

GUIDELINES FOR STORAGE AND SANITIZING OF CHESTNUTS

By Dennis Fulbright, Michigan State University Department of Plant, Soil, and Microbial Science
fulbrig1@msu.edu

This is a technical paper prepared by Dennis Fulbright for USA conditions so Australian growers will need to convert any figures and temperatures and need to check if any of the proprietary chemicals listed are registered for use in Australia.

When chestnuts are in limited numbers, moulds are not very common.

But once the environment is altered by an abundance of chestnuts, moulds begin to grow, first on the compromised nuts, then on the healthy nuts. Storage improvements, which include sanitizers, can enhance the quality of stored chestnuts as they wait for packaging and markets.

Postharvest decay of edible chestnuts reduces nut quality and can lead to severe economic losses. In Michigan, postharvest decay was identified as one of the major problems that negatively impacts fresh chestnuts, accounting for up to 25% of losses after harvest. Recently, several fungal species were isolated from fresh healthy Michigan chestnuts and chestnuts experiencing postharvest shell mould and kernel decay, including *Penicillium* spp., *Acrospora mirabilis*, *Botryosphaeria ribis*, *Sclerotinia sclerotiorum*, *Botrytis cinerea*, *Gibberella* sp., and *Coniphora puteana* (see photo below). Some of these fungi may simply grow across other healthy chestnuts while looking for those nuts that are senescing. Some fungi simply leave dark spots on the hilum (the light spot on the shell of the chestnut). In some situations, the chestnuts covered with the white mantle of *Coniphora* can be washed off and put into StorOx™ and these nuts will remain good.



This white mould is probably *Coniphora puteana*, a wood-rotting fungus that grows across the chestnuts during storage. It finds one poor quality nut, infects it, and then spreads to other poor-quality nuts in the bin.

Worldwide, there are two major chestnut kernel pathogens - both fungal in nature. One is called black rot and it is caused by *Sclerotinia pseudotuberosa* and the other is called brown rot and it is caused by *Gonioprism smithogilvyi*. They both occur in Europe, and only brown rot is of concern in Australia and New Zealand. They are considered serious pathogens that could threaten the industry. These are not just fungi that grow on senescing nuts in storage; they appear to directly invade the kernel as it develops during the summer months and rot the nut before harvest.

Bad and decaying chestnuts must be sorted. But you must reduce the number of poor chestnuts in the bin if you are to ultimately reduce the amount of mould. To do that requires setting procedures and following guidelines. Here are several:

- Grow the highest quality chestnuts using best growing practices including the highest quality cultivars for your area.
- Keep the trees healthy for the entire growing season, providing water and nutrients at appropriate times.
- Recognize that the first chestnuts to fall may be somewhat compromised. Harvest is a bell-shaped curve, with some falling early and late. The best quality is usually found in those that fall in the middle of the bell-shaped curve.
- If you have both Chinese chestnut trees mixed in with European x Japanese hybrid cultivars like 'Colossal', there can be a physiological breakdown of the kernel that is not associated with microorganisms. We call it internal kernel breakdown (IKB). It is an incompatibility between these tree species when one pollinates the other. Stay with Chinese or European x Japanese hybrid cultivars, but not both.

Before harvest starts, the facility in which the chestnuts are to be stored must be thoroughly cleaned with food-safe chemicals that reduce microorganisms.

The temperature must be kept as close to 30°F as possible. This reduces the respiration of the chestnuts (less water loss, therefore less free moisture for microorganisms to grow). The chestnuts do not freeze due to their sugar content, and this temperature can reduce the number and amount of actively growing moulds. The higher the temperature, the more moisture, the more fungi and bacteria, the more water loss and the better the environment is for mould growth. However, if the temperature slides accidentally below 28°F, the chestnuts will freeze and when they thaw, they will be dead and accumulate water-soaked off tastes and smells. They will be spoiled. Do not allow the chestnuts to freeze in their shells.

After the facility is cleaned and the temperature reduced and set, find bins in which to store the chestnuts that offer some type of air flow. The alternative is to move the chestnuts in the facility at least once a week. This can be accomplished by “pouring” the chestnuts from one bin to another. The more often done the better the result. This will also stop the moulds from moving from one bad chestnut to another in pockets. Think about the type of bins. Most large growers use apple bins that hold 800 to 1,000 pounds of nuts. But smaller growers might use crates that hold small fruit. Air movement is critical.

Harvest the nuts, wash, and float. The ones that float might be good, but they are usually more compromised than the sinkers. There are bad nuts in the sinkers too. As you move the chestnuts during storage, you may need

to float them again. Cut open some of the sinkers and determine why the majority are floating. Air pockets, extra shell invading the kernel, or rot? You will get a sense as to why they float.

The next step is sizing. If you make your own grader, try not to use materials that can scratch the shells.

Before you bring the chestnuts into the clean storage refrigeration unit, treat them with a sanitizer. There are several that have reputations for sanitizing chestnuts such as bleach or Chlorox, but these are not as effective as hydrogen peroxide as called hydrogen dioxide or ozonized water. The materials most growers are using now is called StorOx™ or SaniDate™, and the company producing them is BioSafe. It is organically certified. Do not expect it to be safe to handle; hydrogen peroxide is a strong oxidizer, and it will burn your skin. You will need to mix it and follow the instructions. This material kills what is on the chestnuts. It sanitizes the chestnuts. It does not stop the chestnuts from becoming infected from other sources once it has been used on them. You may need to re-treat the chestnuts four times in a season depending on how well you cleaned your facility, the quality of the chestnuts, the temperature at which you hold the chestnuts, and the ability to move the chestnuts. Efficient application, monitoring and examination for microbial spoilage is one of the most important aspects of chestnut production. If you are treating in your own facilities, you must develop strategies to maximize product coverage and efficacy. Hydrogen peroxide in combination with peracetic acid (Storox™; SaniDate™) has been adapted by chestnut producers to better reduce postharvest mould and kernel decay.



Co-op storage facility for chestnuts brought in by members. This facility is cleaned and sanitized, and the temperature is lowered each year before the chestnuts are brought into the facility. These chestnuts will have been treated with the sanitizer before entering this refrigeration unit. Also, the chestnuts in each bin are poured into empty bins at least once every three weeks.



Chestnuts being treated with SaniDate™. An apple bin is dropped into a vat of SaniDate™. Floating chestnuts should be removed.