

Air drying macadamias

extract - MACADAMIA NUT PROCESSING

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3. Drying (see also Decortication / Cracking)

Drying is the most critical step in macadamia processing: actual conditions are kept confidential by processors (Grimwood, 1971). The drying process is often carried out in bins and may last 2-3 weeks. Artificial drying is the preferred method.

Nuts must be dried to a moisture content less than 1,5% before cracking to prevent flavour deterioration, harden the shell and result in shrinkage of the kernels and weakening of the shell-kernel attachment. The drying rate and final moisture content of the nuts is of utmost importance to the quality of the kernels (Hand, 1983). Cavaletto *et al.* (1968) found that the kernels should be dried to 1,2% moisture and Dela Cruz *et al.* (1966) found that 1,1% moisture was the most stable. Since the enzymes responsible for product deterioration are dependent on moisture, the low moisture content as recommended prevents enzymatic reactions to take place to any significant degree during storage for more than one month under sealed airtight conditions. Low storage temperatures in combination with low moisture content, increases the shelf-life of the kernels.

Airdrying may be used to dry the nuts, but the effectivity of the drying step depends on the relative humidity (RH) of the ambient air during this period. The nuts will lose or absorb moisture to remain in equilibrium with the surrounding atmosphere. Moltzau & Ripperton (1939) already found that a RH of 60% or more is not suitable for the air drying of macadamia nuts, since moisture is then absorbed by the nuts. Air drying also requires space and is labour intensive.

Sundrying or air drying does not reduce the moisture levels below 3,5% and these nuts must still be dried to below 1,5% (Grimwood, 1971). Moltzau & Ripperton found that sundrying provided nuts of excellent quality, but similar to nuts dried with artificial heat, the sundried kernels required 25% more cooking time to acquire the same degree of brownness as airdried kernels (Moltzau & Ripperton, 1939). In addition, they maintained that artificial drying at temperatures up to 78°C had no negative effect on kernel quality. They manufactured a stack-dryer which handled the nuts mechanically, since they found that the kernels were not damaged in the process. However, studies conducted since then have revealed that kernels need to be handled with care since any damage from harvest till baking will show up as marks on the cooked kernels (Cavaletto, 1978; Hand, 1983; Grimwood, 1971).

Hamilton *et al.* (1980) and Cavaletto (1980, 1981) recommend lower drying temperatures, i.e. starting at 38°C and raising up to 52 or even 60°C. High moisture nuts must be dried initially at low temperature (ambient to 38°C). The maximum drying temperature which can be used depends on the kernel moisture. If too high drying temperatures (e.g. 51 °C with no pre-drying at lower temperature, kernel moisture 28%) was used, the kernels developed brown centres due to increasing reducing sugars (Prichavudhi & Yamamoto, 1965). They found that 1) macadamia nuts with a low reducing sugar content have the best roasting quality, 2) the brown centres of macadamia nuts, damaged by higher temperature drying, contain more reducing sugars than the light outer layer, and 3) temperature sensitivity of macadamia was moisture dependent. Physiological changes are given as the reason for this. At low temperatures, there is a general decrease in sugar concentration but at high temperatures the reducing sugar concentration increases because of enzymatic inversion of nonreducing sugars to reducing sugars. Brown-centering or localized browning is probably the net result of both moisture gradient in the kernels and increased enzymatic activity in the moist centre. They tested the hypothesis that enzymatic reactions are responsible for these changes, by blanching fresh nuts (97°C core temperature), before drying at 52°C. This reduced the browning, but the nuts roasted slightly darker than those dried at an initially low temperature. Thus the best regime is to dry the fresh nuts at a low temperature until the moisture content has been reduced to 8% or 6%, whereafter the kernels can be dried at 52°C or 60°C respectively. Predrying of only 4 days at ambient temperatures prevented browning (Cavaletto, 1980).

Hansen and Gough (1977) determined the moisture characteristics of macadamia kernels in relation to storage. They determined that the maximum safe relative humidity for storage corresponded to 11,8% moisture content for one batch and 12,4-12,0% in another batch. At a low whole nut moisture content (around 10%), the shell contains most of the water, whereas at a high whole nut moisture content (around 18%), the shell has approximately the same water content as the whole nut. The authors also evaluated a *Kappa Janes* moisture meter for the rapid determination of the overall moisture content of macadamia nuts. They found that the meter provided a rapid and convenient method for moisture determination, but that the use of the larger and probably more reliable cell of the meter still needs to be evaluated.

Joubert and Joubert (1969) recommend that nuts be stored uncracked if they have to be kept for extended periods since insect damage is greatly reduced. Infestation should always be reduced by keeping the storage area very clean. Low temperature storage is recommended for cracked nuts.