



## Stonefruit mealiness – the quiet destroyer

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### Abstract

Consistently delivering high quality fruit to consumers is vital to expanding domestic demand for stone fruit and for meeting the requirements of our export markets. Disorders such as mealiness, internal browning or flesh bleeding or reddening can deter consumers from purchasing stone fruit. Inappropriate temperatures (2-7°C) during storage and handling are the major factor leading to the development of these disorders. Disorders such as mealiness may be considered ‘a quiet destroyer’ as often they do not show up in the early stages of the supply chain but only when consumers discover that the fruit is inedible at purchase. This paper explores the main reasons for consumer dissatisfaction with stone fruit, how disorders occur during storage and handling and how they may be prevented.

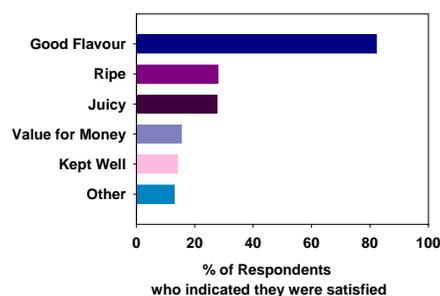
### Introduction

Poor eating quality is one of the major detractors for consumers of stone fruit. During the stone fruit season, Australians consume 1-2 pieces of fruit per week. Domestic consumption has remained static for some time, causing the industry to look for reasons why this is the case. Major reasons for poor eating quality include low fruit

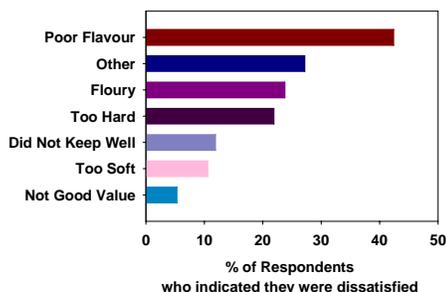
sugars, fruit that fail to ripen properly and fruit that are ‘mealy’, ‘floury’ or ‘leathery’. In this presentation we will examine:

- why Australian consumers are sometimes dissatisfied with stone fruit;
- what are the major physiological disorders of stone fruit;
- what are the main causes of mealiness or internal breakdown and
- how we might reduce the incidence of disorders.

Reasons given by consumers for satisfaction with last purchase



Reasons given by consumers for dissatisfaction with last purchase



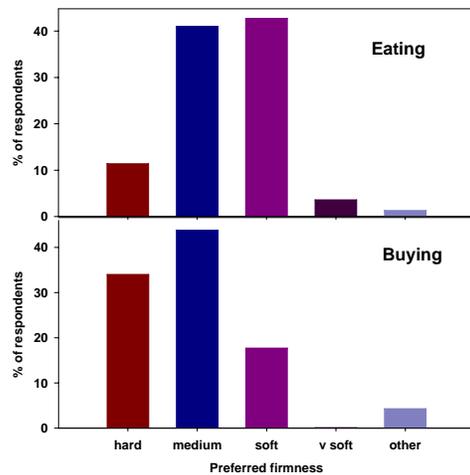
### Major reasons for consumer dissatisfaction

In an in-store survey of 900 consumers in New South Wales and South Australia customers were asked whether or not they were satisfied with their stone fruit purchases. The survey was undertaken in February in 10

Woolworths supermarkets. Eighty three percent of customers interviewed indicated that they were satisfied with their stone fruit purchases. Of the 151 respondents who were dissatisfied with their last purchase 42% found the ‘flavour’ to be lacking whilst a further 56% indicated that the texture was poor (‘floury’, ‘too hard’ or ‘too soft’) (Newman *et al.*,2004).

### Quality – What do consumers really want?

Understanding what consumers really want is one of the key things to successfully marketing our product. Studies in the USA have shown that consumers prefer yellow flesh peaches and nectarines to have a minimum of 11°Brix for yellow flesh high acid



peaches and nectarines and 12°Brix for white flesh low acid peaches and nectarines (Crisosto and Crisosto, 2005). Our survey of supermarkets in NSW and SA showed that consumers have preferred to eat their peaches/nectarines either ‘soft’ (43%) or ‘medium’ (41%). Only a small proportion of consumers expressed a preference for ‘hard’ fruit (11%). Despite this they preferred to purchase their fruit firmer than their ideal eating ripeness. This may be due to consumers having a bad experience with overripe or mealy fruit and by buying their fruit slightly firmer they are trying to alleviate this risk. Fruit must also be

attractive to the eye and be free from disease and disorders. However the hardest of these characteristics for consumers to judge is disorders that leave the fruit mealy or with internal breakdown. Consumers may bite into a fruit that looks good but fails to deliver on eating quality because it is ‘mealy’, ‘floury’ or ‘leathery’.

### Physiological disorders of stone fruit

There are 3 main physiological disorders that develop in stone fruit following storage:

- Dry, ‘mealy’ or ‘floury’ fruit that lack juice or hard textured fruit with no juice (‘leathery’)
- Internal browning
- Flesh bleeding or internal reddening

Changes in flavour may also occur prior to the onset of visual symptoms. The problem with these disorders is that they are develop during storage or marketing and are not evident until the consumer bites into the fruit.

### What are the causes?

Chilling injury is the major cause of these disorders. This occurs when fruit in the supply chain are stored at temperatures between 2 and 7°C (killing or danger temperature zone). Whilst chilling injury will occur at temperatures below this the rate of onset is much slower than at temperatures in the ‘danger zone’. Chilling injury can develop in fruit stored at 2-5°C within 1-2 weeks compared to 3 or more weeks for fruit stored at 0°C (Lurie *et al.*, 2005).

So how long in the ‘danger zone’ is too long? For chilling sensitive varieties 3-7 days at these temperatures will lead to internal breakdown or chilling injury. However

time spent at these temperatures is cumulative so if the fruit is exposed to temperatures in the 'danger zone' along the supply chain they will add up. So whilst a grower storing their fruit at 5°C is unlikely to see any problems by the time the fruit reaches the consumer it may be inedible due to internal breakdown. So all players in the supply chain need to ensure that fruit is not exposed to temperatures in the 'danger zone'.

### **What factors increase susceptibility?**

Varieties vary in their susceptibility to chilling injury. Fruit maturity and orchard factors (crop load and canopy position) also have an impact on fruit susceptibility to chilling injury. In general, early season varieties yellow fleshed peaches and nectarines tend to be less susceptible to chilling injury than late season varieties. However this does not hold true for the white fleshed varieties. Peach and nectarine varieties may be considered highly (eg Flavorcrest, Elegant Lady), moderately (eg. Summer Fire, Snow Giant) or slightly (eg Summer Grand, Spring Lady) susceptible to internal breakdown. However many varieties have yet to be assessed for their susceptibility to chilling injury and with some of the newer varieties there susceptibility to chilling injury appears to be random (Crisosto, 2002).

Some ethylene inhibitors such as 1-MCP may disrupt normal fruit ripening leading to a higher proportion of fruit developing internal breakdown. However this needs to be researched further.

### **How do we prevent mealiness from developing?**

#### *Storing fruit at the right temperature (0-2°C)*

Maintaining the right temperature throughout the supply chain is crucial to ensuring that fruit do not develop chilling injury or internal breakdown. Fruit should be stored at 0-2°C throughout the supply chain and this is the best way to prevent disorders developing. Temperatures in the 'danger zone' should be avoided as these may lead to the development of internal breakdown.

When cooling fruit 'on-farm', the fruit are going to spend some time in the 'danger zone' as the product cools. Cooling the fruit as quickly as possible using forced air cooling will reduce the amount of time that fruit spend in the 2-7°C 'danger zone' and minimise the risk of the fruit developing internal breakdown.

Whilst storing or handling fruit at temperatures above the 'danger zone' may appear to be an attractive proposition, whilst it will prevent the onset of internal breakdown, fruit stored at higher temperatures will deteriorate faster and have a shorter shelf life. So unless the fruit is only to be stored for a short period of time this is not a recommended practice.

#### *Pre-ripening or warming fruit during storage*

In California and Australia, pre-ripening or conditioning the fruit has been shown to have some beneficial effects for reducing the incidence of internal breakdown. Typically during a conditioning program fruit are picked and ripened at 20°C under high relative humidity until they reach a firmness of 3.5-4.5kg (as measured by a penetrometer). They are then force air cooled back to 0-2°C prior to marketing. This conditioning program not only delivers fruit to the consumer 'Ready to Eat' but

because ripening is carried out in a controlled manner, preconditioned fruit are less likely to develop chilling injury or internal breakdown.

Other studies have also shown that intermittent warming during storage can achieve the same benefits (Lurie *et al.*, 2005). However this type of treatment is not very practical commercially.

#### *Controlled atmosphere storage*

Controlled atmosphere storage (lower oxygen, higher carbon dioxide) can reduce the occurrence of internal breakdown. Atmospheres with high CO<sub>2</sub> (10% O<sub>2</sub> and 10% CO<sub>2</sub>) have been shown to delay or prevent the onset of chilling injury. However the additional cost of CA storage is really only beneficial for export fruit.

#### **References**

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