All About Almonds
Fact Sheet 05 – Pit Hardening

Welcome to the fifth edition of "All About Almonds", Pit Hardening. Fact sheets are distributed to almond growers via email and fax, in addition to being made available for download from the levy payers' access page on the ABA website: www.australianalmonds.com.au (follow links to the login section of the "industry" page).

The information provided in these fact sheets should be kept confidential.

Background

The almond fruit is classified as a drupe (or stonefruit) where the hard, lignified stone or pit is derived from the ovary wall of the flower. Unlike most drupes, the outside fleshy mesocarp (husk) is dry and leathery, not for human consumption, and does not increase in size following pit hardening. The absence of any increase in fruit size after pit hardening results in an exponential fruit growth curve (Figure 2) rather than the sigmoid curve of a traditional stonefruit variety such as an apricot.

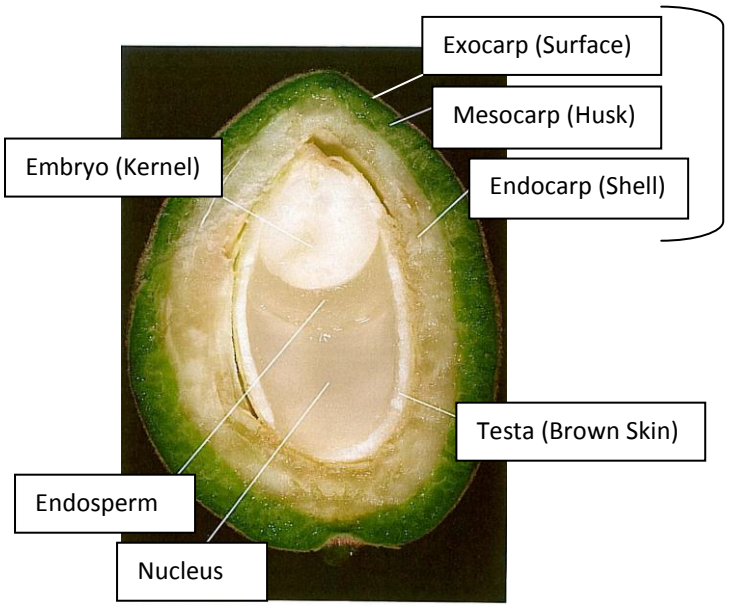

Figure 1. Developing almond fruit (adapted form Ohlendorf, 2002).

Following pollination, fertilisation and fruit set, the early stages of almond fruit and shoot growth occur. The two processes almost occur simultaneously and compete for water, applied nutrients and stored tree reserves. Consequently, it is important to have an understanding of the anatomy of an almond fruit (Figure 1), the various fruit development stages, the interpretation and assessment of the fruit stages and how to correctly manage irrigation and fertiliser applications to achieve the optimum result.

Almond Fruit Development

The development of the almond fruit can be divided into as many or few stages as you like, depending on how complex you make it. In general, the almond fruit has two stages of growth (Figure 2):

- **Stage 1** – Fruit growth where the seed and hull reaches its full size. The majority of cell division and cell expansion normally occurs from 0 to 6 weeks and 6 to 12 weeks after flowering, respectively (Hawker & Buttrose, 1980).

- **Stage 2** – Kernel growth where within the fruit, the embryo (edible kernel) grows and reaches its full size. Following which, the embryo looses moisture and dry weight increases.

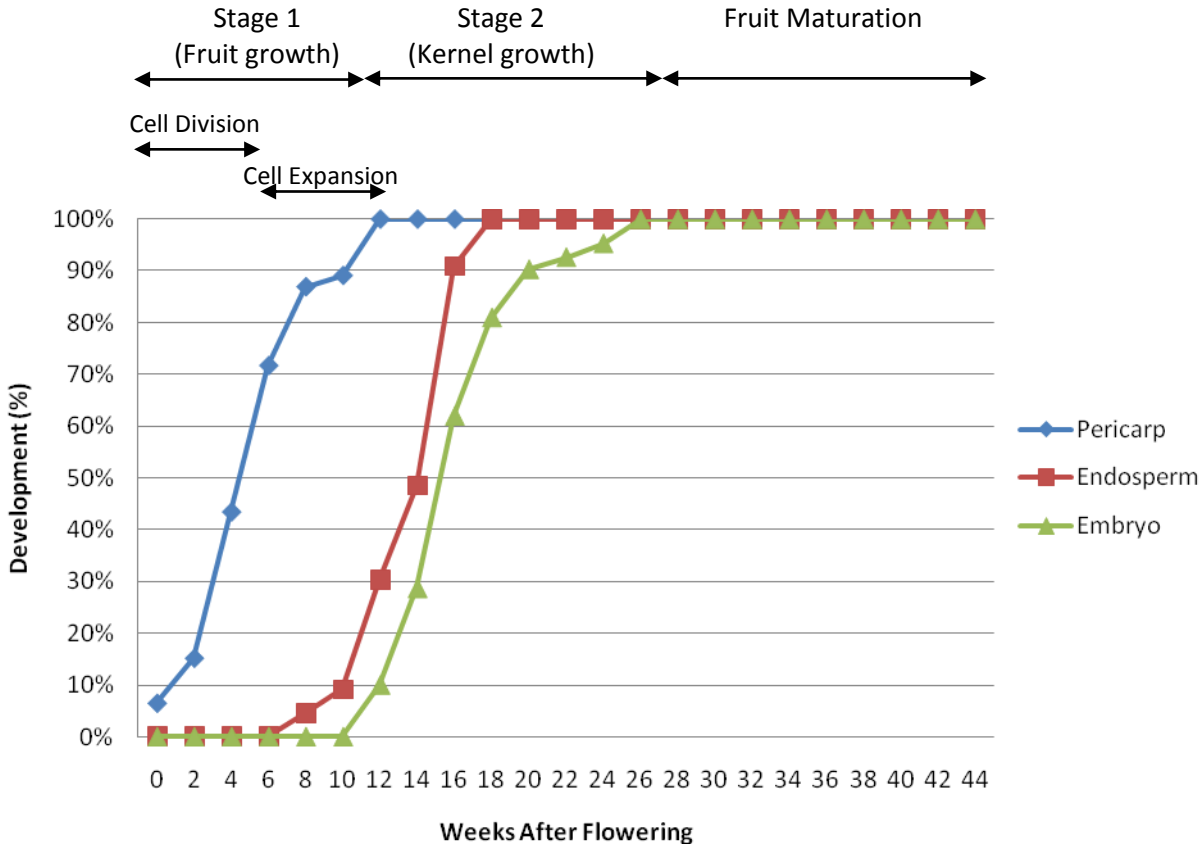

Figure 2. Almond fruit development (adapted from Hawker & Buttrose, 1980).

Pit Hardening

The transition between Stage 1 and 2 is critical and commonly referred to as pit hardening. By definition, pit hardening is the lignification and hardening of the endocarp (shell), the inside layer which surrounds the seed (kernel). Pit hardening begins on the inner surface of the shell cavity and at the end opposite to the stem attachment (Kester *et al*, 1996).

In the field, pit hardening is best assessed with the use of a sharp knife or razor blade and cutting the fruit either length or across ways. To assess the very early stages of pit hardening it is best to cut the fruit longitudinally starting from the opposite end of the stem and finishing with a fruit like that in Figure 1. Due to the lignification process that has begun, the operator should feel a slight

resistance at the endocarp (shell) once passing the blade from the mesocarp (husk) through to the endosperm (translucent gell).

The period following the early beginnings of pit hardening is critical in optimising the potential of the developing kernel. The theoretical potential has been established following the completion of cell division and expansion. However, whether this potential is accomplished is yet to be determined. Water and fertiliser management must be precise as not only are you developing the fruit but also new shoot growth and creation of fruiting positions for next seasons crop. Failure to do so will result in small, pinched and shrivelled kernels and lack of vegetative growth, fruiting positions and lower yield for the following season. In combination with these critical phenological periods, the increase in temperature and evaporative demand also occurs. Consequently, heading into early pit hardening of Non-Pareil (normally the second week in October at the CT Trial), the irrigation program undergoes a two staged increase in crop factor from the last week in September. That is, a 60% increase in crop factor initially, followed by a further 20% increase in crop factor.

If pit hardening is missed in the field, it will usually be highlighted with the monitoring of crop water use with irrigation scheduling equipment. This period will normally show a significant increase in water use. The increase in crop factor leading into pit hardening also coincides with the increase in soil temperatures, subsequent introduction of urea and increase in fertiliser applications.

Early pit hardening till the completion of embryo growth must be given maximum attention as it consists of approximately 33% of seasonal water applications and approximately 50% and 30% of nitrogen and potassium applications respectively.

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