pineapple fruit has no accumulation of starch, there is no reserve for major postharvest quality improvements (Kader, 1992).

Two varieties of pineapple are commercially grown in Sri Lanka. The 'Kew' variety produces large fruits, mainly utilized for caning, while 'Mauritius' variety produces comparatively smaller fruits. 'Mauritius' is the widely grown variety in Sri Lanka (Rupasinghe, 1996).

Successful marketing depends on the proper maturity of fruits at harvest, development of uniform colour and shape of the variety, fruits without injury and with proper wrapping of individual fruits in transport, careful handling without no exposure to moist conditions help in maximizing profit margin.

The most important parameter for marketing pineapples or any other commodity is consistent, high product quality. However, the quality of pineapple in the market is lower than those harvested from the field. Experiments were therefore conducted to find out the reasons for poor quality of pineapple available in the local market.

MATERIALS AND METHODS

A survey was conducted to assess the quality of pineapple in Gampaha district. Twenty-five farmers were randomly selected for the survey. Each farm was visited during the pineapple harvesting season, to observe post-harvest handling practices. Farmer practices considered were, stage of maturity at

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harvest, method of harvesting, method of ripening, method of transport and special handling practices. A questionnaire was designed to gather information on farmers' practices of pineapple harvesting and handling techniques, used from pre-harvesting period to the point of first sale. Open-ended questions were designed to ensure the collection of detailed information on techniques used, skills and level of training of farmers involved.

Quality comparison was made between market samples and standard samples. For quality evaluation, seven commercial farms were selected from the above survey. Standard practices were done according to recommendations of the Department of Agriculture. Fruits were harvested from farms following the maturity index, recommended by the Department of Agriculture. Fruits were also harvested from the same farms, based on maturity index adopted by farmers. Quality parameters measured were: Total soluble solids (TSS), Titratable acidity (TA), pH, Sensory evaluation, Disease incidence (DI) and Visual quality rating (VQR). Fruits were peeled and pressed juice from middle 1/3 of the fruit was used to determine the TSS. Few drops of juice were used to determine the Brix value with a calibrated hand held refractometer. Five ml of juice was pippeted into a conical flask and 20ml of distilled water was added and titrated with 0.1 N NaOH in the presence of Phenolphthalein as an indicator to determining the TA. The end point was taken as slight pink colour. Juice from middle 1/3 of the fruit was used to determine the pH, with a pH meter at room temperature (30 °C). A consumer preference test was carried out to evaluate the quality of pineapple. The sensory property, overall acceptability was investigated using 10 cm Hedonic scale. Results were statistically analyzed using ANOVA and mean separation was done using DMRT 5%.

RESULTS AND DISCUSSION.

All farmers harvested pineapple very much earlier than the maturity stage recommended by the Department of Agriculture (Table 1). Survey further revealed that fruits were mainly harvested at mature green stage. Use of a sharp knife during harvesting was practiced by 100% of the farmers. Removal of fruit from its stalk was not practiced. Entry of pathogenic fungi from the fruit base was therefore not possible. In order to turn peel colour from green to yellowish orange, farmers did not adopt artificial ripening methods. Since pineapple flesh belongs to non-climacteric group, artificial ripening is not recommended. The characteristic nature of pineapple shell converts to yellowish orange colour when harvested fruits reach the market. Although pineapple has a relatively hard shell, the compression load can cause damage to the fruit during transport. Careful stacking was adopted only by 20% of farmers during transport and no attention was given to this aspect by rest of the farmers. Compression, impact and vibration damages result in cumulative internal and external mechanical injuries, which further aggravate microbial rots.

Significantly higher total soluble solids were observed in pineapple following recommended practices, as compared to the commercial practice (Table 2). Pineapple is not capable of having significant changes after harvest. Therefore, stage of maturity at harvest is crucially important. The level of yellow colouration of 'eyes' of the fruit is a measure of maturity. Correct stage of maturity at harvest recommended by Department of Agriculture was 20% yellow colour of the shell. Fruits harvested at this stage had attractive bright yellow flesh colour, compared to those purchased from the market. Fruits purchased from the market showed significantly high acidity than those harvested at 20% shell colour development stage. High acidity and low Brix value of fruits purchased from the open market showed that

Table 2: Comparison of Brix, Titratable acidity (% Citric acid) and Flesh colour of 'Mauritius' pineapple harvested at different practices.

Parameter	20% shell colour yellow	100% green mature
°Brix	17.32[a]	14.73[b]
TA	0.54[c]	0.65[a]
Flesh colour	Bright yellow	Pale yellow

Treatment means in a row having common letter(s) are not significantly different by LSD 5%

Table 1: Recommendations Of the Department of Agriculture and percentage of farmers following these practices.

Handling step	Recommended practice	% farmers followed the recommendations
Stage of maturity at harvest.	20% eyes ye3llow	None
Method of harvesting	Use a sharp knife	100%
Method of ripening	No artificial ripening	100%
Method of transport	Fruits should be placed as to contact crown to crown and sides and bottom of the vehicle should be covered with layer of cushion lining to prevent mechanical damage.	20%

those fruits were not mature enough for consumption.

Effect of maturity at harvest on quality of pineapple.

Green and colour break stages had a slower peel colour development, compared with that of 20% yellow and 40% yellow stages throughout the ripening period (Fig.1). Maturity of pineapple is evaluated on the extent of 'eye' flatness and skin yellowing (Mitra, 1997). Consumers similarly judge

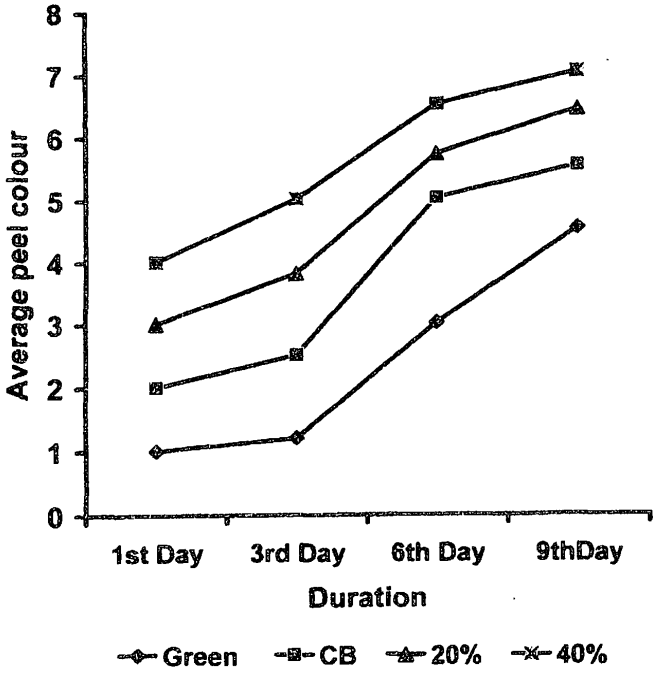

Fig. 1. Peel colour development of pineapple harvested at different maturity stages, during storage at ambient temperature.

fruit quality by skin colour and aroma. The fruit gradually changes colour from dark Green to light Green yellow or sometimes to a deep Orange with the onset of maturity. Fruits harvested at 40% shell colour development reached the maximum peel colour. Although fruits harvested both at green and colour break stage increased peel development with time, the final peel colour remained significantly lower. The climacteric nature of pineapple peel may be not efficient to improve the peel colour in immature harvested fruit compared to that in mature stages.

All fruits except 40% yellow stage harvested at different maturity stages developed flesh colour with storage at ambient conditions (Fig. 2). Fruits harvested at colour break stage and above had higher flesh colour index acceptable for consumers.

Fruits harvested at green, colour break and 20% yellow stage can be kept for 10days at ambient temperature (25 ± 2 °C), compared to those

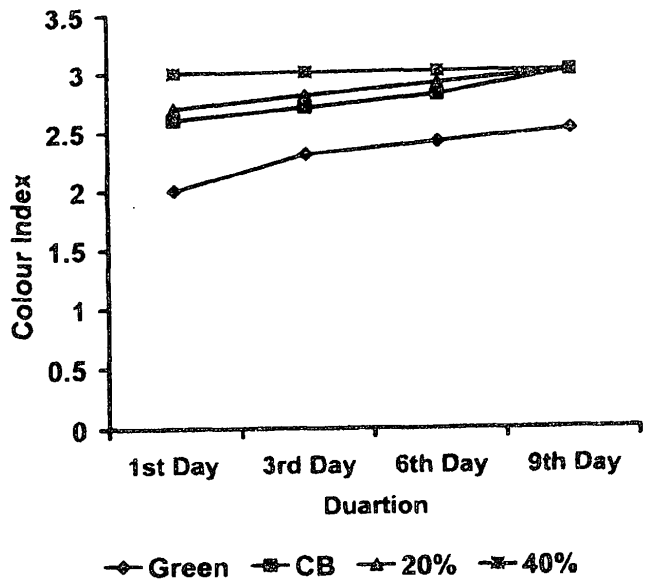

Fig. 2. Flesh colour development of ripe 'Mauritius' pineapple harvested at different maturity stages.

harvested at 40% yellow (Fig. 3). Fruits harvested at 40% may be over mature hence undergo rapid senescence. Reduction of VQR harvested at green, colour break and 20% yellow stage was very slow even at 10 days after harvesting. Ability to display a longer period of pineapple harvested at green stage may be the reason for harvesting at this stage.

Total soluble solid content of four maturity stages of pineapple increased at full ripening and,

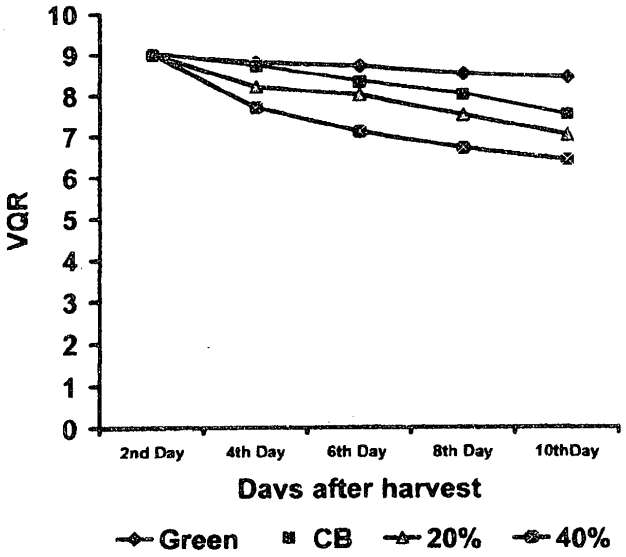

Fig. 3. Average VQR of pineapples harvested at different maturity stages.

significantly higher percentage of TSS content was recorded in 40% yellow stage than other three stages (Table 3). Total soluble solids (Brix values) gradually increased with more rapid increase in the last 6 weeks, as the fruit reached the full ripening stage. Fruit sugars continued to increase through to senescence unless the fruit is harvested. Although

Table 3: Total soluble solids (Brix) content at different maturity stages of 'Mauritius' pineapple.

Maturity stage	2 days after	Full ripe stage
Green	11.6[a]	14.4[a]
Colour break	14.5[b]	14.8[a]
20% yellow	15.0[b]	16.9[b]
40% yellow	18.1[c]	19.1[b]

Treatment means in a column having common letter(s) are not significantly different by DMRT 5%.

pineapple is considered as non-climacteric, Table 3 showed marginal increase in Brix of pineapple harvested at all 4 stages of maturity. This may be due to sugar synthesis during ripening or moisture loss during storage increase the sugar concentration available in the fruit. Sugar content is not always related to the colour stage as agronomic and production factors will affect sugar development.

Balance between TSS and TA gives the better taste of pineapple. Both fruits harvested at green and colour break stages showed very high variation in TSS/TA during the storage (Fig.4). However, the

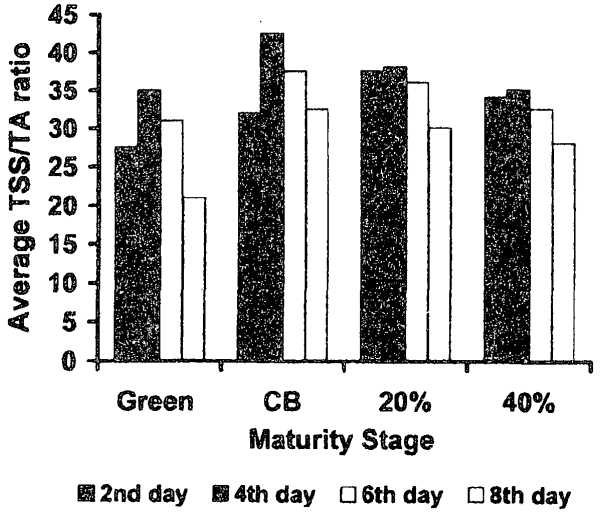

Fig. 4. Change of average TSS/TA ratio of different maturity stages with ripening of pineapple.

balance remained equal in fruits harvested at 20% yellow stage. This indicates pineapple harvested at this stage could maintain the balance between sugar and acidity for up to 6 days. The reason for low ratios in fruits harvested at 40% yellow stage compared to that in 20% yellow stage may be onset of senescence. Based on sensory evaluation, the highest overall acceptability was recorded for pineapple harvested at 20% yellow stage (Table 4). The eating quality of pineapple was reduced when harvested at both above and below these stages. The poor quality of pineapple available in the market is therefore mainly due to fruit harvesting at the incorrect stage of maturity.

Table 4: Results of the sensory evaluation.

Treatment	% overall acceptability
Green	20[c]
Colour break	40[c]
20% yellow	60[a]
40% yellow	50[c]

Treatment means in a column having common letter(s) are not significantly different by DMRT 5%.

It was apparent that growers do not always follow recommended post-harvest handling practices. Pineapple fruits were harvested at different stages of maturity in relation to the market demand. A significantly higher quality was observed in pineapple following recommended practices, while farmer practices, often led to inferior quality.

CONCLUSION

Although pineapple is considered as a non-climacteric fruit, the peel acts as a climacteric due to the increase in peel colour after harvest. Increase in sugar content in the flesh is very small and that increase may be due to loss of moisture. Stage of maturity at harvest seems to be highly critical to the quality of pineapple and 20% yellow colour stage was the best stage. Fruits harvested at this stage showed better quality than all other stages. Ability of fruits harvested at green stage to remain fresh longer may be major reason for harvesting pineapple at green mature stage. However, poor quality of these pineapples reduced consumer acceptability. Awareness program on the importance of harvest maturity of pineapple must be conducted to improve the quality of pineapple in the market. In addition, transport of fruits without damage is also important to reduce post-harvest losses of pineapple.

REFERENCES

Kader AA 1992 Postharvest technology of Horticultural crops. Division of Agriculture and Natural Resources, University of California.

Mitra S 1997 Postharvest physiology and storage of tropical and sub tropical Fruits. CAB international publications.

Rupasinghe U 1996 The variation of Calcium content and Electrolytes leakage of different parts of the pineapple fruit. The Diploma of Food Science and Technology, Affiliated University of Buttala.

Snowdon AL 1990 A colour atlas of postharvest diseases and disorders of fruits and vegetables. University of Cambridge published by wolfe scientific.