

The influence of post harvest handling on cup quality



Cup defects lead to quality claims and reductions in prices and need to be avoided by all means. Cup defects have many causes. These include microbiology growth as well as physical characteristics or environmental influences on coffee during processing, drying and storage. Especially while being wet, parchment and green beans are easily infected by micro-organisms which are potentially causing cup defects and are the reason for Ochratoxin A.

Wet coffee is also taking up smells and aromas quickly. Oil particles make up a major component of the bean's composition and are able take up and store smells and flavours before releasing them during roasting.

Defects can be avoided by responsible and careful

management of the product from the tree to the point of export.

The concept of coffee quality

Coffee quality is a complicated concept as everybody understands something different under "quality" according to a very personal taste preference. Internationally, coffee quality is determined by cup tasting where the indicators acidity, body and aroma are evaluated by moving the beverage in the mouth. According to international requirements, a good coffee should have an elevated, fine acidity, a typical, fresh aroma of coffee without any strange off-tastes and a good body (defined by the amount of soluble particles in the

coffee giving a soft, smooth drinking feeling).

In Vietnam, recently people started to appreciate European style coffee containing high percentages of Arabica coffee such as in Café Latte or cappuccino. In the past and still today, most Vietnamese coffee drinkers prefer the traditional "ca phe den" or "ca phe sua" derived from darkly roasted Robusta and Excelso coffee. The characteristics of the traditional coffee is a high content of caffeine, intensive aroma and a strong body.

Taste Categories...

Basic categories

- Sweet
- Sour/acid
- Bitter

Aroma categories

- Fruity
- Floral
- Citrus
- Grassy
- Musty
- ...

Body

- Thick
- Thin

The European and US American taste profiles are very different. People generally prefer a lighter roast, a lower caffeine content, a fine acidity, a

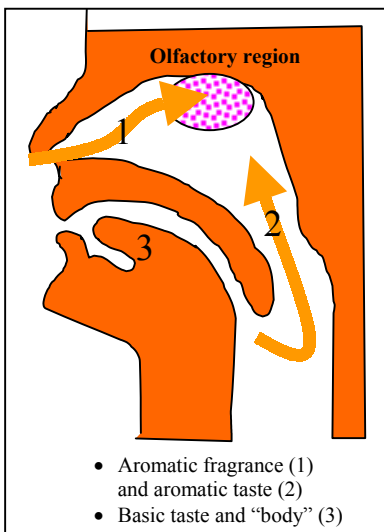
Post Harvest Processing Arabica Coffee

lighter body and a soft, “round” coffee aroma. In order to meet this taste profile, higher priced coffee blends consist mainly of Arabica coffees exhibiting these quality characteristics.

The cup characteristic is the single most important factor for coffee buyers to judge coffee quality and establish a price for buying.

Detection of cup defects

Basic tastes characteristics (“acidity”, “sweetness”, “bitterness”) are detected by the taste organs in the tongue. The aroma of coffee is detected by the olfactory organs in the nose. The texture, or “body” of a cup, is also detected in the mouth



Cup defects are mostly aroma components and are therefore detected in the olfactory region.

Defects from fermentation

Most serious cup defects are caused by wrong fermentation. It is important

to know the main mechanisms during fermentation in order to produce high quality coffee. There are two main groups of micro-organisms which are interacting during fermentation and are influencing the taste of the final product: bacteria and yeasts.

During good fermentation, bacteria and bacterial pectolytic enzymes are the main group to be found. The bacteria (*Erwinea* and *Kliebsiella* spp.) feed on the sugars of the mucilage and liquefy the gel like mesocarp. As soon as the sugars have been digested by enzymes and the mucilage has been liquefied, the pH in the fermentation tank is decreasing. At this point, a different group of micro-organism will become active: the yeasts.

Yeasts are converting sugars into alcohol but are also metabolising the solid parts of the mucilage. The result from the conversion of mucilage are aroma components which can have a negative influence on the cup quality of the coffee, that is fruity coffee. When coffee is left even longer under anaerobic and acid conditions, yeast will convert sugars over alcohol into acids which will cause sour coffee.

Defects derived by insufficient drying and and/or storage conditions

Drying prepares the bean for later processing and

storage. When beans are damaged or not sufficiently or unevenly dried, decrease of cup quality will set in much quicker than at beans which have undergone good drying. As it can be seen from Fig. 1, the moisture content of beans during

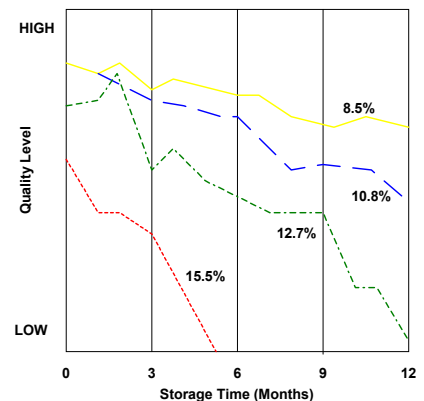


Figure 1: Influence of moisture content and storage time on cup quality (Stirling, Kenya Coffee 1974)

storage has a strong influence on the speed of quality deterioration.

The quick decline of cup quality in wet coffee is due to moulds and bacteria. Wet coffee offers bacteria and mould best growing conditions. Bacteria and moulds are growing on the surface using the coffee beans as a substrate. Through consumption of sugars as well as metabolism by products, cup characteristics are influence.

In order to avoid bacterial and mould growth, it is of utmost importance to dry coffee to a moisture content between 10 and 12% before storing.

Cup Defects from faulty fermentation

FRUITY FLAVOUR AND SOUR COFFEE

The fermentation and liquefying of the mucilage is carried out by so called soft rot bacteria (*Klebsiella spp.*). These bacteria make up the most active part during fermentation.

When beans are fully coated with the sugary mucilage, fermentation bacteria multiply quickly. However, the less mucilage is to be digested, the less bacteria will be active. At this point, yeasts start to grow, which begin to turn the liquefied mucilage into alcohol and “fruity” tasting aroma components. These fruity flavours will be taken up by the beans and will be detected during cupping. In order to avoid fruity flavour, coffee must be washed as soon as fermentation has finished, i.e. when all mucilage has been liquefied.

When leaving coffee too long in the fermentation tank, yeasts will produce firstly fruity flavour and in a second step, sour coffee. Sour coffee is occurring when yeasts turn alcohols into vinegar type acids which cause the “sour” taste.

It is not possible to give a time frame in which fruity flavour and sour coffee develops as the speed of fermentation depends on many factors such as temperature and altitude. The best way to avoid these cup defects is to wash the parchment coffee as soon as fermentation has finished and the parchment feels rough when rubbing with the hands.

FLORAL, WINEY AND HERBY TAINTS:

Like fruity flavours, there are many specific 'bouquet' type taints that occur during alcoholic yeast fermentation. The alcohols are more water soluble and volatile enough to be removed in the washing and drying processes, but the various aldehydes, ketones and perfumery base chemicals tend to dissolve into the essential oil of the green bean and then reappear at roasting giving serious cup defects.

STINK COFFEE

The cause of stinker beans is not from unusual micro-organisms but from excessive fermentation with normal ones. Each day the factory tanks and machinery must be cleaned to make sure that old beans are not retained for several days in cracks and crevices to come out and contaminate a later batch of coffee. Such extreme 'over fermentation' of beans left in small pockets tends to germinate the coffee seed which then rapidly dies and leaves a black spot under the parchment. If the bean has been skinned in the pulping, then the sprout falls out to leave a hollow pit in the end of the bean. These dead beans then rapidly develop a cheesy and evil smelling texture which is very evident when one is squashed or cut. Only one or two such stinker beans can contaminate and spoil a whole batch of good coffee.

Cup Defects from rewetting, insufficient drying and bad storage conditions

EARTHY, MUSTY, PHENOLIC TAINTS and OCHRATOXIN A (OTA)

Moulds and fungi are relevant to quality and can develop on wet parchment. Some moulds produce cup defects while others can develop the carcinogenic Ochratoxin A.

It is usually after the parchment has been washed free of mucilage and left outside in wet weather conditions that mouldiness can occur. The best solution to avoid OTA, musty, mouldy taints, including Rio flavour, is to get clean wet parchment skin dried as rapidly as possible before any mould spores get a chance to germinate.

In emergencies, when no drying can be done in time, wet parchment should be stored under clean water as moulds will not germinate under water.

It must be avoided to leave wet parchment outside when the weather conditions do not allow drying. It should also be avoided to wrap up wet parchment in plastic sails because coffee will start to sweat. The liquids leaving the beans while sweating are rich in nutrients and salts creating the ideal ground for microbiological to thrive. If possible, a steady stream of air should be blown through wet parchment when covered to carry away the excessive moisture from the parchment.

OLDISH, OLD

Aging of coffee is inevitable during storage. The reason for ageing is surface oxidation from coffee beans aided by micro-organisms. It can be however be minimised by storing parchment and processed green bean in conditions of as low a temperature and humidity as possible to keep activity of bacteria, yeasts and moulds at a minimum. Damaged beans (cut, squashed, etc.) are much more subject to ageing as the oily substances from the bean are leaving the bean and build a good growing ground for moulds and bacteria.

Moulds in particular are adept at growing on the surface of dry and concentrated foodstuffs by using the humidity of the air as their source of moisture. Therefore, moisture of ambient air in storage rooms must be kept at a minimum.

A further possibility to reduce ageing during storage is to minimise the use of bags and use bulk filling of containers or silos which can be hermetically sealed instead. Sealed storage conditions will minimise the levels of both oxygen and moisture to contact coffee, but will concentrate carbon dioxide within. Both together will strongly reduce the metabolic rate of the resident micro-organisms and will therefore prolong the onset of the aging process.

Cup Defects from harvesting and processing

GREEN, GRASSY

Green, grassy and some harsh flavours are caused by picking and processing immature cherries. The problem is not so much to do with green unripe cherry which will not pulp, because they will get nipped by pulpers and turn out discoloured and are then easily removed by sorting.

Late in the season, lots of cherries lose their green colour and do not turn completely red. Called under-ripe, these cherries will pulp easily, but along with other nearly ripe cherries earlier in the season the silverskin is full of green chlorophyll. This is very easily seen in fresh wet washed parchment which shows up the colour of the silverskin underneath. One solution to this problem is to sun dry the coffee when weather conditions allow. The ultraviolet light can bleach out the greenness in the silverskin.

Slight greenness often fades with time, and is no longer evident at the final destination, but a lot of unripeness will allow chemicals to be absorbed back into the oil fraction of the final product.

ONION FLAVOUR

There are many different organic chemicals producing off flavours which are not only produced by a variety of micro-organisms, but also by their supply of nutrients. The onset of onion flavour for instance, comes about when the ratio of soluble sugars to proto-pectins (contained in the mucilage) becomes too low.

The initial quick build up of fermentation bacteria of the family *Klebsiella* spp is fuelled by the relatively high levels of sugars present within the ripened mucilage. If however, excessive fresh water is used in pre-washing of cherries and during pulping, most of these soluble sugars are leached out before normal fermentation commences. In this case, the beneficial soft rot bacteria can be overrun later in the fermentation not only by the yeasts but also by other bacteria which convert acetic and lactic acid to propionic and butyric acids, the cause for onion flavour.

These faults can be minimised by recycling of pulping water. Maintaining a high level of sugars and enzymes in the water will speed up the normal bacterial action. It must also be said that the moment that the days pulping is completed this recycled water must be discarded and fresh water be used to start off again the following day.

OTHER TAINTS

Bagginess, oiliness and coal tar taints generally come from contamination. Cheaper types of jute bags contain excessive amounts of, or low grades of batching oils. These are the oils used to lubricate the bag making machinery. Manufacturers of high quality jute sacking always lubricate machines with vegetable oils to avoid this problem. Over lubrication of rotary dryers and drying coffee on the road side are also possible sources of this problem.

Smoky flavours tend to come from leaky burners.

Earthy, dirty, foxy and similar taints and appearance are from too much skins in the parchment, not only during over fermentation, but also at the time of hulling, when the green bean is screwed up against the dry but still dirty skins and parchment hulls.