Future Orchards 2012

Fruit colour

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The colour of the skin is an important quality attribute of many mature fruits. Colour development is in principle genetically determined, but in addition, cultural and environmental factors play a significant role. A sufficient supply of sugars is essential for pigment synthesis.

Pigments in plants can be divided in three groups:

1. Chlorophylls, responsible for the green colour of the leaves.
2. Carotenoids, compounds that have a colour range from yellow, via orange to red.
3. Anthocyanins, red coloured substances belonging to the flavonoids.

The pigments giving the apple the red colour blush belong to the Anthocyanin group of compounds. In apple, light and temperature regulate these activities.

During the greater part of the season the apple fruits are green, at the end of the season the different pigments undergo changes. The red and yellow colours become more visible due to disappearance of the green colour by degradation of chlorophyll, but are also intensified by new synthesis of anthocyanins and carotenoids.

The emergence of the red blush on some cultivars during ripening is not the only period of anthocyanin formation in the apple. The first peak occurs early in fruit development when cell division is still going on; resulting in intensely red coloured fruitlets for a short period.

Leaf number per fruit is an important factor involved in colour development in the apple skin. A sufficient accumulation of sugars in or near the fruit is essential. At least 25 to 40 leaves per fruit (depending on the variety) have been found to be needed for the production of high quality, including sufficiently coloured, fruits.

For a number of fruits, such as apple, peach and pear, direct light is required for anthocyanin synthesis but cherry and plums don’t need light for red colour formation.

With respect to light quality it has been shown that ultraviolet light and blue violet light are important for fruit colouring. The usefulness of ultraviolet lights explains the production of well coloured fruits at higher altitudes. Although the usually lower night temperatures at greater altitudes can also flavour blushing due to lower respiration rates during the night.

The combination of sunny days and cold nights during the period shortly before harvest is particularly important in stimulating red-colour development. This is proven in research done under controlled environmental conditions on apple trees.

Cooling down apple trees by micro sprinkler irrigation under Spanish conditions, during the last week before harvest, increased the anthocyanin content of the skin (better colour). The inside of the fruit has to be cooled down to have an effect. Spraying with 1000-2000l/ha will have very little effect to cool down the inside of fruit.

High Nitrogen contents reduce fruit reddening. On the other hand N deficiency favours colouring. The effect of high N may be indirectly due to a delay of ripening and consequently to a delay in the disappearance of the chlorophyll, but alternatively may be based on more shade cast on the fruit by the higher leaf densities.

Potassium is regarded as a positive factor in the fruit colouring. Phosphorus increases the concentration of flavonoid compound (this gives the red colour). Although spraying products like Seniphos and MKP can have a positive effect on fruit colouring, in some years it is inconsistent.

Reflective cloth is a good product to use to get more light in the bottom part of the trees but it should not be considered as a substitute for poor pruning and thinning. For the desired red colouring of most apple varieties, light must strike the fruit and this is another reason for good pruning. To get the required light on the fruit, summer pruning is sometimes necessary.

Extended periods of 30°C and above reverse the accumulation of anthocyanins (red coloured substances) and may cause sunburn.

In situations where natural colouring of fruits is insufficient to meet market requirements, growers sometimes use sprays of Ethephon to enhance colour. Ethephon does increase anthocyanin formation, but also causes a number of unwanted side effects, such as increased pre-harvest drop, advanced ripening, increased fruit-flesh softening and poorer storability. Enhanced fruit drop can be counteracted by adding auxin to the ethephon, but the other drawbacks remain.

One of the FO2012 objectives is to improve Australian apple and pear grower's attitude to intensification, production quality, world competitiveness and the need to understand profitability.

Replacing the lesser coloured apple varieties with better, high coloured strains, e.g. Rosy Glow, Ruby Pink, Buckeye Gala, will have the greatest impact on colouring in the orchard and will give higher yields if planted in high density orchards.

Fruit size.

To evaluate the effect of cultural treatments or environmental conditions on fruit production, studying fruit growth curves can be very helpful.

However, diameter measurements are relatively imprecise for following of fruit growth. Fruit enlargement is not the same in all directions. But using a graph with the projected size will give an insight into the process and rate of fruitlet growth. With technology like fertigation you can influence the growth to a certain extent.

When monitoring fruit size continuously electronically you will notice that the increase in fruit size occurs at night and early morning. While during the day, especially on dry, sunny days, due to water loss actual shrinkage of fruit can be observed.

Water monitoring and maintain sufficient soil moisture is very important to maintain fruitlet growth.

Light is the key environmental factor that effects fruit growth, and for which the level can change remarkably within a tree canopy. Studies carried out by Tustin et al. (1988)

Fruit shape.

Fruit shape is generally determined by fruit species and cultivars but the cultural and environmental factors play an important role as well.

It is long been known that small seed numbers per fruit are associated with more elongated fruits.

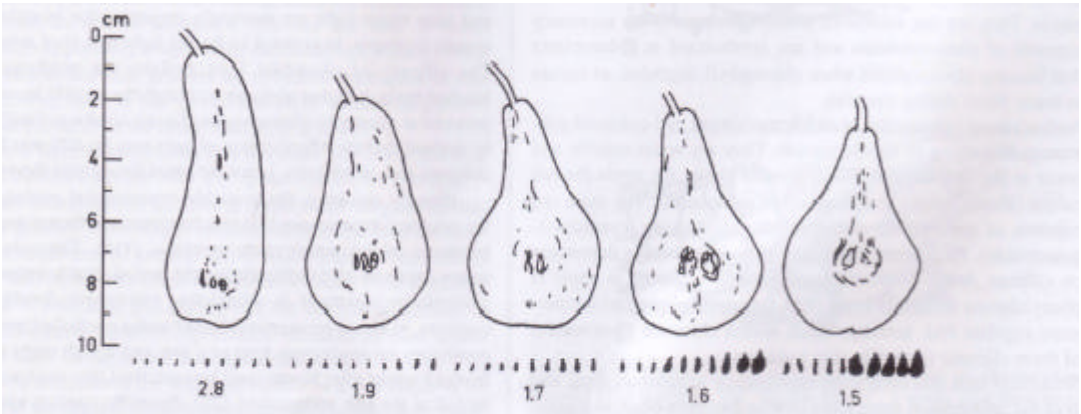
The role of seeds in determining fruit shape is ascribed to gibberellins produced by seeds that control the growth of the cortex tissue. This explains why an uneven distribution of seeds in the fruit is associated with deformed fruit.

The cooler the period after bloom is, the more elongated the fruit shape is.

The fruit on the north side of the trees is normally more flattened.

The fruit shape is mainly determined by temperatures in spring, in particularly during the period immediately after full-bloom.

The relationship with seed numbers is also determined in the same period.



Shape of pear fruits cv. 'Conference' of similar weight but with differently developed seeds. Figures below denote the L/D ratio (from Schander,

Seed development

Seed development is essential for fruit set, but the number of seeds per fruit is considered to have only a small impact on fruit growth.

The leaf-to-fruit ratio has by far the most influence on fruit growth rate.

Pruning, chemical thinners and selective hand –thinning that selects for the “king” fruit typically improves the length/diameter of the fruit.

Good irrigation and good nutrition management is of course very important for your fruit size.