

Harvest Maturity

Asian pear varieties (ie. *Pyrus bretschneideri*, *Pyrus pyrifolia*, *Pyrus ussuriensis*) more commonly known as nashi typically ripen on the tree. European pears (ie. *Pyrus communis*) such as Williams and Packhams need to be picked when they are 'mature' but un-ripe and conditioned at low temperature in a cool room or controlled atmosphere (CA) room to trigger correct ripening. It is important that pears are picked at their optimal maturity as unripe fruit do not ripen properly and over-mature fruit have poor storage life. Ideal harvest maturity will depend on the variety and also the intended storage period.

Harvest times vary between growing regions and seasons. As an approximation, harvest times for the most common types are:

- Williams: early to mid-February
- Packhams: late February to March
- Beurre Bosc: late February to late March
- Corella: late March to April

Maturity Indicators

There are various indicators that can be used to determine pear maturity. Using a combination of methods will provide the most accurate results.

The two most commonly used indicators in the Australian industry are flesh firmness and total soluble solids (TSS) and standards have been developed to guide growers for Williams, Beurre Bosc and Packham's. Starch content can also be used to determine maturity but is less common in the industry.

Flesh Firmness

Flesh firmness is considered the most reliable measure of pear maturity. As fruit matures, flesh firmness drops. Flesh firmness is measured by testing the pressure it takes to puncture pear flesh using a penetrometer with an 8mm plunger.



Figure 1: Penetrometer with an 8mm head used to test flesh firmness

Total Soluble Solids (or TSS)

The juice of pears contains sugars, other carbohydrates, acids, salts and amino acids. These are referred to as the total soluble solids (TSS). As pears mature, sugars become the main component of TSS and their concentration can be estimated using a refractometer. TSS is measured as °Brix. TSS is not considered as reliable an indicator of pear maturity as flesh firmness, but provides a good measure of eating quality.



Figure 2: Hand held refractometer used to test TSS

Starch

As fruit matures, starch is converted into sugars. Measuring the amount of starch in fruit to indicate maturity works well for apples but isn't recommended for pears.

DA Meter – a New Tool For Measuring Fruit Maturity

A new non-destructive way to measure fruit maturity, the DA meter, is currently being tested by DEPI Victoria. The DA meter measures a decline in the skin's green background colour, correlated with ethylene production. Tests on apples and stone fruit have shown that this easy-to-use device is very accurate for determining fruit maturity, once DEPI scientists have established maturity classes for different varieties. Preliminary investigations in the 2013/14 season have shown the DA meter may be a useful tool in pears, but more work is needed to confirm this.



Figure 3: DA meter recording maturity in apples.

Suggested maturity testing (firmness and TSS only)

Sampling fruit

It is best that growers take a number of fruit samples from different trees in a block to determine an average maturity level for the block. Start maturity testing a few weeks before the 'traditional' harvest time, as maturity can vary each year.

Size of the sample is up to the grower, but consistency is the key. Each time a maturity test is done, the procedure should remain consistent.

The recommended procedure is for growers to select five typical trees spread through a block and from these four fruit of typical size are chosen at shoulder height from each tree. This creates a sample size of 20. Fruit should be sampled at the same time of day to ensure consistency. Samples should be taken every three days (twice a week) leading up to harvest.

Measuring flesh firmness

Each piece of the 20 fruit should be tested twice (on opposite sides/cheeks) using a penetrometer with an 8mm plunger. Do not test bruised or russeted areas as this will distort results. A strip of skin should be removed using a vegetable peeler from the mid-line on each side to be tested. Place fruit against a solid object, such as a bench, and hold firmly. The penetrometer should be positioned at right angles to the fruit on the peeled area and pushed into the fruit with even pressure until the flesh is punctured to a depth matching a marked line on the plunger. Record firmness to the nearest 0.25kgs. Average all of the readings and compare with industry maturity standards <Link>.

Important note

The penetrometer should be calibrated regularly. Start calibration by working the plunger in and out a number of times. The penetrometer should then be held vertically (pointed down) with the tip of the plunger against the pan of a set of digital scales. Press the penetrometer down slowly until it registers a 'weight'. Check to see that this weight matches the pressure reading on the penetrometer read-out. If the penetrometer doesn't register a similar reading to the scales, adjustment is necessary using the manufacturer's instructions.

Measuring TSS

This procedure outlines how to measure TSS using a hand held refractometer. These can be either the older models that are held up to the light, or newer, digital models. If possible, use a digital model as these tend to be more accurate.

First zero the refractometer using clean water. Using a sharp knife, slice a thin piece of flesh from the pear (on a side not tested with the penetrometer). Extract the juice from the flesh using a clean, dry household garlic press. Place enough juice to cover the refractometer prism. Read TSS level to the closest 0.2 °Brix. Average all of the readings and compare with industry maturity standards.

Important Note

The refractometer should also be calibrated before use. It can be zeroed using distilled water and then checked against standard solutions of a known °Brix value.

Records

It is important to keep records of maturity tests each season. This can become a useful tool for assessing the changes in maturity dates between seasons and also assessing the effect of harvest time on storage quality.

Other Useful Measures

There are other measures that can be useful to record when maturity testing - size is one of these. While size does not indicate maturity, it's an important parameter to know, particularly for market requirements. When samples are taken for maturity, growers should also measure the circumference of each and average. This can be done using digital calipers, size rings or a Cranston gauge.



Figure 4: A Cranston gauge used to measure fruit size

Maturity Standards for the Australian Industry

Harvest maturity standards have been determined for Australian grown pears. The following standards have been developed for Williams, Packhams, Beurre Bosc and Corella.

Variety	Size	Flesh Firmness (Kg/cm ²)	Minimum TSS (°Brix)
Williams	>65mm	<9.4 (immediate marketing or long term storage)	11.0
Packham's	>70mm	<9.0 (immediate marketing); <8.5 (long term storage)	ideally 11(>11.5 long term storage)
Beurre Bosc	>65mm	<9.0 (immediate marketing); <8.5 (long term storage)	11.5
Corella		<8.0	11.0

Table 1: Maturity standards for pears Source: Goulburn Valley Harvest Maturity Committee and Little and Holmes (2000)

Further information

These Australian and international sites may be useful for growers. However they are intended as an information source only. Any specific recommendations may be outdated or irrelevant for Australian conditions and growers should seek local advice.

Australian Resources

Little, C.R. and Holmes, R.J. (2000) Storage Technology for Apples and Pears. Contact the DEPI Victoria Customer Service Centre to find out how to purchase this book:

<http://www.depi.vic.gov.au/about-us/contact-us>

European Pear Varieties - NSW Department of Primary Industries AgFact:

http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0013/120217/european-pear-varieties.pdf

International Resources

Washington State University Post Harvest Information Network: a wide range of information regarding pear harvest maturity: <http://postharvest.tfrec.wsu.edu/pages/N613A>

Ontario, Canada: <http://www.omafra.gov.on.ca/english/crops/facts/12-041.htm>

DA Meter

http://apal.org.au/wp-content/uploads/2013/12/Stefanelli_DAmeter_APAL_coolstorage_2013.pdf

<http://www.trturoni.com/en/content/8-da-meter>

<http://www.treefruit.com.au/index.php/2012-02-11-05-40-34/orchard-equipment/tools/item/92-innovative-non-destructive-fruit-maturity-meter>