Tropical Agricultural Research Vol. 12: 408-411 (2000)

# Effect of Pre-harvest Calcium Application Level for the Post-harvest Keeping Quality in Mauritius Pineapple

H.M.I. Herath, D.C. Bandara[1] and D.M.G. Abeysinghe Banda[1]

Postgraduate Institute of Agriculture
University of Peradeniya
Peradeniya, Sri Lanka

***ABSTRACT.*** *Internal browning (IB) is a physiological disorder which can occur in pineapple [Ananas comosus (L.) Merr.] mainly under cold storage. The effect of different doses of calcium fertilizer (CaO) basal application for the control of IB development in Mauritius pineapple was studied in this experiment.*

*The field experiments were done in 2 locations of Gampaha and Kurunegala districts. Plots were arranged in a randomized complete block design with 3 replicates and 3 doses of calcium fertilizer (CaO - 100 kg ha$^{-1}$, 125 kg ha$^{-1}$ and 150 kg ha$^{-1}$) were applied as basal dressing in the 3 treatments and a control plot was maintained without calcium fertilizer. Immediately after harvest, fruits were stored in a cold room (15$^{0}$C, 80–85% RH) and analysed for 4 weeks at weekly intervals for fruit calcium content, IB intensity, ascorbic acid content, percentage weight loss, total soluble solids (TSS), pH and titratable acidity after 3 days exposure to room temperature when removed from cold room.*

*Fruits from calcium applied plots were significantly lower in IB development than control up to the 4$^{th}$ week. Up to the 3$^{rd}$ week this was less than 1 of the scale (0 = no IB, 5 = 100% IB). After the 4$^{th}$ week all the treatments were significantly lower in percentage weight loss and IB intensity. Up to the 4$^{th}$ week of cold storage there was no statistically significant difference between the calcium treatments of 125 kg ha$^{-1}$ and 150 kg ha$^{-1}$ for IB intensity, percentage weight loss, TSS and pH. Fruits from the plants treated with 125 kg ha$^{-1}$ showed significantly higher TSS, and IB development of less than 1 in the scale up to the 3$^{rd}$ week compared to other treatments. Also after 4 weeks of cold storage this treatment showed lowest percentage weight loss and highest ascorbic acid content compared to other treatments.*

*It can be concluded that, the application of calcium fertilizer 125 kg ha$^{-1}$ as basal dressing is most effective for the control of IB in Mauritius pineapple.*

## INTRODUCTION

Internal browning (IB) development is a serious problem in pineapple [*Ananas comosus* (L.) Merr.] under cold storage in export conditions. This is a physiological disorder which cannot be identified externally.

---

1 Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka.

Calcium is known to have a significant effect for the control of IB development (Wills *et al.*, 1989). Marschner (1995) reported that, even a small increase in calcium level in fruits is effective to drastically decrease or prevent storage disorders. According to Wills *et al.* (1989), calcium strengthens the structural components of the cell wall delaying or preventing the enzymatic reactions causing browning symptoms. In a previous experiment, Selvarajah *et al.* (1998) have shown that, higher level of calcium treatment (150 kg $ha^{-1}$ – double the recommended dose) is effective for preventing IB in Mauritius pineapple. This experiment was conducted to find the most suitable dose of calcium fertilizer (CaO) that should be applied as basal dressing for the control of IB in Mauritius pineapple.

## MATERIALS AND METHODS

The field experiments were conducted at 2 different locations in Kurunegala (Giriulla) and Gampaha (Pallewela) districts. Plots were arranged in a randomized complete block design with 3 replicates. In the treatments, 3 levels of calcium fertilizer (CaO - 100 kg $ha^{-1}$, 125 kg $ha^{-1}$, 150 kg $ha^{-1}$) were applied as basal dressing and a control plot was maintained without applying calcium. All other fertilizers were applied at recommended level.

The fruits were harvested at 5% maturity stage and immediately after harvest, they were stored in a cold room (15°C, 80–85% RH) and were analysed at weekly intervals for 4 weeks for fruit calcium content by flame photometer, IB intensity by a visual method (Teisson, 1979), ascorbic acid content by 2, 6 dichloro-phenol indophenol method (Askar and Treptow, 1993), percentage weight loss by measuring initial and final weights, total soluble solids (TSS) by hand refractometer, pH by pH metre and titratable acidity by titrating against 0.1 N sodium hydroxide. Fruits were analysed after 72 h exposure to room temperature when removed from the cold room.

## RESULTS AND DISCUSSION

The IB development of fruits from the calcium applied plots was significantly lower ($p=0.05$) than control up to the 4$^{th}$ week of cold storage. The fruits harvested from the plants treated with calcium 125 kg $ha^{-1}$ and 150 kg $ha^{-1}$ showed comparatively lower IB development than the fruits treated with 100 kg $ha^{-1}$. Internal browning development in all the treatments was less than 1 in the scale (0 = no IB, 5 = 100% IB) up to the 3$^{rd}$ week. This was 2.5 in the scale in the control (Fig. 1).

The fruit calcium contents were relatively higher in all the treatments than the control up to the 4$^{th}$ week. Fruits from calcium 150 kg $ha^{-1}$ treatment had significantly high calcium contents than the control from 1$^{st}$ week to the 4$^{th}$ week. The fruits from calcium 125 kg $ha^{-1}$ treatment had significantly high calcium content than the control after 1$^{st}$ and 2$^{nd}$ weeks and after the 4$^{th}$ week of cold storage (Table 1). According to Marschner (1995), high level of calcium can prevent deterioration of cell wall pectates and is important for cell wall stabilization and membrane from integrity. This may be the reason for low level of IB development in the fruits from calcium treated plots.

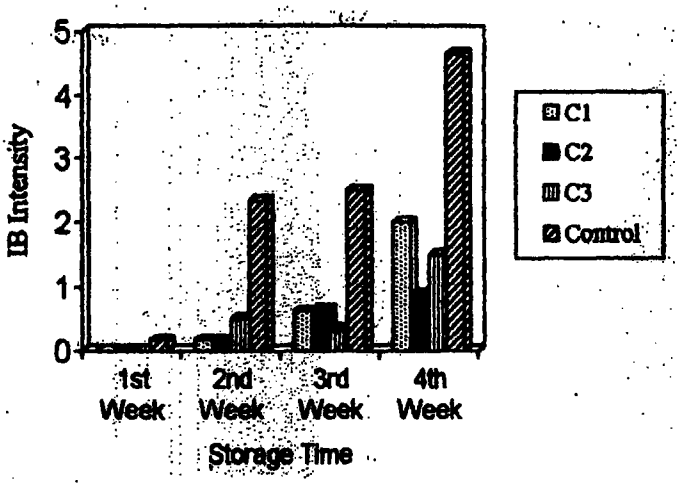


**Fig. 1. Development of internal browning (IB) in fruits during 4 weeks of cold storage.**
[Note: Data represents mean values of 9 fruits. C1 = 100 kg ha$^{-1}$, C2 = 125 kg ha$^{-1}$, C3 = 150 kg ha$^{-1}$].

**Table 1. Calcium contents of fruits (ppm) for 4 weeks of cold storage at 15°C.**

| Treatment | Week | | | |
|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th |
| C1 | 66 bc | 58 c | 53 b | 50 a |
| C2 | 84 ab | 81 b | 73 ab | 57 a |
| C3 | 125 a | 124 a | 123 a | 53 a |
| Control | 48 c | 47 c | 28 b | 35 b |

In each column, means followed by the same letters are not significantly different by the Duncan's Multiple Range Test at p=0.05
Each value represent mean of 9 fruits
C1 = 100 kg ha$^{-1}$ C2 = 125 kg ha$^{-1}$ C3 = 150 kg ha$^{-1}$

After the 4th week of cold storage fruits from calcium treated plots were lower in percentage weight loss than the control. Compared to all the fruits from calcium treated plots, control fruits were highest in IB development, percentage weight loss and lowest in total soluble solids (TSS) and ascorbic acid contents up to the 4th week. Also up to the 4th week of cold storage there was no statistically significant difference between the 125 kg ha$^{-1}$ and 150 kg ha$^{-1}$ doses of calcium fertilizer treatments for the development of IB intensity, percentage weight loss, TSS and pH. This shows that even a moderate level of calcium fertilizer (100 kg ha$^{-1}$, 125 kg ha$^{-1}$) application as basal dressing may be effective

for the control of IB in cold storage. The fruits harvested from the calcium 125 kg $ha^{-1}$ treated plants showed significantly higher TSS and IB development less than 1 in the scale up to the 3rd week. After the 4th week of cold storage, this treatment showed higher fruit calcium content, lowest percentage weight loss (11.2%) and significantly higher ascorbic acid content (14.27 mg/100 ml) compared to control and calcium 150 kg $ha^{-1}$ treatment.

## CONCLUSIONS

The results indicate that, the basal application of calcium fertilizer is effective for the control of IB in Mauritius pineapple and the rate of application at 125 kg $ha^{-1}$ is most suitable.

## REFERENCES

Ascar, A. and Treptow, H. (1993). Quality assurance in tropical fruit processing. Berlin Heidelberg, New York.

Marchner, H. (1995). Mineral nutrition of higher plants. Academic Press, London, U.K. pp. 1-889.

Selvarajah, S., Herath, H.M.W., Bandara, D.C. and Abeysinghe Banda, D.M.G. (1998). Effect of pre-harvest calcium treatment on post-harvest quality of pineapple. Trop. Agric. Res. 10: 214-224.

Teisson, C. (1979). Internal browning of pineapples: I. History. II. Materials and Methods. Fruits. 34: 245-261.

Wills, R.B.H., Mc Glasson, W.B., Graham, D., Lee, T.H. and Hall, E.G. (1989). Postharvest. BSP Professional Books, Oxford, U.K.