December 2024

Best-practice guidelines to prevent bruising in apples during harvest and transport to the packhouse

Recommendations from a project led by Willie Kotze, Manager: Technical Support at Dutoit Agri, and co-funded by Hortgro.

Before harvest

Falling fruit hit other fruit, resulting in significant bruising. Some cultivars are more prone to falling. For example, short stems can lead to growing Cripps Pink, Cripps Red, and Fuji apples pushing each other off the tree.

Correct thinning reduces the risk of push-offs. Some plant-growth regulators can also decrease push-offs by stimulating stem elongation in short-stemmed cultivars.

In addition, the stem attachments of red apples can weaken as fruit maturity advances, increasing the risk of natural drop. Preharvest applications of aminoethoxyvinylglycine (AVG) or 1-methylcyclopropene (1-MCP) retard ripening and help prevent natural fruit drop.

Apples on long, flexible branches are more likely to bruise or drop in strong winds. Although wind reduction is not usually a primary reason for protective netting in apple orchards, nets will mitigate the effect of wind.

High turgor predisposes apples to bruising. Therefore, irrigation should be withdrawn before harvest. The timing of withdrawal will depend on the soil type, but it could be up to a week in heavy soils.

For the same reason, apples should not be harvested within 1–2 days following more than 10 mm of rain.

Uneven roads greatly increase the probability of bruising. Before harvest, all roads used by bin trailers and trucks must be repaired and levelled. In winter-rainfall regions, ridges to divert stormwater can be levelled until after harvest.

Pickers

Results at Dutoit Agri showed that pickers are responsible for only 3%–5% of bruises. Nonetheless, unskilled or careless pickers can cause significant damage. Therefore, team leaders should be trained annually and then be responsible for training their teams.

Novice pickers should be closely supervised, as they are more likely to damage fruit, especially when trying to keep up with experienced pickers.

Apples must be picked using the correct action of twisting rather than pulling. A picker must pick a single fruit with one hand, transfer it to the other hand, and gently place it in their bag. They should never hold two apples against each other in one hand.

Pickers must avoid bumping or pressing their bag against the ladder or any other hard surface. Bags containing fruit must never be placed on the ground — if a picker has to storeh a bag of fruit temporarily, it's better to hang it from the tree. A picker must never run while holding a bag of fruit.

The bottom of a tree should be picked before the ladder is pushed into the tree. Ladders must be moved carefully so the fruit is not bruised or knocked off. This is especially important in cultivars that are picked more than once.

Pickers must never pull branches while reaching for fruit, as the rebounding branches can drop fruit.

Lastly, pickers must empty their bags gently into the bins, taking care not to bump or press the bags against the side of the bin.

Do not overfill bins. The fruit must not protrude beyond the top of the bin once the apples have settled. When bins are stacked, the base of one bin can cause significant damage if it presses down on fruit in the bin below.

Monitoring pickers

Before picking starts, all fallen fruit must be removed from the orchard. Then, team leaders can inspect the fruit on the ground for each picker to ensure potential Class 1 fruit aren't being dropped or knocked off. Continuous monitoring facilitates rapid corrective action.

In addition, pickers should be approached randomly and asked to empty their bags into a box, which is set aside to evaluate damage. This supplements quality-control sampling from bins, ensuring each picker is individually assessed.

Bins

Bins must be in good condition. For example, wooden bins with loose slats can buckle when handled, leading to increased fruit damage. Old wooden bins also tend to have rough surfaces that damage fruit.

Plastic bins are less likely to bruise apples than wooden bins due to the innate natural frequencies of the materials. The higher frequency of plastic results in a lower risk of bruising.

Research by Dutoit Agri has demonstrated a significant reduction in bruising when a commercially available bin liner is used.

Bins trailers

Bin trailers must have rubber inserts at the couplers to dampen movement. The trailers must be level — the risk of bruising increases when forklifts lift even slightly tilted bins. For this reason, the tyres on a bin trailer must all be the same size.

Tyres must also be of good quality, and tyre pressure should be 2–3 bar. Check tyre pressure once or twice weekly when bins are empty. Tyre pressures that are too high lead to more severe impacts on fruit.

The bin trailer must move at 5–6 km per hour or walking speed. Drivers must be discouraged from increasing their speed on tarred farm roads, as this increases fruit damage. The bin farthest from the tractor experiences the worst impacts and should be reserved for juice fruit.

Torsion bars reduce impacts on fruit. Bin trailers, including bin-on-the-ground systems, with suspension are better than those without, and bin-on-the-ground systems are better than conventional trailers. Bin-on-the-ground systems with air suspension produce the least bruising.

Bin-on-the-ground systems with air suspension can safely travel faster than bin-on-the-ground without air suspension or conventional systems.

Forklifts

Research at Dutoit Agri showed that forklifts are a major cause of bruising. They can damage fruit by bumping against bins, driving too fast, accelerating and decelerating too quickly, lifting and lowering bins too quickly, and putting bins down hard. As forklifts handle each bin multiple times, the damage potential is enormous.

Forklifts at the farm and the pack house must be driven responsibly, and bins must be handled carefully. Try to reduce the number of times the forklifts handles the bins — the fewer times bins are handled, the less the potential for bruising. Vibration dampers on forklift masts will help reduce some of the impacts on fruit.

Take care to avoid handling bins with forks that are halfway in. The bins will buckle more, so the fruit inside will move more, pushing against each other and increasing the risk of bruising.

The farm's loading slab must be level and smooth. Any bumps or ruts will result in bruised fruit.

Monitoring on-farm handling

Quality-control samples drawn at the loading slab reflect damage caused by pickers, bin trailers, and forklifts. Therefore, samples must also be assessed in the orchard before concluding that pickers damaged the fruit.

Apples that contact the sides or floor of the bin are more likely to be bruised than those in the middle of the bin. Bruising is also unevenly distributed from the top to the bottom of the

bin, although the pattern can vary depending on the cause. Quality-control samples must be drawn to represent all areas of the bin, as samples from only the middle will likely underestimate the damage but could reflect more directly on pickers.

During harvest, rapid turnaround on quality-control samples is necessary to resolve handling issues timeously. This requires sufficient staff to collect and evaluate samples.

Transport to pack house

Fruit-transport trucks must have air suspension. Although rubber cushioning in the truck bed has declined with the advent of air suspension, it still has value in protecting fruit, especially when roads are particularly bad.

Suspension systems are designed for full loads, so trucks should not travel with partial loads. If this is unavoidable, consider adding extra weight to compensate for the missing fruit bins.

In the past, Dutoit Agri believed 80 km per hour was a safe speed for a truck on a tarred road. However, after logging the impacts on their fruit, they found that 80 km per hour is excessive on many stretches of road. They subsequently determined the safe travelling speed on the gravel and tarred roads between their farms and pack houses.

Growers should consider employing a consultant to help them log impacts on their transport routes, especially where roads are bad or winding.

Besides travelling at the appropriate speed to minimise impacts on fruit, drivers must accelerate and decelerate slowly.

Growers should stipulate safe travelling speeds in their agreements with contractors, and they can use GPS data to monitor compliance.

For more information, view Kotze's presentation at the 2024 Hortgro Technical Symposium on the Hortgro YouTube channel.