Department of Agriculture and Food

GOVERNMENT OF WESTERN AUSTRALIA

Technical Information Dossier for Australia

Apple Variety: [1]ANABP 01(b)

July 2014
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Supporting your success

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The Department of Agriculture and Food, Western Australia (DAFWA) with co-funding from Horticulture Innovation Australia Limited (HIA) manages the Australian National Apple Breeding Program ANABP. The objective of the breeding program is to maximise benefit to Australian Industry through the release and commercialisation of new apple varieties.

This project has been facilitated by HIA and has been part-funded by the Apple Industry levy. The Australian Government provides matched funding for all HIA's R&D activities.

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GOVERNMENT OF WESTERN AUSTRALIA
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1. Introduction

Fruit of the apple variety ANABP 01Ⓟ have a striking dark purple-red skin colour with prominent lenticels which give the skin a distinctive sparkling appearance. Fruit are generally round to globose in shape and medium to large in size. Fruit are fresh tasting with an excellent balanced flavour at optimum maturity, are juicy and crisp and have an attractive contrasting creamy white flesh.

This apple offers industry a unique appearance which is not matched by any other commercially grown apple variety in Australia and provides a distinctly different apple experience for consumers in the middle to later period of the apple season.

ANABP 01Ⓟ is harvested between early and late April depending on seasonal variation in climate[1]. At later harvest dates it can be eaten straight from the tree and therefore available for fresh sales. Earlier harvested fruit are suitable for storage, and with appropriate cool storage provide ideal eating from May to October in Australia.

This apple is grower friendly in that the fruit colours easily and the tree is productive and easy to manage with good regular cropping.

It was bred in Western Australia and is suited to the warmer Mediterranean climate found in the South West of WA where it produces regular crops of medium to large size fruit that are not prone to surface cracking, superficial scald or internal disorders. It has been tested throughout similar climates in Australia's major apple growing regions with positive results.

Fruit of ANABP 01Ⓟ that meets specification will be sold under the brand name Bravo™.

[1] **Please note:** Information refers to ANABP 01Ⓟ grown in the Manjimup and Donnybrook regions of the South West of Western Australia.

2. Origin and breeding

ANABP 01Ⓟ was bred by the Department of Agriculture and Food, Western Australia (DAFWA) at Stoneville Research Station, Western Australia. It originated from a 1992 cross between Cripps Red[2] and Royal Gala.

ANABP 01Ⓟ has the excellent eating qualities of Royal Gala, and a distinctive dark purple-red colour, which stands out from other varieties including its parents. Its prominent lenticels and contrasting creamy white flesh enhance its unique appearance. Parentage is shown in Figure 1.

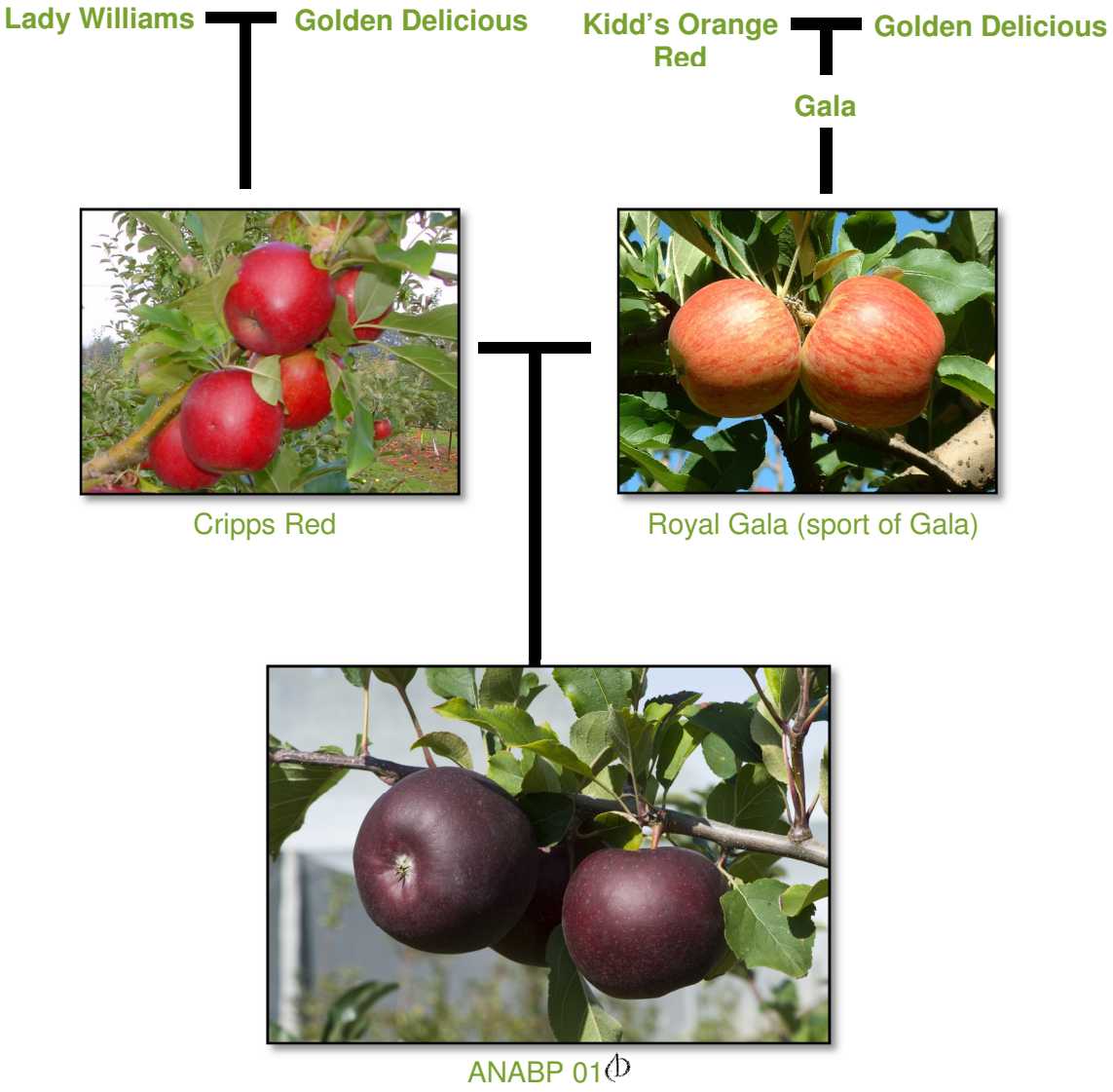

Figure 1 The ANABP 01Ⓟ family tree

[2] Cripps Red apples of an appropriate quality may be sold using the trademarked brand name Sundowner™.

3. Variety description

3.1 Tree growth

3.1.1 Vigour and shape

ANABP 01ⓑ trees have medium vigour and a spreading growth habit with wide branch angles similar to its parent Cripps Red. The development of fruiting laterals is sufficient but not prolific. The variety is suited to a range of rootstocks and tree training systems. It has also been observed to have some burr-knotting not unlike its other parent Royal Gala.

3.1.2 Wood

One-year-old shoots are a dark purple-brown in colour, somewhat similar to Red Delicious. Shoot thickness, inter-node length, shoot pubescence and shoot lenticel numbers are similar to its parent Cripps Red.

3.1.3 Leaves

Leaf blades are short to medium in length and narrow to medium in width. Overall they are shorter and narrower than Cripps Red which has medium to long leaves of medium width.

3.2 Flowering

In Manjimup, Western Australia, ANABP 01ⓑ flowers later than both Cripps Red and Cripps Pink[3] and the flowering period overlaps well with other later flowering varieties such as Red Fuji and Granny Smith (see 4.2.4 Pollination). Trees respond well to the application of the dormancy breaking chemicals which can be used to manipulate the time of flowering and also compact the flowering period.

3.3 Fruiting habit

ANABP 01ⓑ bears fruit on both spurs and one-year-old shoots and trees have not demonstrated any tendency towards biennial bearing.

[3] Cripps Pink apples of an appropriate quality may be sold using the trademarked brand name Pink Lady™.

3.4 Harvest time

Fruit of ANABP 01Ф (see Figure 2) ripen towards the end of the apple harvest season, about 21 days before Cripps Pink. In Manjimup this is normally around early to mid-April but is dependent on seasonal conditions.

Figure 2 ANABP 01Ф fruit on tree

3.5 Fruit description

3.5.1 Shape

Fruit is generally round to globose in shape, with a moderately shallow and regular eye basin (calyx end) and slightly open locules (seed cavities) – shown in Figure 3.

Figure 3 ANABP 01Ф fruit shape and skin colour

3.5.2 Skin colour

Fruit of ANABP 01ⓟ has a dark purple-red blush covering 90 to 100 per cent of the surface with green/yellow background colour that changes to yellow when fully mature. The high percentage of over-colour means that on many fruit the background colour is not evident. Blush colour develops more readily than for Cripps Pink. The dark over colour seems to intensify due to exposure to full sunlight as well as the diurnal temperature variation required for colour development of other red apple varieties. Lenticels are small to medium and very prominent.

3.5.3 Flesh

The apple has a firm, crisp, medium texture with moderate to thick skin. At harvest maturity, fruit sugar content is between 13 and 15 per cent and acid levels are between 5 and 7g/L.

The flesh is white to creamy white in colour depending on the stage of maturity and is moderately dense. The dark purple-red skin colour can sometimes lead to colour 'bleed' into the flesh when fruit are cut (see Figure 4).

Figure 4 Flesh colour of ANABP 01ⓟ immediately after cutting

3.5.4 Size

Fruit of ANABP 01ⓟ are medium to large in size depending on crop load and seasonal factors. The average size is between 75 and 85mm in diameter and the average weight ranges between 180 and 245g.

3.6 Disorders

The fruit is not highly susceptible to sunburn or prone to surface cracking, bitter pit or internal disorders under Western Australian conditions. In early trials under commercial conditions, visual symptoms of magnesium deficiency (yellow chlorosis on older leaves) were observed even though tissue analysis indicated that leaf levels of magnesium were low to normal and not deficient as would be expected.

Some surface pitting has been noticed especially on fruit from young trees which have been grown with a heavy nutrient program. This pitting decreases significantly as trees mature and less fertiliser is required to promote tree growth.

Powdery mildew has been observed on ANABP 01Ф, particularly on young trees which may be associated with insufficient spray applications at a nursery or early first year orchard growth. Monitoring and routine fungicides are recommended to ensure powdery mildew is not a problem.

Secondary flowering occurs late in the flowering period and 'rat tails' grow out from the main flower/fruit cluster. These secondary flowers may set fruit which can develop and reach maturity. This fruit is not typical of ANABP 01Ф and can be elongated, dense and less sweet. This secondary fruit set on 'rat tails' must be removed either at blossom time or at thinning.

Image shows a typical 'rat tail' or secondary flower cluster on ANABP 01Ф

4. Production

4.1 Climatic requirements

ANABP 01Ф appears to have a moderate chilling requirement. This is based on the observation of slightly delayed bud burst and some secondary blossoming on trees at the Manjimup Horticultural Research Institute. The recent winter chill portions accumulated at the Manjimup site was:

2016	2015	2014	2013
76	64	56	62

This is using the Dynamic Chill Model which is the current model used to calculate winter chill. It calculates chill as chill portions based on hourly temperatures. The

optimum chilling temperature starts at 6°C and effectiveness tapers to zero at -2°C and 14°C. Temperatures above 14°C can negate previously accumulated chill.

It is a late season variety that performs well in regions with long warm to hot summers. Evaluation to date has been carried out mainly in Donnybrook and Manjimup (see Figure 5). Fruit over-colour commences to develop early in the season and becomes an intense purple-red when close to harvest maturity.

Trees have also been planted at a number of Australian Pome Fruit Improvement Program sites in the eastern states where fruits have also developed a deep purple-red colour. There have been some differences in the intensity of colour, pattern of colour, time of maturity and shape at some of these sites compared to fruit from trees grown at WA trial locations. Preliminary evaluation has suggested that ANABP 01Ⓓ will be suited to most of these regions.

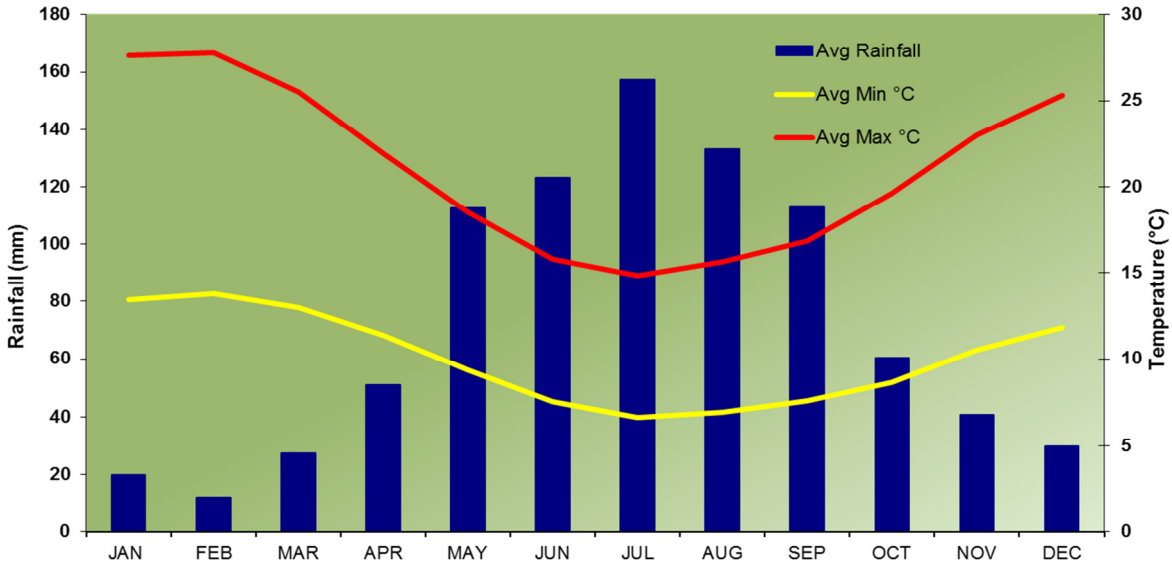

Figure 5 Mean daily maximum temperatures, minimum temperatures and rainfall for Manjimup, Western Australia from 1993 to 2016

4.2 Management strategies

In Western Australia, ANABP 01Ⓓ has been trialed successfully on MM106 and M26 rootstocks.

ANABP 01Ⓓ has wide angled branches with sufficient but not prolific fruit lateral development. The tree shape indicates that it would be suited to a range of rootstocks and tree training systems.

4.2.1 Rootstocks

In Western Australia most apple varieties have historically been grown on MM109, MM104 or MM106 rootstocks and planted at relatively low tree densities. More recently the dwarfing rootstocks M26 and M9 have been used as planting densities have increased.

Trial work at Manjimup, Donnybrook and at Australian Pome Fruit Improvement Program sites in a number of eastern Australian locations has demonstrated that ANABP 01Ф will perform well when grown on MM106 and M26 rootstocks. The choice of rootstock however is dependent on the orchard management system, soil fertility and the history of the planting site. Although ANABP 01Ф has only been trialed on M26 and MM106 it is expected that it will be suitable for production on all of the rootstocks listed above.

4.2.2 Tree training

ANABP 01Ф can easily be trained to produce a well-structured, open tree that allows good light interception and distribution throughout the canopy. This will ensure uniform fruit colour and maturity development within the tree and the continued production of fruiting buds along the fruiting laterals.

ANABP 01Ф has proven productive in trials on a tall spindle system, which is based around a permanent central leader combined with many semi-permanent, simple, single-lined fruiting laterals along the central leader. This indicates that the selection should be adaptable to a range of semi-intensive training systems.

4.2.3 Pollination

Cross-pollination is required for regular cropping. Choose pollinisers that have compatible pollen and an overlapping flowering period. In 2011 a small pollination trial indicated that the pollen of some commercial varieties was more compatible than others (see Figure 6). Royal Gala did not set any fruit and should, together with other Gala types, be avoided as a polliniser for ANABP 01Ф.

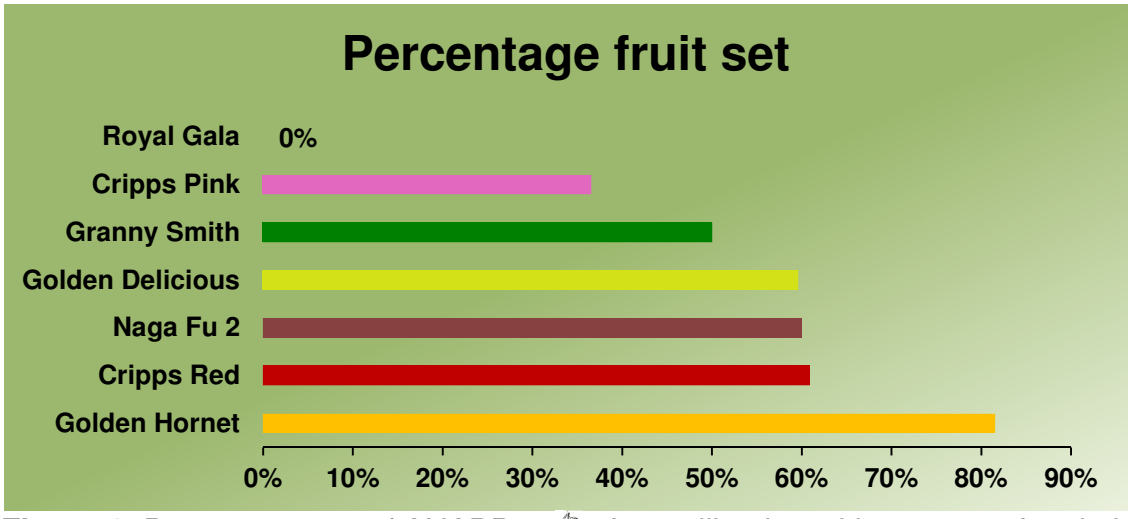

Figure 6 Percentage set of ANABP 01Ф after pollinating with a range of varieties at Manjimup, Western Australia

Flowering times for different varieties are influenced by local climatic conditions and this needs to be considered when selecting suitable pollinators.

In Manjimup, ANABP 01Ф flowering overlaps with the flowering time of Granny Smith, Cripps Pink, Golden Delicious and Red Fuji in most seasons as shown in Figure 7.

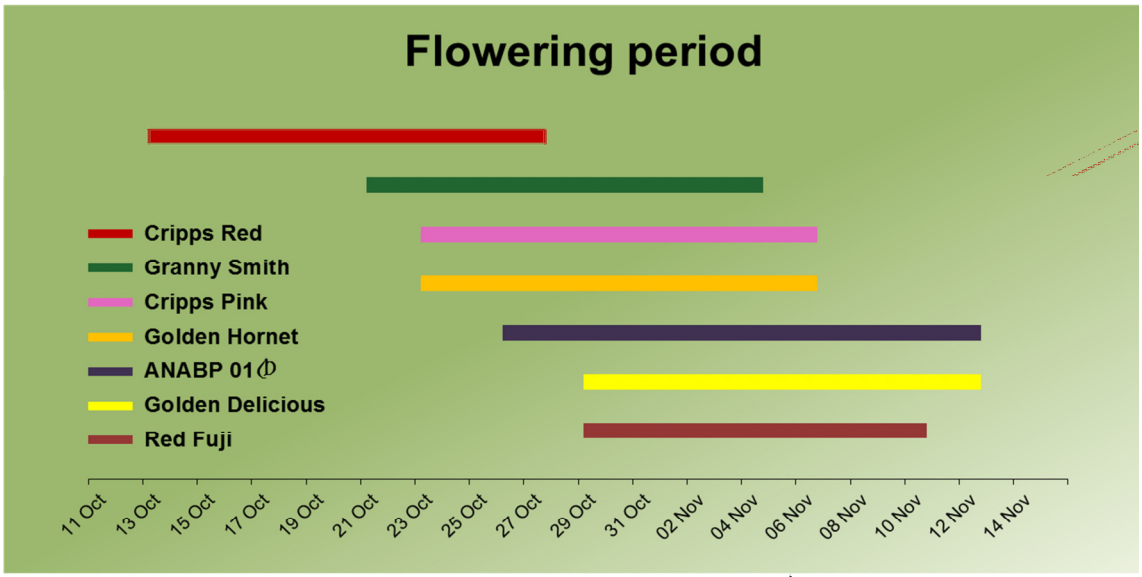

Figure 7. Approximate flowering period for ANABP 01Ф, other commercial varieties and Golden Hornet crab apple at Manjimup, Western Australia

Current trends in orchard planting are towards more intensive production techniques which include the preference for blocks of a single variety. To be able to satisfy the requirement of cross-pollination an alternative to using another commercial variety is to use a crab apple variety. A pollination study conducted at the Manjimup Horticultural Research Institute in the 2013/14 season showed that the crab apple variety Golden Hornet is a good polliniser for ANABP 01Ф. In that trial 82% of pollinated flowers set fruit. Flowering overlap was also good with at least 10 days observed.

4.3 Irrigation

4.3.1 Young trees

In the establishment phase (first two to four years) irrigation needs to provide sufficient soil moisture to allow the tree to grow to its optimum tree canopy space as early as possible.

In Western Australia, irrigation has commenced each season once 25mm of weekly evaporation has been recorded (normally in late spring to early summer). A number of soil moisture monitoring systems and equipment is available and can be used to assist with irrigation scheduling. If tensiometers are used they should be set at 30cm depth and used to schedule irrigation to maintain soil moisture between field capacity[4] and 25–30 centibars throughout the growing season.

[4] **Field capacity**: The percentage of water remaining in the soil two or three days after the soil has been saturated and free drainage has ceased.

4.3.2 Cropping (Fruiting) trees

In mature trees irrigation should be managed to avoid vigorous shoot growth, preventing internal shading and minimising pruning costs.

A number of soil moisture monitoring systems and equipment is available and can be used to assist with irrigation scheduling. If tensiometers are used they should be set at 30cm depth and used to schedule irrigation to maintain soil moisture between field capacity and 40–50 centibars without waterlogging.

In hot dry summers applications of 30mm are required at 10–14 day intervals to return soil moisture to field capacity in medium to heavy soils.

Short periods of supplementary irrigation during heat-wave conditions (35–40°C) have been shown to be beneficial for reducing heat stress.

4.4 Nutrition

In common with all apple varieties ANABP 01Ⓟ requires balanced nutrition to produce a profitable crop. It is a moderately vigorous variety that responds well to routine nutrition management. A regular leaf and soil sampling program which takes into account variations within the orchard is important to achieve this.

Soil analysis can be used to estimate the ability of the soil to supply essential nutrients to the tree, while plant tissue (leaf) analysis measures the current nutrient status within the tree.

By using both soil and plant analysis together, a fertiliser program can be custom designed for orchards and potential nutritional problems may be detected before visual deficiency symptoms appear. A soil pH of between 5.5 and 6.5 (measured in calcium chloride) will ensure that all required nutrients are available to the plant for uptake under normal circumstances.

4.5 Crop load: management and thinning

ANABP 01Ⓟ sets regular crops annually and has not shown any tendency for biennial bearing.

An open tree structure that allows good light interception and distribution throughout the canopy will ensure regular cropping with good fruit size and colour.

Although ANABP 01Ⓟ has produced regular crops the actual fruit set has not been excessive. Trees grown under commercial conditions in Western Australia have not required any chemical thinning to regulate an optimum crop load. Crop load has been managed solely with early hand-thinning that is completed before the end of November.

The thinning target has been seven fruit per square centimeter of limb circumference but in many cases only five fruit per square centimeter has been achieved. Thinning to 2 fruit per cluster has proved to give excellent colour and fruit size. Yields of 56 tonnes per hectare have been recorded on six-year-old trees in the Donnybrook region (Table 1).

It should be noted that cropping potential was compromised by drought conditions experienced at the trial site in Donnybrook in 2010/11. With higher tree densities and more favorable growing conditions higher yields should be achievable. The use of chemical thinning agents will be a future research requirement if fruit set becomes excessive.

Table 1 Yield results from Donnybrook, Western Australia

	t/ha					
Rootstock	**Y1 - 2008**	**Y 2 - 2009**	**Y3 - 2010**	**Y4 - 2011**	**Y5 - 2012**	**Y6 - 2013**
M26	0	0	27.1	22.9	23.9	56.2
MM106	0	0	12.9	20.7	16.9	43.5

Optimum crop load will depend on the orchard management systems and the desired target fruit size distribution for marketing.

5. Fruit quality

5.1 Harvest maturity

ANABP 01® matures early to mid-April in Manjimup, Western Australia, with the potential to be earlier on more dwarfing rootstocks and/or in other regions. Blush colour develops readily as fruit matures with fruit colour darkening a week or two before optimum harvest. No additional chemical treatments are required to encourage fruit colouring or maturation. Comparison with other varieties is shown in Figure 8.

Starch score is the best indicator of harvest maturity. It is important to begin monitoring starch breakdown using the iodine test well before the expected harvest time to ensure the optimal harvest time is captured. Starch scores should be 3 (on a 1–6 scale) at harvest maturity. The conversion from starch to sugar seems to occur slowly giving a longer harvest window (10-14 days) without compromising the fruit quality and storage capabilities. At this stage the over-colour is highly developed and covers 90 to 100 per cent of the skin surface. Background colour is not a useful guide to maturity because fruit are so highly coloured that in many instances background colour is not visible.

Pressure changes slowly over the harvest period. Average pressures at early harvest maturity are between 8 and 10kg. Sugar should reach at least 13 per cent before optimum harvest maturity and can increase to 16 per cent over time. At this stage acid is in the range of 5–7g/L. Fruit mature quite uniformly over the tree and can usually be harvested in one to two picks.

Once fruit has reached the optimum harvest maturity for long-term storage the maturation process is relatively slow so a long harvest window of two to three weeks will allow for multiple picks if required. When fruit begin to develop slight skin greasiness on the tree, the end of the harvest window has been reached. At this stage starch reaches 5 (on a 1-6 scale). Fruit harvested after this stage develops further skin greasiness over time, may crack around the stem, are unattractive to eat and have no effective storage life.

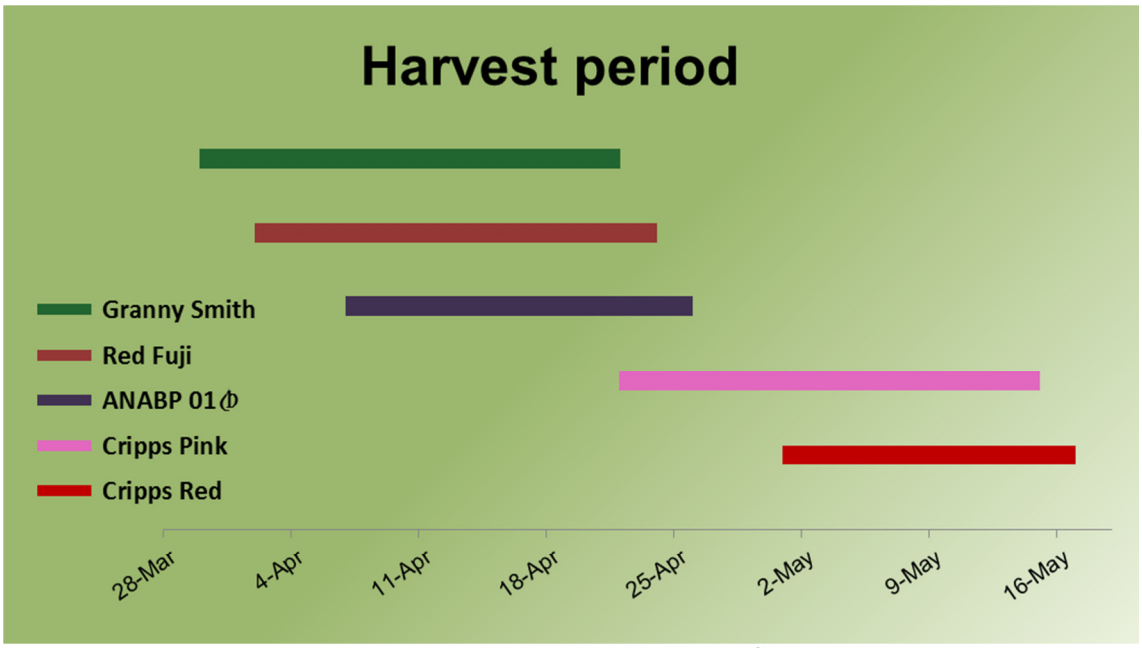

Figure 8 Approximate harvest period for ANABP 01Φ and other commercial varieties at Manjimup, Western Australia

At harvest it was noted that fruit quality defects were minimal and this was also evident at packing when the packout percentage was extremely high.

5.2 Postharvest treatments

ANABP 01Φ has not been found to be susceptible to scald or to bitter pit in storage to date. While this variety has not proven particularly susceptible to storage rots, dipping fruit in a registered fungicide prior to storage is good practice to avoid risk of blue mould, grey mould and bitter rot. Calcium applied after harvest and as foliar applications during the growing season can improve fruit firmness and storage quality.

5.3 Storage

ANABP 01Ф has moderate storage capacity and fruit has shown to be very responsive to being treated with SmartFresh™ (1-Methylcyclopropene) within 7 days after harvest. It should be stored for no longer than 2-3 months in good air storage (at 0–0.5°C) but this can be extended to 3-4 months with treatment of SmartFresh™. In good controlled atmosphere storage (at 0–0.5°C)[5] 6-7 months storage life can be achieved. Fruit stored longer than this may be unacceptable due to the loss of flesh firmness. In controlled atmosphere (CA) storage trials carried out in Western Australia fruit was stored in an atmosphere containing 2.5 per cent oxygen and 1.5 per cent carbon dioxide.

ANABP 01Ф responds to good temperature and storage management. Fruit should be pre-cooled to 2–4°C within 24 hours of harvest. Optimum storage temperature is 0 to 0.5°C.

ANABP 01Ф fruit treated with Smartfresh™ (1-Methylcyclopropene) was shown to maintain higher pressure levels over four months in conventional cold storage. The quality of fruit coming out of CA may also be improved by using this product.

Fruit harvested at a starch score of

- 3 should be stored for a minimum of 3 weeks prior to marketing.
- 4 should be stored for a minimum of 2 weeks prior to marketing.
- 5 are ready for immediate marketing.

Table 2 shows optimal maturity indices for storage of ANABP 01Ф.

[5] There may be capacity to extend storage through the use of registered postharvest treatments

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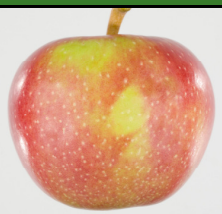
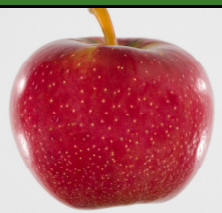
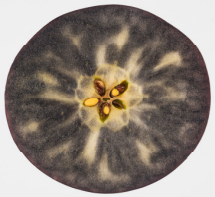
Table 2 Harvest maturity table

Marketing	Starch degradation (1–6 scale)		Background colour		Over-colour		Sugar % (° Brix)	Pressure (kg)	Skin greasiness
Immature Do not harvest		**1:** Full black stain with no clearing in cortex.		Green background		Red	12	>9kg	Not greasy
Long term storage maturity		**2–3:** Clearing extends into the cortex (30%). Core partly clear.		Green to green-yellow background where visible		Purple-red	13	8–9kg	Not greasy
Optimum storage maturity		**3–4:** Clearing extends into cortex (50–60%). Core clear.		Yellow-green background where visible		Purple-red to deep purple-red	14+	7–8kg	Not greasy
Short term storage maturity		**4–5:** Clearing extends to 70% of cortex. Core clear.		Yellow background where visible		Deep purple-red to very deep purple-red	14+	7–8kg	Not greasy
Mature fruit Immediate sale		**6:** Almost entire cortex clear.		Yellow background where visible		Very deep purple-red	14+	6–7kg	Greasiness becoming apparent

5.4 Eating profile

At earlier harvest dates, where fruit are specifically harvested for storage, fruit are too firm and acidic to be eaten immediately and will not be at optimum eating until after they received a minimum of 3-4 weeks of cool storage. At later harvest dates ANABP 01Ⓟ can be eaten with less storage time or straight from the tree and is therefore available for fresh or immediate sales.

ANABP 01Ⓟ has acid levels between 5 and 7g/L (sugar:acid ratio range is approximately 22:1 to 26:1 at a sugar level of 13 per cent and 35:1 to 40:1 at a sugar level of 15 per cent). It is a crisp, crunchy apple with good sugar to acid balance and a pleasant flavour and has similar acid levels to Cripps Pink[6] at harvest.

5.5 Sensory description

ANABP 01Ⓟ has been characterised by experienced apple evaluators as having a balanced flavour with medium to high levels of both sugar and acid at optimum eating maturity. It is distinctly different in colour (dark purple red) to other apples assessed and is generally obloid (flat globose) in shape.

5.5.1 Appearance

Apples are full coloured, with dark purple-red skin over-colour and globose to obloid (flat globose) in shape although some fruit from king blooms can be more conical. The colour most closely resembles Starkrimson and some other Red Delicious strains which have been left to hang on the tree well after maturity. In many instances the background colour of the fruit is not evident as fruit are completely coloured. Where the background colour of ANABP 01Ⓟ is evident it ranges from green through green-yellow and yellow depending on the stage of maturity. Fruit have moderate levels of bloom and distinctive lenticels which are prominent, especially after they have been washed and brushed (see Figure 9).

Figure 9 ANABP 01Ⓟ showing lenticel prominence

[6] Cripps Pink apples of an appropriate quality may be sold using the trademarked brand name Pink Lady™.

5.5.2 Taste

ANABP 01ⓟ has a good balance between sugar and acid, with distinct sweetness, medium acidity and a slight aroma. It has moderate to high crisp and crunch, and is firm and juicy with moderate to high flesh density.

5.6 Product category

The eating quality and appearance attributes of ANABP 01ⓟ are very acceptable to many consumers and it is envisaged that the unusual appearance presents significant opportunities for this variety in both local and overseas markets. The unique colour and distinctive lenticels combined with good eating characteristics will provide a distinctively different experience for apple consumers.

Based on current storage information the market window for this variety is expected to be from May to October for Southern Hemisphere fruit.