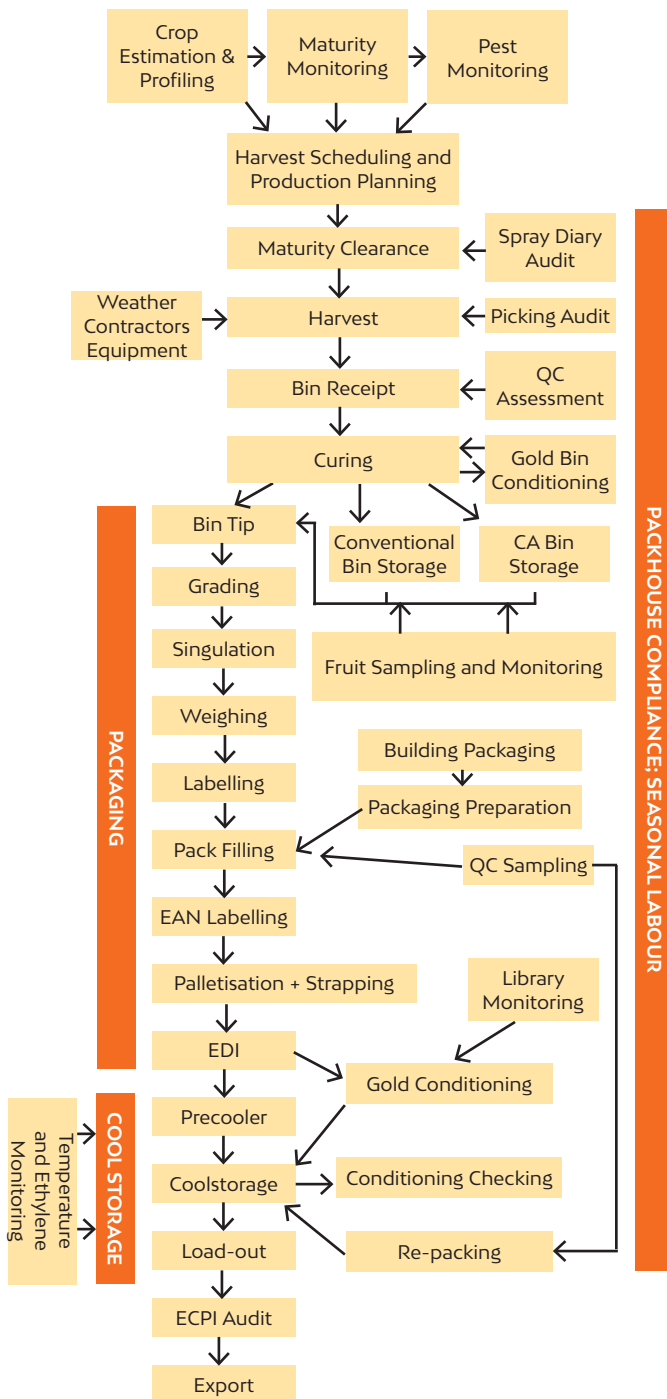


CHAPTER SIX  
**HARVEST AND  
POSTHARVEST PRACTICES**



# CHAPTER SIX HARVEST AND POSTHARVEST PRACTICES



The diagram to the left outlines the key processes and management actions that take place in preparation for and after harvest.

This chapter will now go into each of the actions outlined in the flow chart to the left. This chapter will be split into two broad sections including:

## THE SECTION IS DIVIDED AS FOLLOWS

<b>6.1 Harvest</b>	<b>120</b>
<b>6.1.1 Timing</b>	<b>122</b>
<b>6.1.2 Kiwistart Premium</b>	<b>122</b>
<b>6.1.3 Time Payments</b>	<b>122</b>
<b>6.2 Postharvest</b>	<b>123</b>
<b>6.2.1 Packing</b>	<b>123</b>
<b>6.2.2 Labelling</b>	<b>124</b>
<b>6.2.3 Packaging</b>	<b>124</b>
<b>6.2.4 Coolstorage</b>	<b>124</b>
<b>6.2.5 Shipping</b>	<b>125</b>



## 6.1 HARVEST

---

To ensure consumers continue to buy Zespri Kiwifruit, it is important that the fruit taste consistently good. Before fruit is harvested, it must be mature enough to ripen when it is off the kiwifruit vine. Depending on the variety (as the criteria can vary for each), the fruit needs to meet:

- the minimum dry matter (DM) threshold
- the right colour (Gold3 only)
- the minimum Soluble Solid Concentration (SSC) or brix (sugar content of an aqueous solution)
- have sufficient black seeds (Hayward only)
- minimum firmness

When it is time to harvest, an independent laboratory will test the fruit maturity, and if it meets the standard will give a clearance to pick. Dry matter is the most important aspect of fruit maturity for a grower, as a large proportion of their fruit payment is based on the dry matter percentage. Dry matter is largely made up of starch; this starch is converted into fruit sugars during the ripening process. The higher the dry matter, the greater the potential for high soluble solids when the fruit is ready to eat; high levels of soluble solids generally mean tasty fruit.

Additionally, a residue test must be taken to confirm the fruit has been grown to the crop protection standard (CPS). Residue tests involve taking a fruit sample that is sent to the lab for analysis, where approximately 350 compounds are screened for. The test result is only valid for 42 days so if harvest is delayed a second test may be required.

Right:  
Sampler collecting a  
maturity sample



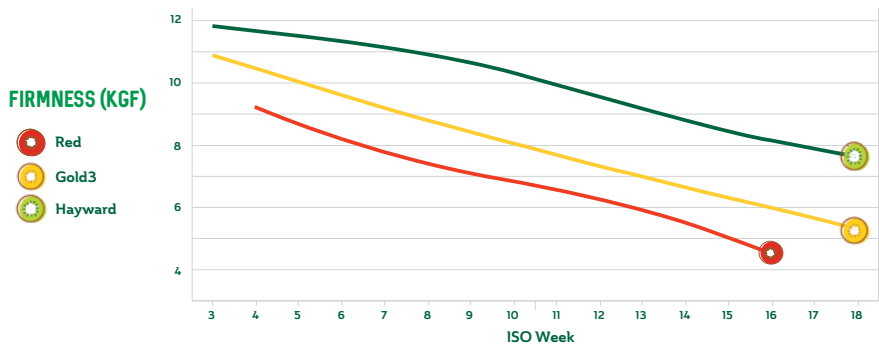
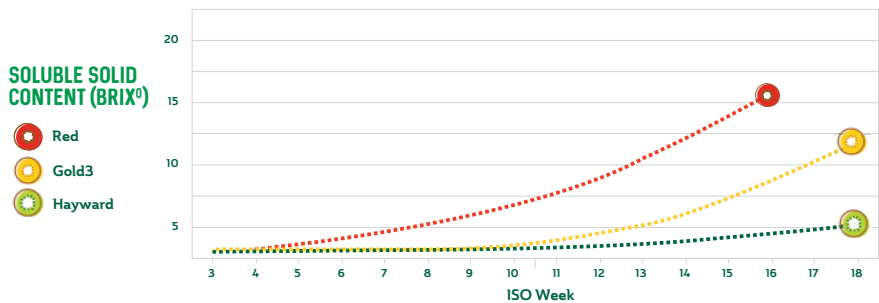
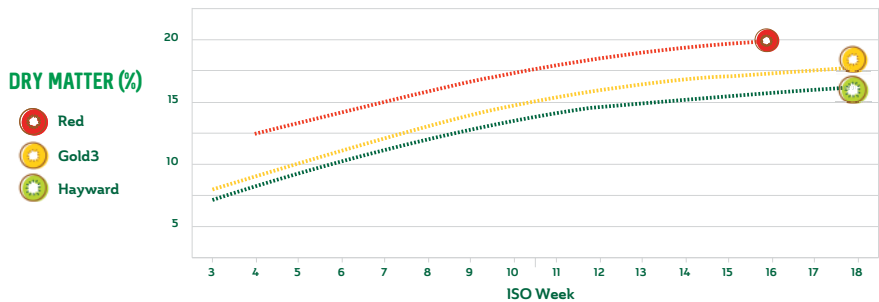
Right:  
Fruit slices after being dried  
in a dehydrator



### Testing for Dry Matter

Dry matter is measured by cutting a 2-3mm slice from the middle of the fruit and drying it in a dehydrator – the proportional difference between the wet weight of the slice and the dry weight of the slice is the dry matter percentage. The dry matter percentages from every fruit in the sample is used to calculate the Taste Zespri Grade (TZG) of the sample. The TZG is then used to determine how much of the maximum taste payment a grower will receive, e.g., if the maximum taste payment for a tray of fruit was \$5.00, a TZG of 0.8 would mean that the grower would receive 80% of the maximum taste payment, or \$4.00 per tray.

Soluble solids concentration (SSC) or brix is measured by a refractometer which uses light refraction to measure different sugar concentrations. Degrees of brix are the units of measure a refractometer uses. SSC and brix are effectively interchangeable terms. Generally, the greater the maturity at harvest the greater the taste and storage potential of the fruit. Brix can also be used when the fruit is eating ripe as a measure of how 'sweet' the fruit is. Fruit is increasingly being tested by retailers at the point of sale as an assessment of fruit quality. The higher the dry matter of fruit at harvest the higher the brix will be when sold at eating firmness at point of sale.



Note: The curves represent averages from multiple seasons and sites.

Note: ISO Week refers to the International Organization for Standardization date and time standard. Using this standard across the value chain reduces confusion between countries who may measure the start and end of a week differently (ISO week is Mon-Sun).

## 6.1.1 Timing

Each variety reaches maturity at a different time, depending on location and seasonal climate fluctuations. Gold kiwifruit harvest starts in mid to late March and is normally complete by early May. Poverty Bay, Hawke's Bay and coastal Bay of Plenty are usually harvested ahead of other regions. Research is still ongoing for Red kiwifruit, but it is expected to be mature around early March. Hayward (Green) harvest starts in late March and peaks in May and is usually complete by early June. There are some regional variations with Poverty Bay and coastal Bay of Plenty having the earliest harvest most years. Harvest in the more elevated regions in the Bay of Plenty follow in May and June. Nelson has a relatively short harvest window due to their naturally later maturity and early onset of winter cold. This means harvest is usually limited to the first three weeks of May.

## 6.1.2 Kiwistart Premium

The fruit picked at the start of the season is termed 'KiwiStart'. This fruit has reached a level of maturity where it will ripen off the vine and be acceptable to consumers but has not reached its optimum size or taste on the vine. Zespri incentivise growers to pick early by compensating them for lost fruit size and taste payments. Zespri want fruit to hit the markets shelves before competitor fruit from Chile. Further, Zespri want to sell as much fruit as possible before mainpack in May. A more balanced supply over time also reduces storage costs and fruit loss.

## 6.1.3 Time Payments

KiwiStart compensates growers for their fruit being sold early; Time Payments compensate growers for their fruit being sold late. Time Payments cover the additional costs of storing and supplying kiwifruit overtime. As kiwifruit is stored longer, it requires additional coolstorage and because the fruit is deteriorating overtime, condition checking, repacking, fruit loss, and taste compensation levels all increase. There are a variety of variables that lead to kiwifruit being able to be stored for months. Maximising storage potential requires optimisation of inventory management practice, fruit maturity and high-quality fruit handling.

KiwiStart and Time Premiums extend the New Zealand kiwifruit selling season. Markets require consistent supply so that New Zealand kiwifruit is available to their customers for as long as possible.

Right:  
Emptying fruit into bins for  
transport to the packhouse



## 6.2 POSTHARVEST

Packing and cool storage are not regulated by statute and there is active competition between postharvest operators that helps to minimise growers' postharvest costs. There are approximately 53 packing facilities and 85+ coolstores used in the kiwifruit industry. These facilities are located in Northland, Auckland, Bay of Plenty, Gisborne, Nelson and the Manawatu. The smallest facilities pack from 200,000 trays (3.55kg/tray) per season whilst the largest pack upwards of 15 million trays per season.

A packhouse operator receives fruit from the kiwifruit orchard in bins. These bins are not always packed immediately but left to sit for the fruit to cure. Curing refers to the delay between harvest and fruit entering the cool store. This is optimally for 48hrs, in a covered but well-ventilated area at ambient temperature. This removes the field heat from the fruit and allows for some drying out of the stem scar and other physiological changes in the fruit that can lead to better long term storage performance and less risk of botrytis rot. The fruit then passes through the packing chain to be packed and stored before shipping or is stored for a time in controlled-atmosphere (CA) storage before packing.

Right:  
Kiwifruit passing over grading tables in the packhouse

Far right:  
Kiwifruit on the sizer where they are weighted and sent to the packing lane where that size is being packed



### 6.2.1 Packing

Packing is the key control point where the fruit is segregated into market-acceptable product. Fruit is graded for defects, sized, labelled, and placed into packs suitable for the market (either trays or loose-filled bulk packs). Quality Control (QC) staff take samples of fruit to monitor for pest or defects that may have been missed and to ensure all parts of the packing and coolstore process meet the relevant standards. Product traceability moves from the orchard bin down to the individual pack level. It is at this point that maturity, dry matter, Global Good Agricultural Practice (GAP) requirements and market restrictions and regulations are all consolidated and identified electronically at the pack and pallet level, using European Article Number or EAN barcode labels (see 5.2.5 Traceability for an example).

For more information on GAP, see Chapter 8. For more information about the equipment used in the pack house see Chapter 7.

## 6.2.2 Labelling

Markets have wide ranging pack and label requirements. Individual fruit labelling of the Zespri brand is a requirement in all markets in preparation for retail sale. All fruit labels contain either a Price Look-Up (PLU) code for that cultivar and size of kiwifruit, or a bar code for price point differentiation by size at the point of sale. Some markets have additional market specific labelling requirements at the individual pack level. For example, South Korea, Brazil, India, Malaysia, Vietnam and Russia, all require country specific language showing the local contact details of the importer. These labels must exactly meet the importing countries statutory requirements to allow entry.

Right:  
Individual fruit label  
with bar code.



## 6.2.3 Packaging

Packaging is a key market messaging tool with branding and graphics carefully controlled. In some cases, customers require specific packaging requirements. In-market packing is used to meet customer requirements with fruit transferred from loose filled bulk packs into smaller retail packs or bags. All packaging must protect the fruit through the whole supply chain and be able to be disposed of at the end of its use in market. There are a variety of pack types that customers can order.

Right:  
Examples of Zespri kiwifruit  
repackaged into retail packs  
for specific markets



## 6.2.4 Coolstorage

Coolstores, utilising refrigerated air, are used to reduce the temperature of kiwifruit so that it stores for longer. Controlled atmosphere (CA) storage is also used where oxygen, and carbon dioxide concentrations, as well as temperature and humidity, are regulated to enable kiwifruit to store longer. EDI (Electronic Data Interface) is the system by which data is fed from the packhouse to Zespri for the overall inventory management. This data includes information about the fruit packed and stored so that each tray can be assigned to the appropriate market for load out. Further quality checks are completed at the wharf before the fruit is loaded via a ECPI audit (Export Consignment Product Inspections).



## 6.2.5 Shipping

Zespri uses two modes of shipping to deliver kiwifruit from New Zealand to offshore global markets: chartered refrigerated ships (or reefer ships) and containerised liner services. The 2021 season was marked by significant issues related to the Global Supply Chain Crisis (due to disruption by the pandemic) resulting in Zespri sending over 54% of volumes to markets on reefer ships. On average the historical split sits around 40% Reefer vessels: 60% Containerised Liner Services.

### Reefer Ships

Zespri "hires" or charters a whole ship, controls where and when the ship will travel and only carries the one cargo type, kiwifruit. These ships carry between 2,500-6,000 pallets. Reefer ships load kiwifruit at various regional ports in New Zealand, close to where fruit is harvested (Nelson, Gisborne and Marsden Point) however most of the volume is loaded out from the port at Tauranga. Once fully loaded, the charter vessels travel direct to the key markets of Europe, Japan, China and Korea, a journey of between 2-4 weeks. Reefer ships offer the advantages of quick direct transit times, ability to condition fruit whilst transiting to a destination and allow large volumes of fruit to be delivered to markets.

A Zespri Fruit Monitoring Technician (FMT) travels on-board each reefer, from mid-March to mid-June, to carry out the fruit conditioning. This involves ripening the fruit so it is in a 'Ready to Retail' state when it gets to market, with the characteristic textures and flavours. Their role involves assessing fruit development, monitoring fruit flesh and air temperatures, and releasing ethylene gas on request. The fruit development and temperature data they collect on board is sent back to Zespri for assessment, then any required actions are communicated back.

Right:  
A typical reefer ship



Right:  
Pallets being lowered and stowed into the hold of a reefer ship







### Containerised Liner Services

Container ships are capable of carrying a variety of cargo types belonging to different cargo owners. Cargo is loaded and stowed on the vessel in units called TEU (twenty-foot equivalent unit) or FEU (forty-foot equivalent unit) that can be either dry or refrigerated units. Zespri uses refrigerated FEU units that carry 20 pallets of kiwifruit per FEU. These ships travel a fixed route every week, which may involve stops at many ports prior to reaching the final destination, similar to the experience of taking a ride on a public bus. Zespri uses such services to many destinations including Taiwan, USA, Australia, South-East Asia, Middle East, South America, and South Africa.

Containerised services offer the benefits of a cost-effective freight solution as only the required space is booked and there is the ability to send cargo to many destinations.

In 2021, it is estimated Zespri will ship globally from New Zealand over 14,500 FEU (290,000 pallets) on containerised liner services and charter some 66 reefer ships carrying over 379,000 pallets.

Right:  
A typical container ship

