



ALL ABOUT ABOUT ALMONDS

HARVESTING IN ADVERSE WEATHER TO MAINTAIN QUALITY DURING STORAGE

Key points

- Moisture management is key to maintaining kernel quality during storage.
- Harvest decisions require a daily watch on weather forecasts. Best drying results are achieved when days are long, sunny and warm, low humidity and good air circulation.
- When rain is imminent, wait until the rain has passed. The best place for an almond is to remain on the tree where air can circulate and help dry the fruit more quickly.
- Only start the harvest process when the forecast allows for the process to be completed without the fruit getting wet.
- Do not windrow wet fruit without further treatment as this will create the ideal conditions for fruit spoilage.
- Back sweep windfalls to avoid mixed nuts.
- Manage irrigation and do a first sweep after shaking to avoid nut absorbing moisture around drip irrigation lines.
- Conditioning, finish drying, or mechanical drying will assist in removing moisture when adverse weather persists.

Introduction

Stored almonds have the potential to spoil from naturally occurring pests and diseases. Fruit moisture is one of the critical factors that influence the potential for spoilage and food safety risks during storage. To minimise this potential almond kernels need to have a moisture level of 6% or less when they go into storage. The arid climate in Australian almond growing regions with low rainfall, high evaporation, and hot summers provide optimal drying conditions for harvest from

mid-February to mid-April. Untimely rain during harvest can slow down the harvest process and make it difficult to achieve the required moisture level.

This fact sheet aims to provide a framework to help growers make these difficult decisions during harvest when they are faced with adverse weather so that food safety risks are minimised, and maintaining the Australian almond reputation for high quality nuts.

The harvest process

The aim of harvest is to remove all the fruit, maintain crop quality, and deliver the crops as quickly and cost-efficiently as possible without damage. For almonds the harvest process is complicated and done slightly differently on every property. However, the process can be summarised into five main steps:

1. Shaking the fruit off the trees (Figure 1),
2. Drying the fruit on the orchard floor (Figure 2),
3. Sweeping and windrowing the fruit (Figure 3 and 4),
4. Conditioning windrows (Figure 5),
5. Gathering (pick-up) the fruit from the orchard floor (Figure 6), and
6. Stockpiling and fumigating the fruit under cover until received by the processor (Figure 7).

Some of these steps may be repeated more than once depending on the season, orchard layout and operations, and available machinery. For example, sweeping may require more than one pass to remove fallen fruit from the drip-line and removing fruit from mounds. The best results are achieved when the orchard and weather conditions are dry.

When to start harvest

Once nuts have reached [maturity](#) the decision to begin harvest is a balance between reducing fruit moisture as



Figure 1. A harvest machine is used to shake fruit off trees once they have reached maturity and have sufficient moisture and weight to assist with shaking. If rain is imminent, do not shake. The best place for almonds is to remain on the tree where there is good air circulation around the fruit.

harvest David Doll (The Almond Doctor) provides his insights ([click here](#)).

After shaking from the tree, the fruit dries on the orchard floor before it is swept, windrowed, collected and stockpiled. Best results are achieved when drying occurs on fine-warm sunny days, with low humidity and good air circulation.

Once harvest has begun, trees may need some time to dry before shaking particularly after rain events or in the morning after a heavy dew. Fruit will need to be swept off drip irrigation lines as soon as possible to avoid absorbing moisture and may require a dedicated 'first sweep' if the conditions aren't ready to windrow straight away.

Back sweeping to manage windfalls

Adverse weather often results in nuts dropping on the ground before trees are shaken which is referred to as windfall. If there is a high number of windfallen nuts before Nonpareil has been harvested there is the potential for "mixed nuts" where the pollinator varieties mix in with Nonpareil on the orchard floor. The practice of back sweeping is often used to separate the pollinator windfalls by bringing them back under the tree row before shaking the Nonpareil trees.



Figure 2. Drying the fruit on the orchard floor typically for 3 to 10 days after shaking helps reduce the moisture levels in the fruit. Adequate light penetration is needed for the fruit to dry between the tree rows.



Figure 3. A first sweep (and blow) removes nuts from the tree base and drip-line so they don't get wet from irrigation.



Figure 4. After drying the fruit on the orchard floor, a second pass with the sweeper will form windrows in the middle of the row. Sweeping should only be done when the soil is dry to avoid excess dirt in the windrows.



Figure 5. Conditioning of the windrow will help remove dirt, sticks, leaves and other trash from the windrow and facilitate the drying process.

Avoiding moisture

Humidity, morning dew, intermittent showers, and rain, are all sources of free moisture which can be absorbed by the fruit at any stage of harvest. This can cause delays and may require additional measures to assist the drying process to get the kernel back down to 5-6% and hull below 12%.

It is important to keep a daily watch on the [weather forecast](#) to make sure there is enough time to complete each step of the process or to be ready to put in place additional measures.

If rain is imminent the best place for almonds is to remain on the tree where there is good air circulation around the fruit. Fruit on the tree will dry out quicker and avoids nuts getting wet by laying on damp ground or water pooling on the orchard floor. If rain is forecast, the best course of action is to 'wait' until the rain has passed before starting to shake any more trees.

Showers or small amounts of rain, 0-6mm are likely to only dampen the surface of the fruit, or the outside of windrowed nuts. As the amount of rain, or frequency of showers, increases the potential for moisture to be absorbed by the fruit also increases.

Small amounts of moisture should dry out relatively

quickly with a return to dry conditions and air circulation. However, if a rain event is followed by cool, still, humid conditions or further rainfall the drying time is extended. Therefore, additional measures will be essential to assist the drying process such as conditioning and turning fruit over or spreading onto a drying area outside the orchard. The longer the fruit stays moist and in the same position, the higher the food safety risk.

Things to consider when harvesting during adverse weather:

- If rain is imminent, it is best not to start harvesting unless the weather conditions allow the process to be completed without the fruit getting wet. Before shaking ensure there is adequate time to dry the nuts and pick them up before it rains.
- If rain is imminent and nuts have been shaken, it is important to do a first sweep (blow) to remove nuts from the tree base and the drip-line as it is harder to remove nuts from these areas when they are wet. Leaving the rest of the shaken fruit spread-out on the ground will help with air drying.
- Sweeping should only be done when the soil is dry to avoid excess dirt in the windrows.



Figure 6. Fruit is picked-up from the orchard floor and removed from the orchard for drying or stockpiling.

To accelerate the drying process, many growers 'condition' the windrow which is the process of picking up the existing windrow and putting it back onto the orchard floor in the same location. Conditioning the windrow will remove most of the trash as well as turning the nuts over, exposing moist surfaces to ambient air (Figure 6). This process becomes most important when there are high levels of moisture needing to be removed and in poor drying conditions.

Conditioning can be done using specialised equipment but can also be achieved by removing the shoot from a standard harvester (pick-up).

Drying within the orchard

Drying within the orchard is common practice and helps when there is inconsistent drying on the tree, allowing a few days (typically 3-10) for shaken fruit to dry on the orchard floor. The main consideration in achieving effective drying within the orchard is how much sunlight reaches the orchard floor. Light interception by the trees should not exceed 80% as this means that 80% of the ground will be covered by shadows at solar noon and is not effective for drying nuts. The higher the light interception by the tree (i.e. more shading on the ground) the longer it will take for the nuts to dry on the orchard floor, especially in still conditions.

Light interception may be reduced by large tree growth; east-west tree row configuration; undulating landscapes of hills and swales; late season fruit maturity and harvest; unhedged trees.

Things to consider when drying within the orchard:

- Less than 80% light interception (shading) at solar noon is recommended to have enough light to dry the fruit between the tree rows;
- Fruit in orchards with high light interception (shading) may need additional measures to assist the drying process e.g. finish-dried on a drying area or mechanically dry.

- Do not windrow wet fruit without further treatment as this will create the ideal conditions for fruit spoilage.
- In cooler temperatures (below mid 200°C) consider temporarily reducing irrigation application during harvest to reduce orchard floor moisture.

Conditioning

The process of shaking and sweeping not only brings almonds into a windrow, but it also brings in other foreign material from the orchard floor such as weeds, dirt, stones, branches, mummy nuts and leaves, commonly referred to as trash.

Removing surface trash (leaves, sticks, branches, weeds etc) during pre-harvest preparation will in-turn reduce the amount of trash collected in windrows and facilitate the harvest and drying process.

Trash collected in windrows is usually removed by the harvester when it is picked up. However, in wet conditions trash will hold moisture and sticks to the fruit adding to the total volume of material that needs to dry off before being picked up and stockpiled. This will in turn increase drying times and costs more in fuel to move the product around.



Figure 7. Nuts are removed from the orchard and windrowed into dedicated drying areas where there is better light interception and wind movement, so the nuts dry faster reducing drying times from 10 days in the orchard to four days on the drying area depending on weather conditions.

Finish drying on drying areas

Finish drying on drying areas is becoming more common practice in Australia and is reported to reduce the time to get nuts from in the orchard into storage within five days despite adverse weather (Figure 7).

A drying area is a designated area that is maintained weed free specifically for finish drying the fruit. The open area has better light interception and wind movement, so the nuts dry faster reducing drying times from 10 days in the orchard to four days on the drying area depending on weather conditions. Given the open area windrows may be wider and higher as the only constraint is the width of the spreading kart given there are no trees, branches or driplines to work around. This also makes the pickup process a lot faster than in the orchard. The height and width of the windrows may need adjusting according to the forecast conditions.

Benefits of finish drying:

- Provides an option to dry almonds during adverse weather for orchards with high light interception (above 80%) resulting in shading from trees;

- Harvest is recommended to start earlier to minimise possible damage that may occur with double handling (especially with Nonpareil);
- Post-harvest irrigation and fertigation can recommence sooner without the risk of wetting nuts as the fruit is taken out of the orchard earlier;
- Cleaner product with leaves and sticks removed through the stick jack when moving to the drying area;
- A viable alternative to drying when conditioning or mechanical drying methods are inaccessible.

Mechanical drying

Mechanical drying involves forcing air through the almonds using various methods including fans, dehydrators, controlled storage environments. This is explained further by Michael Coates in his practical solutions presentation as part of the [ABA food safety and quality webinar](#).



Figure 8. Almonds are stockpiled on-farm and covered with taupes to protect from the rain.



Figure 9. Nuts stored under cover allows nuts to dry on farm protected from the rain.

On-farm storage

More growers are investing in on-farm storage facilities under temporary (e.g. taupes, Figure 8) and permanent structures (e.g. sheds, Figure 9). This allows flexibility in timing for delivery to processing facilities which may be delayed during wet seasons. It is important that these areas provide protection from rain and moisture getting into the fruit. Good maintenance of structures (both temporary and permanent) is key to avoid moisture getting into the fruit through holes or overflowing drain pipes etc. Consider the site location when establishing on-farm storage areas to avoid surface water ingress underneath the stockpile from pooling due to uneven surfaces or positioning in low lying areas. Orientation is also important, allowing maximum light interception particularly for season drying when

mornings have heavy dew. Contact should be made with processors to confirm pick-up arrangements. If a delay is anticipated requiring stockpiles to remain on-farm for any length of time, consideration should be given to fumigating stockpiles to avoid spoilage. This should be done as soon as possible.

DISCLAIMER

Any recommendations, suggestions or opinions contained in this publication do not necessarily represent the policy or views of the Almond Board of Australia. No person should act on the basis of the contents of this publication without first obtaining specific, independent, professional advice. The Almond Board of Australia and contributors to this resource may identify products by proprietary or trade names to help readers identify particular types of products. We do not endorse or recommend the products of any manufacturer referred to. Other products may perform as well as or better than those specifically referred to. Horticulture Innovation Australia Limited (Hort Innovation) and the Almond Board of Australia (ABA) makes no representations and expressly disclaims all warranties (to the extent permitted by law) about the accuracy, completeness, or currency of information in AL19001 - Australian almond industry innovation and adoption program. Reliance on any information provided by Hort Innovation and the ABA is entirely at your own risk. Hort Innovation and the ABA is not responsible for, and will not be liable for, any loss, damage, claim, expense, cost (including legal costs) or other liability arising in any way, including from any Hort Innovation or other person's negligence or otherwise from your use or non-use of AL19001 - Australian almond industry innovation and adoption program, or from reliance on information contained in the material or that Hort Innovation provides to you by any other means.

Hort
Innovation
Strategic levy investment

ALMOND
FUND

This project has been funded by Hort Innovation using the almond research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Almond Board of Australia ABN 31 709 079 099

1801 Bookpurong Road, Loxton, S.A. 5333 | admin@australianalmonds.com.au | +61 (0)8 8584 7053

