

Oleocellosis & Oleo Audit

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Introduction

An 'Oleo audit' is a process that is recommended for citrus growers and packers when oleocellosis, a rind disorder of citrus fruit, becomes a problem. It involves taking samples of fruit during the harvesting, transporting and packing line operations and determining where the disorder begins and how it can be prevented.

What is oleocellosis?

Oleocellosis is the unsightly damage to citrus fruit rind caused by the release of oil from damaged oil glands. It has been traditionally referred to as a 'burn' caused by the released oil. It is more prevalent when wet cold fruit are picked and the oil glands easily ruptured as a result of finger and impact pressure. The released oil damages the rind and within 2 to 3 days an unsightly blemish develops. It is particularly a problem with gas ripened or degreened fruit where the damaged surface does not change colour and remains green. This stands out as a very unsightly blemish against the background of the orange coloured rind (photo 1). On close examination of the affected surface it can be seen that it has become roughened as a result of the tissue around the remaining glands sinking, (photo 2).



Photo 1. Oleocellosis development on a Washington navel orange which has been highlighted when it was degreened.



Photo 2 & 3. Close-up view of the surface of an oleocellosis affected orange. Note the depressed area around the remaining oil glands.

How bad can it get?

In the Washington navel orange season of 1993, when fruit were being exported from the Riverland, oleocellosis development affected up to 90% of some grower/packer lines. It became obvious 2 to 3 day after packing, but continued to develop for up to 7 days, resulting in a very unsightly blemish.. This was noticed either at the wharves in Adelaide, before the fruit was loaded onto the ship or in some cases where packers were aware of the problem, they had held the fruit at the packinghouse and found the 'oleo' on re-examination of the fruit. In the latter case it involved expensive repacking and/or discarding of fruit (photo 3) to either the juice trade or downgrading and sale on the local fresh market. When fruit arrived in the USA, some lines where so badly affected with oleocellosis they had to be repacked. This was not only a very expensive process but it meant the import order was not completely filled.

The estimated cost of this repacking operation and fruit loss was \$3M.

Why was it so bad?

Picking fruit during winter months has always presented problems to the citrus industry, with it being very difficult to get dry weather when fruit moisture content will drop, making the rind cells less turgid (more flexible) and less likely to rupture during harvest. In 1993 the Riverland area received a lot of rain and days on end with overcast conditions when fruit had little chance to dry out. It becomes very difficult under these weather conditions to fill export orders by specific times and there is pressure to harvest fruit when conditions are not ideal and likely to cause damage.

The other factor that governs the extent of oil damage is the strength of the cell walls of the oil gland. Last year these seemed to be very easily broken. Reasons for variations in cell wall strength are many, but mineral nutrition may be a factor. Some initial research at Gosford indicates that calcium concentration is higher in cells of fruit categorised as tolerant to 'oleo', however more research is required to confirm this.

Methods of reducing ‘oleo’ incidence

Current recommendations for control of this disorder are based on the principle of not picking fruit when they are cold and wet. The guideline for determining when to harvest fruit after rain or heavy dew is by measuring the pressure required to rupture the oil glands (RORP). When the pressure is low, it indicates that little force is required to break the oil glands and that fruit should not be harvested under those conditions. The recommended pressure suggested by the US importers was 9 lbs (approx 4 Kg). Results in using the RORP test in Australia have been however variable and the incidence of oleocellosis is still a problem.

There are also times during the cool moist winter months when navel oranges have been exported when the oil glands are easily ruptured and don't pass the recommended minimum RORP pressures yet the crop has been harvested. Under those circumstances extreme care has to be taken to ensure the oil glands are not broken. More information about the RORP kit and symptoms of oleo are available in the ‘Oleocellosis Prediction Tools’ document.

Oleo Audit

The idea of doing an ‘Oleo Audit’ is to check where in the harvesting and handling procedures damage is occurring to the fruit. This should allow the operator to find out what is producing the damage at that handling step and remedial action can then be taken.

The flow diagram below (Table 1) gives some examples of how an ‘Oleo Audit’ can be conducted.

When to Sample	Sample Handling Procedure				
After Harvest	»	Select 20 fruit & hold for 3 days	»	Examine fruit for oleocellosis	» Record number damaged
After fruit are sent to packinghouse	»	Select 20 fruit & hold for 3 days	»	Examine fruit for oleocellosis	» Record number damaged
After loading onto packing line	»	Select 20 fruit & hold for 3 days	»	Examine fruit for oleocellosis	» Record number damaged
After washing	»	Select 20 fruit & hold for 3 days	»	Examine fruit for oleocellosis	» Record number damaged
After wax application	»	Select 20 fruit & hold for 3 days	»	Examine fruit for oleocellosis	» Record number damaged
After grading	»	Select 20 fruit & hold for 3 days	»	Examine fruit for oleocellosis	» Record number damaged

Table 1. Schematic diagram of a suggested sampling procedure that can be used to conduct an ‘oleo audit’. Each packinghouse should develop its own sampling procedure according to the location of the risks of fruit injury.

It is suggested that at least 20 fruit be taken at the different handling steps in processing the fruit and that they be put aside for 2 to 3 days to allow for oleocellosis to develop. By examining the fruit for ‘oleo’ and even counting the number of fruit affected at each handling step it can be quickly determined where the rind damage is occurring. For example, if there is only 1 fruit with significant oleo after harvest and this increases to 5 after the fruit are delivered to the packinghouse, this is an increase from 5% to 20% of fruit sampled. The graph below (figure 1) is an example of the type of data that can be obtained by using this procedure.

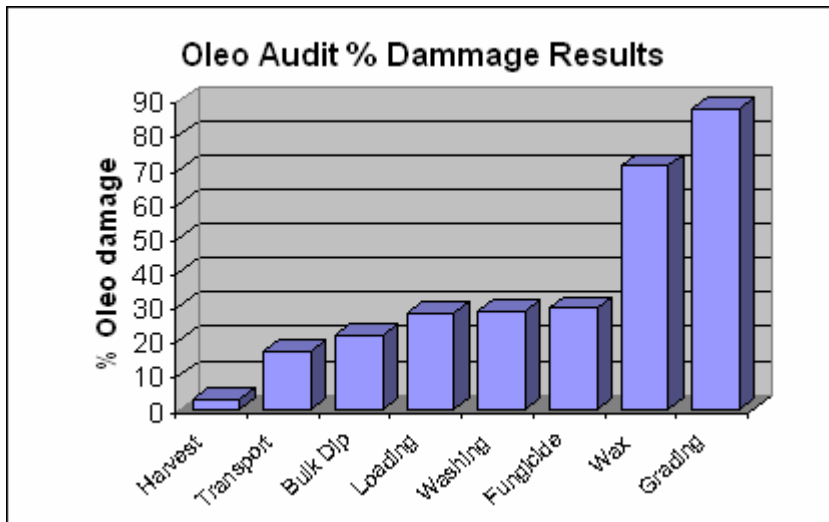


Figure 1. Results of doing an `oleo audit', which indicates that rind damage is occurring during transport of fruit to the packinghouse and also during the waxing and drying operation.

The damage occurring during the transporting of fruit to the packinghouse could be due to rough roads or the fruit being conveyed too quickly, causing them to bounce and rub against one another, resulting in the rupture of oil glands. Damage during the waxing operation maybe due to the hardening of wax on the brushes, resulting in rind damage to the fruit.

Current research

The Horticultural Research and Development Corporation is funding a research programme at Gosford where the factors governing the development of oleocellosis are being investigated by the author. The aim of the work is to either 'toughen-up' the oil glands so they don't break easily or protect the rind so the released oil cannot cause the damage. Results of the work will be published shortly.

More information about the RORP kit and symptoms of oleo are available in the 'Oleocellosis Prediction Tool' document.