

Best Practice Guidelines: Gala varieties

1. Maturity indexing (MI)

Fruit maturity at harvest is the most critical factor that influences post-harvest life of fruit, especially for Gala apples that are sensitive to ethylene. Ethylene stimulates the production of enzymes that break down the cell walls, which accelerates the fruit ripening process. Once this natural process starts, starch breakdown rapidly increases. It is very important to note that, once this cell wall breakdown has started, the process is irreversible. Loss of firmness, mixed maturity and lenticel breakdown are the three major disorders associated with Gala varieties.

There is only one way to mitigate the abovementioned and that is to manage fruit quality by harvesting at the correct maturity. Only fruit that have been harvested at the correct stage of maturity can keep marketable quality for an extended period under CA (controlled atmosphere) or regular storage conditions. It is also very important to note that Gala was traditionally only considered for up to 3 months of storage. However due to current market demand, this variety is now stored 3-9 months.

Best practice is to start with maturity indexing 3 weeks before the estimated first harvest date.

2. Harvest recommendations

Table 1 is a general guideline and summarises several maturity parameters with desired ranges for Gala varieties at harvest. Starch breakdown, firmness, and sugar (TSS %) are most used for harvest recommendations. For traditional striped Galas background colour can also be used. However, in certain regions and seasons, this parameter might be insufficient for harvest recommendations i.e., when background colour is still green, but pressures and starches are already advanced, leading to fruit that will be post-optimum and not suitable for long-term storage.

Table 1: Maturity indexing parameters and norms for Gala varieties *for* harvesting

Variety	Firmness (kg/cm ²)	Sugar (TSS %)	Acids (g/ L)	Starch degradation (%)	Pip colour
Gala	>7,3	11,2 - 12	3 - 4	20-30	1/2 brown

Firmness (11,2 mm tip)

Special focus to harvest >7,3kg/cm² for sensitive markets (min. export 5,9 kg/cm²).

Sugars

Total soluble sugars (%) recommended for sensitive markets with respect to minimum export is 11-12%.

Titrateable acids (%)

The lower the acids, the poorer the storability. Make sure that high acids are not induced by high nitrogen concentration, such as in the example of young orchards or very vigorous orchards with low crop load. See Table 2 for more information.

Table 2: Titrateable acids range for Gala varieties

Low	Optimal	High
<3	3-4	>4

Pip colour

A minimum pip colour of ½ brown is recommended to harvest. In years when background colour and starch breakdown do not correlate well due to starch density being greater on cellular level, TSS%, firmness and pip colour can assist in harvest recommendations. See Annexure A for additional information regarding pip colour.

Starch

20-30% starch breakdown for 8 out of 10 fruit is recommended as optimum harvest maturity.

Full red (block colour) Gala varieties

Background colour is not sufficient every season as a harvest maturity indexing parameter. Focus on starch degradation, firmness and TSS% measurements and the trend present within the sample range. Also sample within the canopy according to tree architecture complexity i.e., top and bottom and inside and outside fruit to review maturity of fruit according to canopy position. Shade and non-shaded fruit differ according to maturity. Review the BigBucks technical manual for visual examples on sampling according to canopy position.

<https://www.bigbucksapples.com/index.php?page=harvesting>.

3. Harvest management strategy with plant growth hormones

When it comes to harvest planning, plant growth hormones (PGRs) are more readily used these days. The reason this technology has gained popularity is due to the following advantages gained by the grower when applied correctly:

- Reduces ethylene production and thus delays starch breakdown and ripening.
- Improves harvest management flexibility and ability to respond to weather.
- Maintains fruit firmness, increases fruit size and reduces fruit drop.

Apply ReTain (AVG) and Harvista (1-MCP) as recommended by pre-harvest consultants. Annexure B gives a summary of these harvest management chemicals. Also review the harvest guideline for BigBucks with respect to latest ReTain (AVG) research.

<https://www.bigbucksapples.com/index.php?page=harvesting>.

4. Fruit intake

Splitting fruit into 2 groups is recommended:

1. High risk fruit for long-term storage, so-called “hot parcels” i.e., young trees, vigorous orchards (high nitrogen, low calcium, and low phosphate in fruit) with low crop load and any additional stressed orchards.
2. Normal intake.

Additional notes on BigBucks should be reviewed with respect to managing heat damage regarding cooling before sorting and packing.

<https://www.bigbucksapples.com/index.php?page=harvesting>

Delivery after harvest should be within 6-8 hours.

Field heat

Field heat from bins should be managed by lowering temperature to -1,5 °C. Corners of the bin can measure -1,7 °C. Make use of thermocouples and measure the middle of the bins to determine the cool down rate. Use proven and good cultural practises to limit temperature fluctuations.

SmartFresh (SF)

Aim to apply within five days or less, but SF within 7 days after harvest.

5. Storage

Filling a CA room – Review CA storage protocol.

Store high-risk lenticel fruit in under either RA or short-term CA conditions to allow development of lenticel breakdown and sorting before packing. When breaking CA storage, wait 10 days before packing for the lenticel damage to become visible (adapted from Lenticel Best Practise Guide, December 2022, Henk Griessel).

Humidifiers - Manage humidity as high as possible.

Samples - Rank and evaluate CA rooms with respect to change in ethylene concentrations.

Example of how to sample: take one apple out of 20 crates over 10-week period before storage. The foregoing sampling recommendation will help with variability within the sample range.

Pre-sorting

Best practise entails treating fruit with SF first and to only start with pre-sorting **after** SF treatment. The risk is too great with the variability of maturity within samples to pre-sort before SF.

Storage regime

Review recommended temperature and gas regimes for cold storage for Gala varieties in Appendix 2. Oxygen (%), carbon dioxide (%), temperature (° C) and storage period is summarised in this guideline, chrome-extension:

https://www.hortgro.co.za/wp-content/uploads/docs/dlm_uploads/2019/01/2019-recommended-applespears-storage-protocols-camanual.pdf

6. Packing

Throughout the whole packing process, the fruit temperature should never rise above 12°C. Do not take more than 20 bins out of storage while packing. Logistics should be coordinated with respect to labour tea breaks and lunch time, thus minimising fruit exposure to higher temperatures.

Use bags with micro perforations. Manage time exposed to flumes and drenches (loadshedding). Ensure that chemicals in the water is maintained at the optimum concentrations (adapted from Lenticel Best Practise Guide, December 2022, Henk Griessel).

Inspection

Make sure to plan in advance with respect to PPECB fruit inspections therefore limiting temperature exposure.

Pallets

The process from pallet building to forced cooling should be less than 90 minutes. Build pallets in cold storage if possible.

Forced-cooling

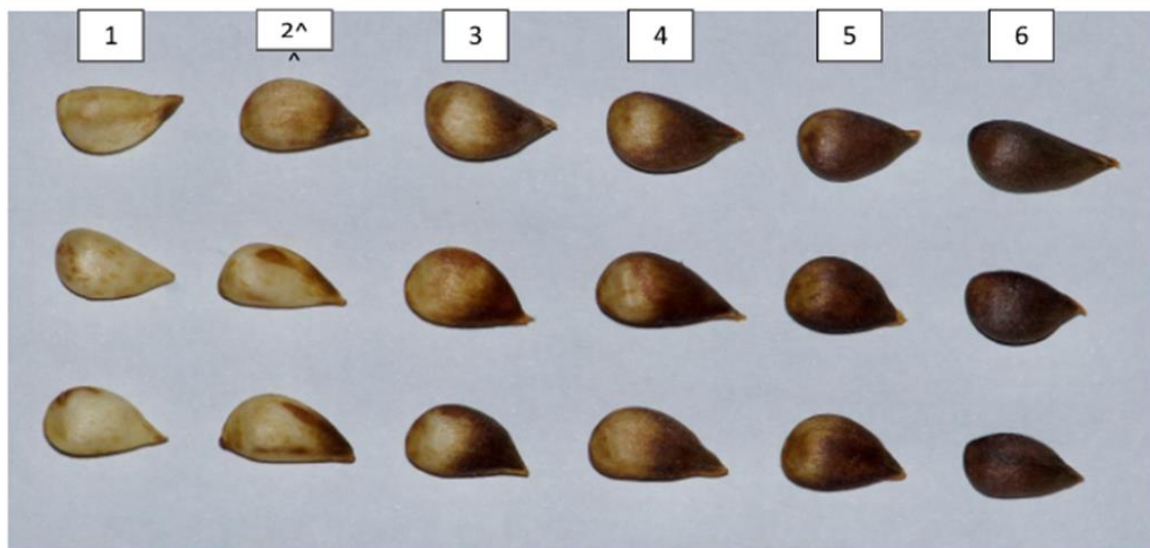
Make use of perforated bags, aim to be at optimum temp within 2-5 days.

Loading temperatures

Recommended loading temperature is -0,5°C with closed vents.

Annexure A

Pip colour index: GDL AVG (ReTain) spray guide example



^ Index value of 2 for GDL (NIVV) = ReTain spray

Indeks	1	2*	3	4	5	6
Pitkleur/ Pip colour	0 Wit pit/ White	1 / 4 Bruin kleur/ Brown colour	1 / 3 Bruin kleur/ Brown colour	1 / 2 Bruin kleur/	3 / 4 Bruin kleur/ Brown colour	Vol bruin/ Full brown

ReTain note only for GDL (NIVV):

When using the 1-6 index, ReTain sprays for GDL will be recommended when pip colour reaches 1.8 - 2.0 i.e., Hortec reports index values.

Annexure B

PLANT GROWTH REGULATORS AND HOW THEY AFFECT FRUIT MATURITY

There are two plant growth regulators (PGRs) that are currently registered in South Africa for use on apples that can interfere with the production of ethylene and delay fruit ripening namely, ReTain® and Harvista™. Both PGRs are effective in delaying fruit ripening however they have very different compounds with respect to the modes of action, optimal timing, and effect on the fruit. Below a short summary follows to help growers understand how these two PGRs work to control fruit maturity and facilitate in harvest management.

	ReTain®	Harvista™
Active ingredient:	aminoethoxyvinylglycine (AVG)	1-methylcyclopropene (1-MCP)
Mode of action:	A "look-alike" for one of the chemical precursors to ethylene. When absorbed into plant tissues, AVG binds irreversibly with a key enzyme, thus preventing the ethylene precursor from binding and in return blocks the production of ethylene.	Blocks the ripening effects of ethylene by binding up the ethylene receptors on the plant cell membranes, thus making them unresponsive to ethylene action.
Main effect(s):	<ul style="list-style-type: none"> • Natural ripening is slowed, including stem loosening • ↓ Fruit flesh softening • ↓ Starch disappearance • ↑ Red colour formation • Can reduce watercore and stem-end cracking. 	<ul style="list-style-type: none"> • Slows starch breakdown • ↓ Fruit softening • ↑ Red colour development • ↓ Pre-harvest drop • Can delay the onset of watercore.
Application:	For this product to be effective it must be applied well in advance of the climactic rise in ethylene production that signals the onset of fruit maturity. Apply during wind free conditions and slow drying conditions (04h00 – 06h00). Use full bloom dates, however, also make use of maturity testing i.e., GDL that have more than one generation fruit on the tree. When looking at seed colour for GDL around 1/3 seed colour (brown) will be a good indication (1.8 – 2.0 pip analysis).	Can be applied anywhere between 21 and 4 days from expected commercial harvest. Unlike other orchard sprays, this product is not tank mixed. A retrofitted orchard sprayer using an inline injection system is required to ensure the active is kept separate from the water until the point of spraying. Therefore, AgroFresh applies the products or trains the growers who purchase their own inline injector system.

	No rain should be present at least 6 hours after application and do not apply on wet foliage as product efficacy can be compromised.	
Recommendation:	<p>1. Apples (all cultivars) *: 830 g/ha @ 1000 L water or 83g/ 100L water, 28 days prior to anticipated first pick. Ideal for cultivars that are harvested in single picks i.e., Golden Delicious.</p> <p>2. Royal Gala, Cripps Pink (Pink Lady®) and Braeburn**: 550 g/ha @ 1000L water or 55g/ 100L water, 7 days prior to anticipated first pick.</p> <p>* To delay whole harvest with 7 – 10 days.</p> <p>** This late application will not delay the 1st pick but will help control the maturation rate of the later picks.</p>	<p>1. Golden Delicious *: spray 5 – 10% starch breakdown.</p> <p>2. Royal Gala and Cripps Pink (Pink Lady®) *: spray 10 – 15 % starch breakdown. Commercial trend in EGVV is to apply earlier, closer to 5-10% starch breakdown for first generation fruit.</p> <p>* To delay whole harvest with 7 – 14 days.</p>
Warning:	Do not use on stressed trees i.e., mite problems, drought or waterlogged conditions. Do not apply in combination with pesticides, other PGRs or plant nutrients.	Do not use on stressed trees i.e., mite problems, drought or waterlogged conditions. Do not apply in combination with pesticides, other PGRs or plant nutrients.
Take note:	Use an organo-silicone surfactant i.e., BREAK-THRU® or Silwet L-77® at 50 mL/ 100L water.	This product is applied by a proprietary in-line injector system. Contact AgroFresh for additional information.

Please note: The response of most PGRs is highly influenced by the weather conditions before, during and after they have been applied to the trees. Therefore, record keeping with respect to spray date, time and weather should always be recorded so that one can evaluate the influence of PGRs for the specific orchard.