Preliminary investigation into the uneven ripening of banana peel after 1-MCP treatment

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1. Introduction

Peel appearance of banana fruit is an important quality criteria that influences consumer acceptability. Many studies have shown promising results with the use of the ethylene antagonist 1-methylcyclopropene (1-MCP) on extending green life and shelf life of bananas (Macnish *et al*. 1997, 2000; Golding *et al*. 1998; Jiang *et al*. 1999; Harris *et al*. 2000). However, uneven peel ripening following some different timings of 1-MCP treatment has also been observed (Golding *et al*. 1998; Harris *et al*. 2000). This uneven peel degreening appears when, after ethylene treatment, 1-MCP is applied to bananas which have not completely lost the green colour and results in a dull-grey appearance with some visual symptoms similar with chilling injury. In this preliminary experiment we investigated the hypothesis that the uneven peel ripening could be related to an imbalance in respiration pattern, with accumulation of volatile compounds such as ethanol and acetaldehyde. Different post-ripening treatments (1-MCP, nitrogen, ethanol, chilling temperatures) were used to assess if dysfunctional ripening behaviour could lead to the appearing of these symptoms.

2. Materials and Methods

Five bunches of mature green bananas (*Musa* sp., AAA group, Cavendish subgroup, cultivar 'Williams') from Coffs Harbour, NSW, were used for this experiment. After ethylene treatment (200 μL L^{-1} for 24 h at 20°C) bananas were allocated different treatment units: 1-MCP treatment (200 ppb, 20°C, 24 h), nitrogen treatment (O_2 < 0.1%, 20°C, 24 h), ethanol treatment (0.3 mL L^{-1}, 20°C, 24 h), chilling treatment (0–2°C, 24 h) and

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untreated control (20°C). In each treatment were allocated bananas from five different bunches. Ethylene production, ethanol and acetaldehyde production, skin colour, chlorophyll fluorescence, chlorophyll content and firmness were assessed at regular intervals.

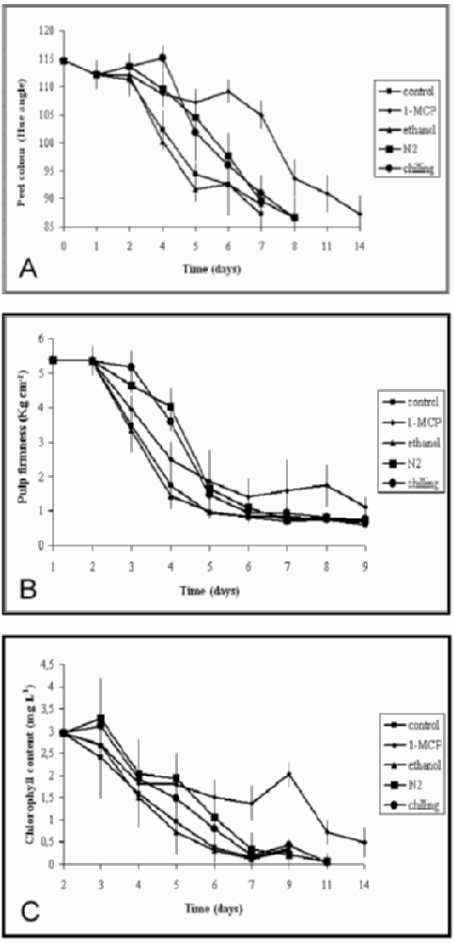

Fig. 1. Peel colour (**A**), pulp firmness (**B**) and chlorophyll content (**C**) of banana fruit treated with 200 μL L^{-1} of ethylene then treated with 200 nL L^{-1} of 1-MCP for 24 h at 20°C (1-MCP) or with 0.3 mL L^{-1} of ethanol (ethanol) or kept for 24 h in nitrogen atmosphere (O2 < 0.1%) at 20°C (N_2) or stored for 24 h at chilling temperature (0–2°C) (chilling) or maintained at 20°C and not treated (control). Day 2 = 48 h after ripening initiation with ethylene/24 h after various treatments. Bars indicate standard deviation.

3. Results

Different accumulation of volatile compounds was observed between 1-MCP-treated and untreated fruits but not significant difference in ethanol and acetaldehyde was noted between 1-MCP-treated greyish bananas and fruits from other treatments.

Ethylene production 24 h after 1-MCP, ethanol, nitrogen or chilling treatment and 48 h after ethylene treatment generally increased during ripening. Ethylene production was not affected by the 1-MCP treatment which in contrast delayed peel degreening (Fig. 1). The peel colour of 1-MCP fruit at the end of the experiment (Day 14) was similar to the peel colour of the other treatments at Day 7–8 (Fig. 1); anyway, 1-MCP-treated fruit maintained a general uneven light-green colour moving from the middle towards the tips. The presence of general greying within the peel was evident in 1-MCP treated fruit. All other post-ripening treatments did not lead to the appearance of the 'grey' colour on the peel. It appears the 1-MCP treated peel may still undertake some normal senescence events that occur during banana ripening. Considering the effect of the other experimental conditions tested, we observed that the 24 h post-climacteric nitrogen and chilling treatments led to a temporary inhibitory effect on ripening after Day 2, but this delay disappeared with the continuation of shelf life (Fig. 1). These results are likely to be related to the effect of initial low O_2 and low temperature storage conditions (24 h) on slowing down fruit metabolism or altering normal pulp softening.

4. Conclusions

These results suggest 1-MCP treatment 24 h after the initiation of ripening can still delay peel degreening by decreasing in chlorophyll content and maintaining chlorophyll fluorescence. However the 1-MCP treatment may not prevent other peel aging events, such as peel browning. Peel aging events and uneven peel degreening and ripening in 1-MCP treated fruit maybe affected by other factors such as water content. This hypothesis is currently being investigated.

References

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