

## *Harvesting and Processing of Almonds*

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Originating in Central Asia, different almond varieties have been disseminated around the world and have been introduced in the United States of America by the Christian missions. Since then, the central valley of California has become the principal almond-producing area of the world with around 50% of the world's production. Other areas that are currently main producers are Oceania (Australia), the Mediterranean (Spain, Italy), and Asia (China, Iran, Turkey).

Hot, dry summers and cool, rainy winters are the ideal conditions to get the maximum yield from the almond trees. The *Prunus dulcis* or *Amygdalus dulcis* (technical names for the almond tree) will bloom between February – March in the northern hemisphere and between July – August in the southern hemisphere, and will ripen 5-6 months later. Cold temperatures during blossom should not go below 2° - 6°C to avoid damages.

In California, there are more than 30 almond varieties and not all of them blossom at the same time. Ten of these varieties represent over 70% of production, the majority being classified as Nonpareil, Missoni and California. In Spain the main varieties are Marcona, Largueta, Guara, and Valencia. It's worth noting that Valencia is not a variety itself but is a group different almond varieties.

As the almond trees need to be pollinated, the orchard rows will be comprised of trees of compatible varieties.

The orchard rows are spaced about 4-6m apart with about 400 trees/ha. This is possible due to an effective irrigation system that can produce a better crop yield not only for the current crop, but for the following crop year as well.

As other fruits from the *Prunus* genus, almonds are considered a fruit stone. It grows within a shell covered by a hull that does not develop completely until the latest stages. When the fruits start ripening, the hull starts to open. By the end of the summer the almonds are expected to be completely matured. As an indicator the two halves of the hull start splitting until they are fully bent back and the shell is visible.

The **harvest** will occur between August – October in the northern hemisphere, and between February and April in the southern hemisphere, depending on the moisture level of the nut. Harvesting can be done manually or mechanically by shaking the limbs or the tree trunk to knock the nuts out of the tree. If harvesting is carried out when the hull starts splitting, then the risk of attack by the naval orangeworm, the predominant almond pest, would decrease. The moisture content of the nuts when they first fall from the tree will be higher and the nuts must be dried on the orchard floor for 7-10 days. However, the longer the nut lies on the floor, the higher the potential risk of pests, rain damage or other disease. If harvesting is carried out when the hull's halves are significantly opened then the moisture level will be lower and the time the almonds need to dry on the orchard floor will be reduced to 4-7 days.

Once on the orchard floor, nuts are swept into rows to be collected and stockpiled while waiting to be hulled and shelled. **Stockpiling** is a critical stage of the post-harvest. The risk of aflatoxins-producing mould growth increases if the moisture of the in-hull almonds exceeds ~ 9%. Tarps used to cover the piles can be removed during the day and pulled over again at night to avoid condensation and an increase in moisture. Almonds in stockpile are prone to be attacked by pests so good hygienic conditions on the orchard floor are essential to reduce the risk of pests by removing mummies (desiccated nuts left from the previous harvest), rotten hulls and other debris. Fumigation can also be carried out while the nuts are waiting to be hulled and shelled. Phosphine is the fumigant that is currently used, replacing methyl bromide, as this has been banned in the EU.

Another risk at this stage is concealed damage that can be produced if the nuts are exposed to high temperature, and humid storage conditions. For instance, a summer rain while the nuts are stockpiled and fumigated will make those nuts more susceptible to a dark brown to black discoloration in the centre of the nut. These nuts cannot be detected by any screening and if the concealed damaged is extreme the flavour of the almond will be affected.

Almonds will be **hulled and shelled** prior to being sent to the factory where they will be processed further. There are 2 types of hullers: hulling cylinders (used for wetter

hulls) and shear rolls (only for dry hulls but better for removing tight hulls). The huller will remove the hull leaving the in-shell nut and also helps remove twigs and foreign matter coming from the fields. For shelling the almonds, shear cracking rolls can be used. During these processes up to 30% of the kernels could suffer damages such as scratching, chipping, or breaking. The factors to be considered to avoid such damages on the kernel are: roller speed differential, almond orientation, roller's clearance.

Then a series of vibrating screens and aspirators will help to separate hulls, unhulled, in-shell and shelled nuts and fine debris. The unhulled and in-shell nuts will pass again through the huller and sheller. The kernels will undergo further cleaning, and grading process passing through more vibrating screens, and aspirators. Depending on the factory the cleaning could involve x-ray machines, laser sorters, aspirators, magnets, metal detectors, and manual sorting. Further processes could also be blanching, roasting, flaking, etc. Almonds will then be packed in 25 lbs, 50 lbs, 2200 lbs. cartons.

Prior to shipping, the quality of almonds coming from USA is inspected by a USDA inspector. By the time the almonds should arrive in the UK they have been already fumigated with aluminium phosphide and ready for distribution.

#### References:

- FAOSTAT (<http://faostat3.fao.org/browse/Q/QC/E>)
- Fruits and Nuts, Volume 4 of Genome Mapping and Molecular Breeding in Plants, Chittaranjan Kole.
- Almond Production Manual. Warren C. Micke, University of California (System). Division of Agriculture and Natural Resources. UCANR Publications, 1 Jan 199.
- Almond Board of California. <http://www.almonds.com/processors/processing-safe-product#tc-stockpiling>.