

Harvest Management of early season varieties focusing on Royal Gala

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Harvesting is the culmination of a years work. It is often been stated that the post harvest quality of fruit is determined during its development on the tree and the way it is harvested. Even the most specialised storage can do no more than preserve existing fruit attributes for a defined period. Therefore care and attention needs to be taken if harvesting is to provide the fitting end to a season of fruit growing.

Leading into harvest there are many things to consider and prepare.

1. Fruit destination/markets. Fruit destination and market can influence harvest decisions. Fruit that is destined for quick sale may not require the same maturity indices as fruit destined for storage and later sales. Determining fruit maturity can aid in deciding which blocks have the desired attributes for long term storage and which blocks are better suited for short term storage. (See Tables 1 & 2)
2. Harvest planning. Choosing which blocks to pick first is often dictated by the maturity of the fruit. However many factors influence the way fruit mature: -
 - Crop load e.g., (light crop load may encourage early harvest, heavy crop load a later harvest).
 - Tree health –healthy foliage encourages colour development whereas poor tree health can restrict colour development.
 - Pest & Disease –Pests such as mites can reduce the efficiency of leaves and slow colour development in fruit. Trees affected will be slow to develop colour but will still be maturing.
 - Tree Nutrition- (same as tree health), also excessive nitrogen can promote increased vigour which can delay fruit colouration.
 - Harvesting schedule – amount of bins/tonnes to be picked.
 - Climatic conditions-
 - Orchard location –
 - Hail/bird netting – can delay colour development
 - Irrigation – Avoid irrigation immediately prior to harvesting as this can soften fruit and make them susceptible to bruising. In some countries, restricting irrigation 2-3 days before harvest reduces picking bruises.

- Fruit Size – Trees with larger fruit often develop colour faster and mature earlier than trees with small fruit and therefore require picking earlier. (Fruit size may be influenced by crop load and therefore crop load rather than fruit size is influencing fruit maturity).
 - Others- Retain™ (AVG) delays harvest by 1-2 weeks by inhibiting ethylene production which can assist with fruit size development and delaying of fruit maturity.
3. Machinery maintenance. Undertaking a thorough maintenance program on all harvest machinery prior to harvest can save valuable time and avoid fruit spoilage.
- Picking bins should be checked and cleaned prior to use. Wooden bins require each bin being checked for protruding or loose nails and damaged boards should be replaced.
 - Picking ladders checked for cracks and defects.
 - Picking bags checked and fixed.
4. Staff. Attracting and retaining suitable staff for harvesting is becoming more and more difficult everywhere. Smarter ways of attracting staff involve: -
- Advertising using the internet
 - Advertising in boarding houses
 - Providing suitable accommodation

Training staff for picking can be frustrating but is money well spent if done correctly. Proper training assist with achieving the desired fruit quality.

Wage rates must be enticing to attract and hold staff. A fixed hourly wage rate or contract bin rates with incentives to encourage productivity of quality fruit are commonly used in many countries. How these are structured can affect production and staff harmony.

Supervision of staff is also key to maintaining the desired quality and ensuring a smooth harvesting season. Supervisors require good people skills to be effective.

Contract picking can lead to poor quality fruit without the right structures in place to monitor each picker e.g., regular bin audits.

5. Other factors affecting harvest.

Tree size and rootstock can influence the way fruit mature. With a variety like Gala, some rootstocks such as MM106 and MM793 encourage a larger tree size, which

usually develop fruit with varying degrees of fruit maturity. An example of this is the fruit on the tops and outsides of trees can have better colour development than fruit from the bottom of the tree, however colour development does not indicate fruit maturity and eating quality. Pay attention in larger trees to fruit maturity using the maturity parameters below rather than colour. (Background colour can assist pickers to differentiate between fruit ready to pick and immature fruit, however pickers should be tested for colour blindness, as red and green are often difficult to distinguish for some people).

Dwarf or smaller trees grown on M9 often promote more even fruit maturity from top to bottom providing the right tree structure and architecture is employed compared with the more vigorous rootstocks.

Harvest maturity and fruit quality assessment guidelines

– (Source: Apple & Pear Growers Association of SA Inc. Rural Solutions SA & Department of Primary Industries Victoria)

Apple maturity and the decision to harvest should ideally be based on at least three maturity parameters. The most reliable are;

- *Starch Content*
- *Fruit Firmness*
- *Sugar Content (total soluble solids)*
- *Background Colour for Jonathan, Golden Delicious and Granny Smith.*

The section below describes procedures for measuring the total soluble solids, the firmness and the starch score of apples. Harvesting for export should only take place when the results of the above tests and fruit colour (red area) meet the export standards. To assist the harvest decision, record the results from successive samplings.

The information contained in Table 2 and 3 can be used as a harvest guide for Australian apples. Tests can be carried out on each piece of fruit in the order of fruit firmness, sugar content and starch content.

Table 2. Harvest maturity parameters for controlled atmosphere and long-term cold storage. The starch index values relate to the Washington scale.

Variety	Background Colour ²	Firmness (kg) ₁	%TSS (?Brix)	Starch Index
Gala		>6.5	>12.0	1.0-2.5
Jonathan	GGY (1.5)	>6.0	>11.5	2.0-3.0
Golden Delicious	GY (2.0)	>6.5	>12.0	2-0-3.0
Red Delicious		>6.5	>10.0	1.4-3.0
Cripps' Pink		>6.5	>12.0	1.5-3.0
Cripps' Red		>6.8	>12.0	1.5-3.0
Fuji		>6.1	>13.0	2.5-4.0
Granny Smith	GGY (1.5)	>6.5	>12.0	1.5-3-0
Lady Williams		>7.0	> 14,0	1.5-3.0

Table 3. Harvest maturity parameters for apples destined for immediate marketing. The starch index values relate to the Washington scale.

Variety	Background Colour ²	Firmness (kg) ₁	%TSS (?Brix)	Starch Index
Gala		>6.0	>12.0	>3.0
Jonathan	GY (3.0)	>5.9	>11.8	>5.0
Golden Delicious	GY (3.0)	>6.1	>10.5	>5.0
Red Delicious		>6.4	>10.7	>4.0
Cripps' Pink		>6.2	>14.0	>3.0
Cripps' Red		>6.4	>14.0	>3.0
Fuji		>6.1	>14.0	>4.0
Granny Smith	GGY (1.5)	>6.5	>12.5	>5.0
Lady Williams		>7.0	>14.0	>5.0

¹ recommended minimum values are higher than current Australian standards to allow for declining firmness during marketing

² values in brackets are using the Victorian Jonathan Colour Chart > more than.

Selecting a representative sample of fruit from the orchard

To test these maturity parameters a sample of 20 fruit needs to be collected from each orchard block.

1. Select five typical trees spread throughout the block
2. Pick four apples of typical size around each tree of shoulder height.
3. A mix of fruit should be selected from the inside and outside of the canopy and from a North, South, East and Westerly direction. Damaged fruit should be avoided. This includes sunburn and rubs. A total of 20 fruit should be picked.

Note that the above sampling procedure should be done a number of times over the weeks or days leading up to harvest to determine the optimum harvest date. To get consistency between results, sampling should be done at a similar time of day (preferably mid morning).

*It should be noted that to achieve best results the sample of apples must be tested **immediately after picking**, in the field if possible.*

The tools to perform the 3 main maturity tests include a penetrometer, a refractometer, a sharp knife, iodine solution (2%), a flat dish to dip apples, a cutting board, tissues, pen, disposable gloves, distilled water and record sheet.