

Marketable Yield and Optimising Quality

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February 2007

Most critical factor is the out-turn specification required by the customer.

The consumer is the ultimate judge of quality. The eating experience needs to match or exceed their expectations. This is the only way you can guarantee repeat sales.

1 What The Consumers Are Looking For:

Crisp, juicy fruit with acceptable flavour for their taste.

Individual tastes vary and can range from sweet, bland sub-acid fruit generally favoured by the younger consumer, ie, Coca Cola kids, right through to sharp acid type apples favoured by older consumers in certain “niche” markets.

Royal Gala, Red Delicious, the new Prevar variety Sweetie and Golden Delicious are good examples of the sweeter end of the spectrum, while Pink Lady®, Braeburn, Granny Smith and Jazz™ are more towards the acid end of the spectrum.

What they don't like are dry, mealy fruit, poor in juice without much flavour.

In the case of European pears the flesh needs to be juicy and melting in the mouth. European pears should not be allowed to ripen on the tree, but be harvested mature, then ripened after harvest and marketed to the consumer in eating ripe condition. Some varieties of European pear need a period of cold storage between harvest and ripening if they are to ripen satisfactorily.

Asian pears are more like apples and can be eaten in crisp and juicy state off the tree.

Appearance, while initially important in attracting consumer to the product becomes secondary to the eating experience once the fruit is in their mouth.

Fruit size tends to be market specific, but the overall trend is for larger size fruit to command higher prices than smaller fruit. As small sized fruit generally stores better than larger sized fruit, southern hemisphere producers selling in northern hemisphere marketplaces out of season have a competitive advantage over northern hemisphere producers with larger fruit.

Discerning customers will generally pay premium prices for high specification fruit and have developed objective fruit out-turn specifications to ensure they get what they want. Australian local supermarkets are rapidly following suit.

Uniformity and consistency within the line is critical. This is only possible from trees with good within-canopy light levels and uniform crop loads.

2 *Growing the Right Fruit*

Fruit quality is determined by orchard husbandry practices, the main ones being pruning, thinning and harvest management.

2.1 *Pruning and tree architecture*

Determines bud quality and is the starting point for fruit quality. Focuses on light exposure within the canopy. High quality apples need 50% or more ambient light exposure.

2.2 *Tree vigour management*

Once the tree has filled its allotted space, only weak to moderate shoot growth is required to maintain a productive canopy, eg, 15 to 30 cm annual extension growth. Excess vigour causes shade, predisposes the fruit to physiological disorders such as bitter pit, and represents the lost fruiting opportunity.

2.3 *Thinning and Crop Load*

Maximising marketable yield is the objective. Getting the crop load right is the key to meeting this objective.

Optimum crop load is usually well below natural fruit set levels.

Crop load is the single most important factor under the fruitgrower's direct control to influence orchard performance, sustainability and profitability.

Crop load is critical to quality and impacts on the following:

- Determines yield.
- Main driver of fruit size.
- Influences the following fruit quality parameters:
 - Soluble solids
 - Fruit firmness
 - Colour development
 - Harvest period
 - Keeping quality
 - Fruit flavour

Table 1 Effects of Crop Load on Pressure and Brix

Variety	Specific Crop Fruit /cm ²	Brix	Fruit Pressure
Royal Gala	9.25	10.9	-
Royal Gala	5.07	12.2	+0.5 kg <i>f</i>
Fuji	12.7	12.5	5.9 kg <i>f</i>
Fuji	8.2	14.7	6.3 kg <i>f</i>
Pink Lady	15.38	13.36	73.44 N
Pink Lady	5.52	15.23	86.69 N
Braeburn	Regular crop	10.9	9.6 kg <i>f</i>
Braeburn	Light crop	11.3	9.8 kg <i>f</i>

Overcropping delays harvest, suppresses colour development, reduces fruit size, lowers fruit firmness and brix levels. Fruit from overcropped trees seldom meets the requirements of UK supermarkets in regard to brix and pressure levels.

Undercropping increases the risk of many post-harvest disorders – notably bitter pit, and internal breakdown disorders, as well as lowering potential yield and profit.

2.4 *Cropping Orchard Nutrition*

Relative to the developing orchard the fertiliser programme needs to change from high to low nitrogen because excess nitrogen suppresses colour development and pre-disposes the fruit to numerous post-harvest storage problems.

High fruit calcium levels with adequate phosphorus and potassium levels are essential for high fruit quality. Foliar calcium sprays over the growing season are essential to maintain adequate fruit calcium status. In some circumstances, foliar phosphorus and potassium sprays may also be needed.

3 *Harvest Management*

The stage of fruit maturity at harvest has a profound influence on storage behaviour and outturn. Maturity development is tracked by the objective measurement of starch degradation as measured by starch iodine patterns, fruit firmness by pressure testing, sugar levels by brix testing of juice using a refractometer, and background colour against green/yellow swatches. Sometimes titratable acidity levels are measured and very sophisticated maturity testing may also measure internal ethylene content of the flesh.

Maturity testing should commence around 14 days before anticipated harvest date, and be carried out at regular time intervals from that date, usually weekly, or maybe more often if maturity appears to be moving rapidly.

Optimum maturity stage for harvest will depend on storage procedures and market requirements.

As a general rule, storage outturn will be at its highest from fruit picked relatively early in the maturation process and steadily deteriorates with later picking dates.

Royal Gala for long-term storage needs to be picked at SPIs 1 to 2 on a 6 point scale, whereas for short term storage, SPI 3 will give the best product. Royal Gala picked at maturity suited for long-term storage may not have reached its full colour development. It is normal for some colour development in store as ground colour changes from green towards yellow.

Pink Lady® storage life is also extremely sensitive to harvest maturity with increasing risk of internal browning disorders (IBD) as harvest maturity advances.

Unless the tree canopy management has been very good with uniform light levels throughout the fruit bearing zones of the canopy and short flowering period careful selective picking based on fruit size and colour development is necessary to deliver consistent uniform lines of fruit.

Early varieties such as Royal Gala need frequent selective picking to maximize their potential, sometimes a 3 to 4 day turnaround.

With Royal Gala, fruit firmness declines through harvest and storage.

Relative to fruit picked at optimum maturity:

- 1 week late is 7% softer.
- 2 weeks late is 14% softer
- 3 weeks late is 18% softer

Royal Gala then loses up to 20 to 30% of harvest pressure in storage.

4 *Harvest Manipulation Opportunities*

Harvest maturity can be advanced by:

Trunk girdling between petal fall and 4 to 6 weeks prior to harvest will advance maturity. Response is variety and rootstock dependent. Royal Gala is fairly responsive, with four to seven day harvest advancement possible. High vigour rootstocks are more responsive than low vigour rootstocks.

Ethephon application at commencement of ripening process. Response range in 200 to 400 ppm or higher dose rate. Higher rates adversely affect post-harvest storage and shelf life, so are not recommended. Anecdotal evidence indicates pre-harvest ethephon application suppresses fruit sizing.

Harvest maturity can be delayed by application of Retain® three to four weeks prior to anticipated harvest date. Royal Gala is particularly responsive. Up to 7 to 10 day delay in harvest maturity is possible under optimum conditions. Fruit continues to size following Retain® application. Retain® may suppress colour development and is not recommended on blocks with a history of poor fruit colour development. Later season varieties can be less affected by poor colour development if the harvest delay moves their harvest period into weather conditions more conducive to colour development.

5 *SmartFresh*[®]

This recently released technology has huge potential for improving apple storage behaviour and outturn. It is an ethylene blocker which is applied to harvested fruit. Its effect is to halt or slow down ripening, enabling fruit to retain firmness and juicy texture throughout its storage and shelf life period. It is also very effective at controlling superficial scald in susceptible varieties.

Because it shuts down the ripening processes, correct harvest maturity is critical to fruit quality on outturn. Fruit which has been harvested too early in its harvest maturity may fail to develop satisfactory flavour following treatment with SmartfreshSM. Fruit harvested at this maturity performs well under CA storage because fruit flavour continues to develop in store, albeit slowly. Best results from SmartfreshSM in regard to fruit flavour and quality on outturn may come from fruit harvested just a little more advanced in maturity than the fruit maturity stage considered optimum for long term CA storage without SmartfreshSM treatment.