THE POSTHARVEST
PHYSIOLOGY OF
CHINESE CABBAGE
CV. 'YUKI'

by

Kerry Porter

B. Ag. Sc. (Horticultural Science, Honours, The University of Adelaide)

A thesis submitted in fulfillment of
the requirements for the degree of

Doctor of Philosophy

The University of Adelaide

Discipline of Wine and Horticulture

School of Agriculture and Wine

Faculty of Sciences

Waite Campus

2003
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APSTRACT

Chinese cabbages are a leafy, head-forming Asian vegetable grown for both domestic and export markets. Limited information about the postharvest physiology of Chinese cabbage and incorrect postharvest practices often lead to poor quality heads. This study investigated the effects of various pre- and post-harvest factors on the postharvest life and sought to increase the knowledge of the postharvest physiology of Chinese cabbage.

Chinese cabbages cv. 'Yuki' was used for all experiments in the study. In 1999 the cabbages were grown in Ovens, Victoria, and transported to Adelaide in refrigerated road transport after harvest and overnight cooling. In 2000 and 2001 the cabbages were grown in Virginia, South Australia, and were transported to coolrooms at the Waite campus of the University of Adelaide within three hours of harvesting.

Various postharvest evaluations were used to assess the Chinese cabbage heads after harvest and during storage. They included weight loss, trimming loss, respiration rate, ethylene production, and quality score. Energy substrate levels and chlorophyll fluorescence were also measured in selected experiments.
Harvesting at five different times during the day and imposing a half-hour delay before cooling did not affect the postharvest behaviour of the Chinese cabbages. This was despite exposure of the heads to temperature differences of up to 15°C between harvest times throughout the day. The quality of cabbages harvested at dawn, mid-morning, midday, mid-afternoon, and dusk were similar before and after nine weeks storage at 0°C. The lack of effect is attributed to the protective function of wrapper leaves, which were removed at harvest.

Intermittent water stresses imposed on the Chinese cabbage plants during growth did not affect the postharvest performance of the stored heads. Relative water contents of leaves from the high, moderate and no stress treatments were 94.3%, 94.0% and 93.8%, respectively immediately after harvest. It is possible that the stress treatments applied were insufficient to elicit a response or that the cabbage plants were able to recover fully upon rewatering.

An investigation of three different storage temperatures showed that cabbages stored at 20°C had higher metabolic rates, weight loss and trimming loss and lower quality than cabbages stored at 0°C and 2°C. Respiration rates were 0.8, 1.1 and 23.6 mL CO₂·kg⁻¹·hr⁻¹ for cabbages stored at 0°, 2° and 20°C, respectively. No differences were found between the two low temperatures except in the occurrence and severity of symptoms of the disorder, Patchy

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Papery Necrosis (PPN), which were worse in cabbages stored at 0°C. Lack of symptoms prior to storage and in cabbages stored at 20°C suggest that this disorder is a form of chilling injury.

Chinese cabbages were subjected to four wounding treatments: dropped, trimmed, compressed, or no wounding (control), designed to simulate injuries typically sustained during postharvest handling. Differences were found between the trimming treatment and the other three treatments for ethylene production, weight loss and trimming loss. No differences were found between treatments for respiration rate and quality, with quality scores of 3.1, 3.1, 3.7 and 3.3 (± 1.1) for control, trimmed, dropped and compressed treatments, respectively. Wounding treatments had no adverse effects on the postharvest life or length of storage of the cabbage heads.

Exposure of Chinese cabbages to 0.01 μL.L⁻¹, 0.1 μL.L⁻¹ or 1.0 μL.L⁻¹ 1-methylcyclopropene (1-MCP) for 12 hours prior to low temperature storage did not extend postharvest life nor affect quality. Increased respiration rate and ethylene production were detected directly after fumigation in cabbages treated with 0.1 μL.L⁻¹ and 1.0 μL.L⁻¹ 1-MCP suggesting a stress response, but decreased to levels similar to those of the control after cooling. Weight loss for control (0.0 μL.L⁻¹), 0.01, 0.1 and 1.0 μL.L⁻¹ 1-MCP treatments was 3.0%, 2.8%, 2.4% and 2.9%, respectively, after nine weeks storage.
Minimally processed Chinese cabbage leaves stored in sealed plastic barrier bags were used to investigate the effects of modified storage atmospheres containing high levels of carbon dioxide (CO₂) and/or oxygen (O₂). Atmospheres were monitored for changing gas levels and the minimally processed cabbage was assessed for visual quality over 14 days in 7°C storage. High O₂/low CO₂ initial atmospheres resulted in higher quality Chinese cabbage. Quality scores for 30/70, 0/70, 30:21 and 0:21 CO₂:O₂ atmospheres were 2.1, 4, 1.3 and 3.1, respectively after 14 days storage.

These results highlight the protective function of the wrapper leaves, the importance of low temperature storage, the value of careful handling, and the significance of production issues in postharvest quality. This study indicates the disorder, PPN, is a form of chilling injury, and that the use of 1-MCP is not recommended for Chinese cabbage. Both super-atmospheric O₂ storage and minimal processing of Chinese cabbage have potential but require further investigation. The results from this study will be useful to those involved in the Chinese cabbage industry.