Coffee storage

Preserve coffee quality during storage & container loading by controlling moisture

Processors and exporters need to store coffee parchment over longer periods before export processing and container loading can take place. For quality reasons, coffee is best stored in the form of parchment as long as possible before export processing. The parchment layer provides a good physical protection of the bean. The moment that the parchment and silverskin is removed by hulling and polishing the natural surface of the green bean itself is damaged and opened to action by micro-organisms. The 'aging' process, aided by poor ambient conditions, can be reliably measured from that point on. As a rule of thumb, green coffee should not be stored longer than 2 weeks under hot and humid conditions before export!

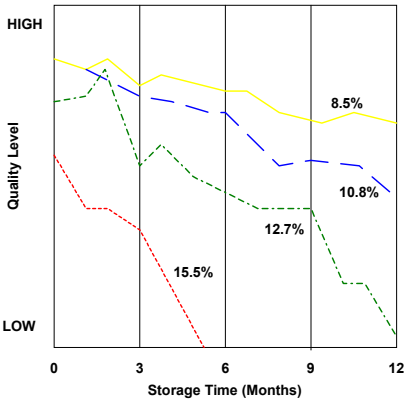
High temperatures and humid conditions are the main determinants for quality decline of both green bean and parchment and need to be kept at a minimum during storage. Applying good management practices in the warehouse and having an understanding of the interrelation between coffee beans and the storage environment will enable processors to better preserve of coffee quality during storage.

Characteristics of coffee during storage

After drying coffee, parchment coffee needs to be cooled down before the final assessment of moisture content can be done. Only when moisture content in cooled down coffee is around 11% moisture, coffee can be stored safely. Coffee grown in a high humidity environment, such as Vietnam, has a slightly softer bean structure than green bean from an arid environment, and it needs to have a slightly lower moisture content to maintain good storage qualities.

Quality tends to deteriorate during storage in close correlation with moisture content of the bean: the higher the moisture content., the quicker quality will decline! Therefore, moisture content of beans needs to be kept low and thoroughly controlled throughout the storage period!

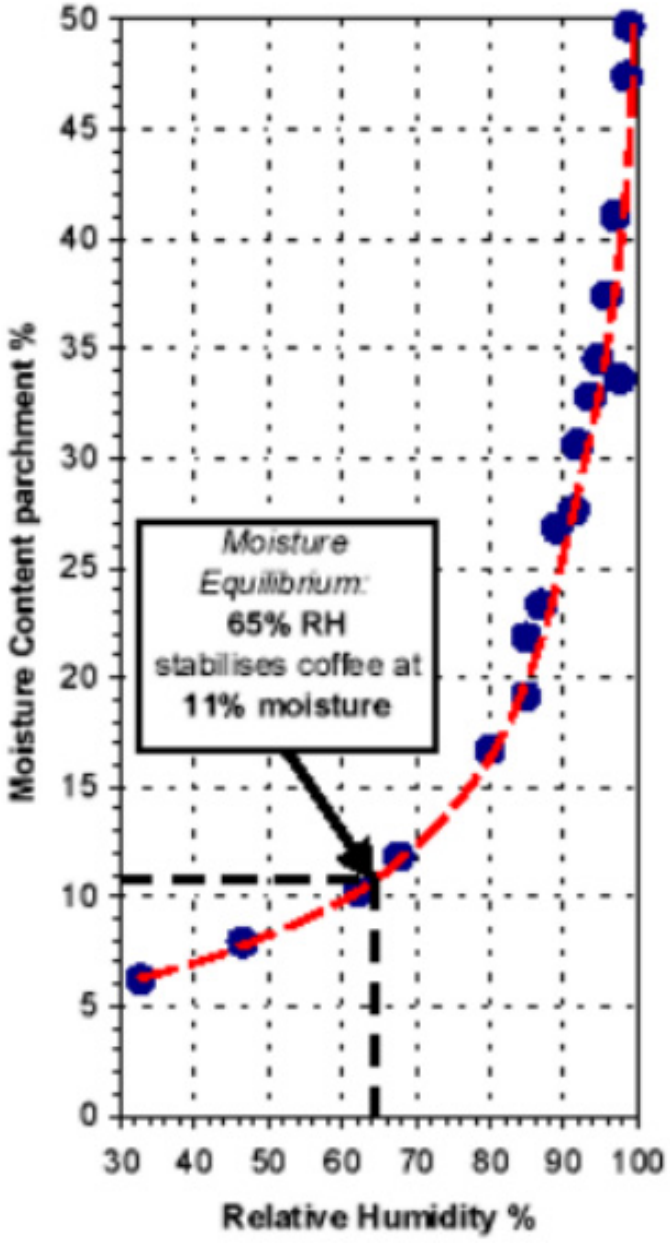
In Vietnam, ambient conditions are wet and warm and coffee will take up moisture again if not protected and stored appropriately. The best measure to keep moisture content of coffee stable and prevent it from regaining moisture is by providing dry and cool storage conditions while limiting the contact of coffee with ambient, humid air.



Influence of bean moisture content and storage time on cup quality (Stirling, Kenya Coffee 1974)

A relatively easy measure to achieve a minimum exchange of moisture between coffee and the humid air is to store parchment coffee in bulk. This will limit the surface area of parchment coffee getting in contact with ambient air. Typically, this

Moisture Isotherm for Parchment Coffee at 25 degrees C



Source: Stirling (1973), in: Kenya Coffee

A moisture isotherm is a line that describes at which levels of coffee moisture content an equilibrium with the ambient relative air humidity is given. Therefore, at any given point on the moisture isotherm, no exchange of moisture between the seed and the ambient air is occurring.

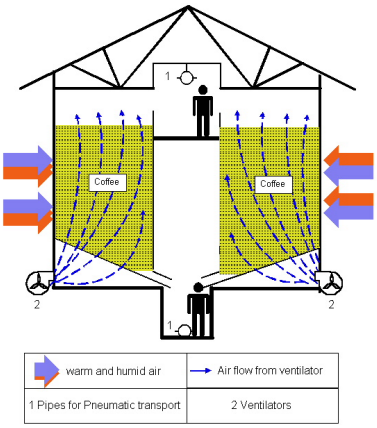
In this case, at around 65% relative humidity (RH) of the air, parchment coffee will stabilise at a moisture content of a desired 11%.

Higher RH will cause rewetting, lower RH will have a drying effect. In general due to the heat of machinery and action, the relative humidity inside a dry factory is much lower than outside the building.

is achieved by storing coffee in large bins, silos or in organised piles of coffee bags. If parchment is stored in coffee bags, bags should be made from jute to allow coffee to "breathe". Jute bags should be covered a plastic tarpaulin as moisture protection.

Conditioning of stored parchment coffee in bulk

Conditioning is a simple but effective process for quality preservation during storage of coffee parchment. It also allows the blending of different lines of beans so as to, year by year, produce a consistent product



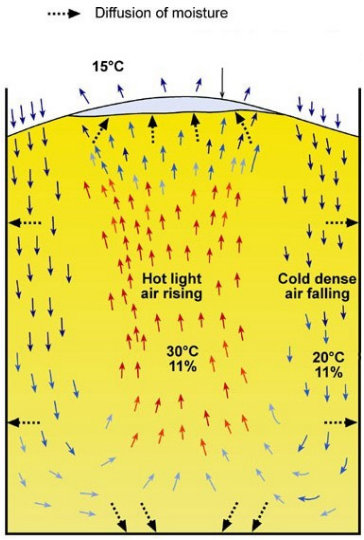
Conditioning bins allow ducting air through the stored coffee for moisture correction while protecting it from ambient humidity, Design: K. Calvert

In order to control and maintain optimum moisture in the stored coffee, air is carefully moved through coffee stored in bulk, at around 3 to 5 m/min. The air for conditioning coffee in bins or silos must be of low humidity in order not to moist coffee. This is done by monitoring the ambient relative air humidity or adapting it through careful warming. The relative humidity of the air to be blown through the coffee should be around 55 to 65% for stabilising coffee at 11 to 12% moisture (moisture sorption isotherm).

Conditioning helps to level out temperature and moisture content within and between lots of coffee and by that, controlling and preserving quality over longer periods.

In simple terms, conditioning requires:

- Bins or silos made from bricks or strong plywood
- a fan to slowly move air backwards or forwards through the stored coffee
- controlling equipment for determining coffee moisture contents and air humidity to decide when and how to take corrective measures.



Moisture migration due to temperature gradients in bulk storage. Source: http://sgrl.csiro.au/storage/moisture/moisture_damage.html

The benefits of storing and conditioning of coffee in bulk

Limiting surface contact of coffee with humid ambient air

Levelling out moisture content and temperature of stored coffee (green or parchment)

Moisture adjustment of coffee through controlled ventilation (limited)

Controlling moisture migration within stored coffee

Reducing damage due to condensation at cold walls and floors

Maintaining coffee quality, freshness and presentation

Providing basis for handling coffee with pneumatic system for bulk shipment preparation

Bins should not be made from metal because it is not insulating well against outside temperature fluctuations. Metal conveys heat much quicker than other materials causing condensation inside the bins. Condensation will result in uncontrollable pockets of moisture inside the bin. Bricks or ideally thick plywood is a much better choice as insulation capacity is higher and less condensation will occur.

Ventilation fans do not need to be of high power and speed – as long as coffee bulk is at around 4 m depth, a normal fan as used in homes is sufficient to

move enough air through the coffee for conditioning.

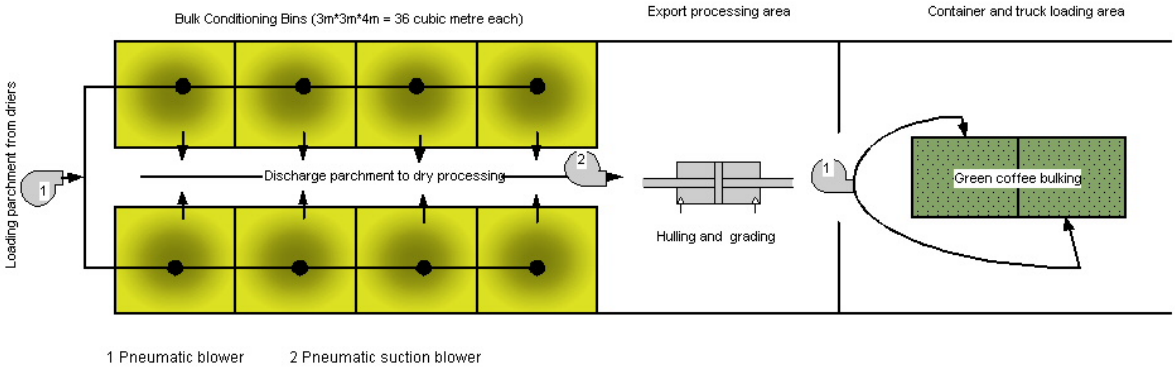
For control of moisture in the coffee, a conventional moisture meter can be used. For the control of relative humidity, an electronic wet bulb thermometer is recommended which automatically calculates the relative humidity of the air and supports the manager in the decision when to use the conditioning fan.

Pneumatic transport raw coffee handling systems

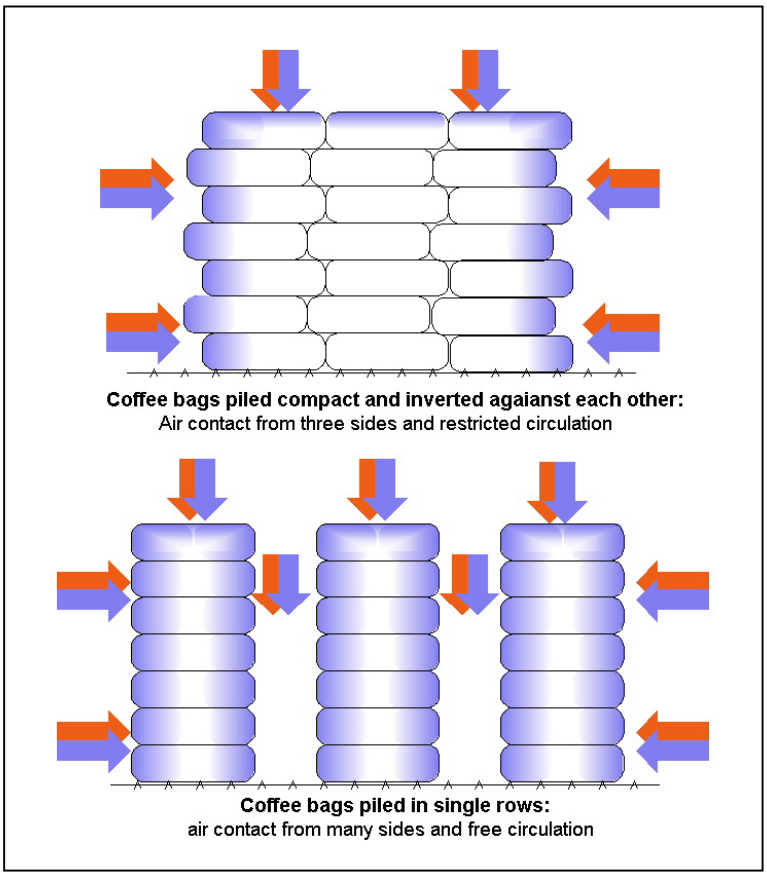
In addition to the mentioned aspects of quality control, bulk storage brings advantages in handling. By the use of a pneumatic transport system, the use of bags can be reduced. Pneumatic systems are very divers - coffee can be transported by blowing or suction action with much higher powered fans than is required for conditioning. the same equipment. Coffee is conveyed quickly and safely without the use of plastic or jute bags from one location to the other and provides the basis for preparing bulk container shipments.

Pneumatic systems ease handling of dry coffee (parchment & green bean).
Pictures: www.kongskilde.com, www.conveyair.farmca.com

In a pneumatic system, coffee can be moved horizontally as well as vertically without the danger of physical damage. Screw conveyers as often used for dry parchment movement have the disadvantage of only moving coffee in straight lines and posing a danger of crushing parchment coffee and beans when overloaded. In pneumatic system, coffee is transported by air flow with a much smaller danger of damage. Disadvantages of pneumatic systems is the problem of large amounts of dust occurring and possibly electrostatic effects. However, this can all be overcome by careful planning and the inclusion



Schematic storage, dry factory and export stuffing facility using a pneumatic system. Design: K. Calvert



Coffee should be stored in large piles to limit contact and circulation of air

of cyclones separating coffee from light dust.

Coffee storage in bags

If a silo system is not available and coffee is stored in bags, the storage manager needs to limit the contact of coffee bags with the humid ambient air to prevent rewetting of coffee. The less humid air gets in contact with the bags, the smaller the risk of rewetting. Coffee bags should be closed stacked in organised and compact piles to limit air circulation and exposure In addition, piles should be placed on wooden pallets to avoid direct contact with the floor. In order to avoid direct contact of moist air with bags, a simple plastic tarpaulin should be placed on coffee bags for protection.

Storage management & location

In order to avoid microbial contamination of coffee in storage, storage must be kept clean and free of animals such as bugs, mice and rats. Also, smoking is not allowed in a storage and dry processing facility to reduce risk of fire as well as contamination of the product.

The storage facilities must be in good distance from processing facilities, especially from dried pulp and old dust from previous hulling and grading. as they are sources of bacteria and moulds which can contaminate the raw product and can cause OTA infections.

Portable moisture meters

Moisture control of stored coffee needs to be carried out on a regular basis for taking corrective measures. A range of portable moisture meters is commercially available.

Portable moisture meters need to be calibrated and used in a consistent manner to enable comparable results. A properly calibrated portable meter, operated under controlled conditions, can be expected to provide accurate moisture readings. For accurate readings, samples need to be prepared and presented in a consistent way.

Factors that can influence the performance of portable meters and should be kept at a minimum, include:

- Temperature differences between the test sample and measurement cell
- Temperature differences between ambient conditions and coffee to be measured
- Moisture differences between individual beans
- Moisture gradients within beans

Calibration of meters

Calibration of a portable meter is important and must

be done before each season. It is quite difficult to achieve an accurate calibration curve because it requires a series of samples covering a range of different moisture. Well-equipped quality testing laboratories like CAFECONTROL can assist in calibration.

Container loading

Just before export, the coffee is loaded into containers either in bulk or in bags. In Vietnam, most coffee is loaded in jute bags, although bulk shipment is the preferred option due to easier handling and less danger of quality damage during transport.

Before loading coffee on a container, the container must be thoroughly checked for water leakages as well as for foreign smells from prior usage. If leakages can be found, often indicated by rusty patches, or any other damages or foreign smells are recorded which have a possible impact on the coffee, the container is to be rejected and the shipping company is to supply a new container.

Loading of containers should be done in dry conditions and not in direct sunlight. Rain will quickly rewet coffee and too much heat exposure to the container will result in condensation.

Before loading, the inside of the container needs to be fully dry. Contact from coffee bags to the container wall is to be avoided and ideally, waxed cardboard or at least water absorbent paper should be used as a protection between container wall and coffee bags.

When loading bags in containers, bags should be closed stacked similar to the recommended system for storage above to limit surface area and air circulation.