

Product Description

Green coffee represents the fundamental branch point in the coffee food system between the farm and the consumer. All processing methods eventually produce green coffee, and green coffee provides the principal input for all saleable 'value-added' products whether whole roasted beans or soluble coffee sachets mixed with milk powder and sugar. This is the form in which international trade and pricing is conducted.

The international value of a lot of green coffee will be established according to the species of coffee, the production method, the regional origin, moisture content, purity (proportion of 'defects'), flavour and, of course, demand. It is in this form that it will be stored (though not exclusively) awaiting sale, being transported between climatic regions, then blended and roasted.

Identifying the raw materials and the intended use in a HACCP evaluation is the first step in identifying known hazards. The first focuses on inputs to the production system under evaluation, and the second focuses on its destination so that any known implicit aspects that effect hazard analysis can be brought forward for further consideration.

The HACCP team's description of the product must be accurate and complete. This forms the basis on which the team will later identify and assess potential hazards associated with the product.

Form 1:

HACCP Form 1 (below) presents a summary of key elements of the product description. Other information will be covered in the team's discussion of the product and may also be reported as part of the HACCP documentation. Coffee is produced in many countries according to many different processes. Different harvesting practices can lead to discernable differences in the starting material, different processing methods may involve different 'intermediate' products with varying capacities to support the development of associated hazards, different marketing practices may lead to significant variability in the opportunity afforded for the development of related hazards. These factors should be noted in the product description developed by the HACCP team.

The effect here is either to ascribe more hazards to one 'raw material' or to consider each possible variation as a distinct raw material with distinct hazards. If the position of the HACCP team is such that the input material cannot be distinguished or that it will be processed together, you have one functional raw material with a longer list of hazards, i.e. the assumption must be that all lots contain all hazards even though some may only be associated with a particular source/origin that may in fact be absent in the lot in question.

This also raises the aspect of the specificity of HACCP evaluation to a process: an alteration in the source of a raw material, just as much as the replacement of a machine by another, requires a re-evaluation. A thorough knowledge of raw material origins is necessary but at this stage of HACCP development once raw materials are clearly identified and their properties described, the properties that



may ameliorate or intensify the known hazards can be identified. The aspects of the process of production of the product, to which the raw materials contribute, are systematically dealt with in light of the identified hazards in subsequent steps of the HACCP analysis. An oversight or, indeed, research revealing a new problem after the completion of a HACCP plan, at this stage may blind the analysis to a hazard.

The sample HACCP forms given below are from the position of an exporter. Green coffee is bought and sold at different points in the coffee chain depending on the structure of the national industry in question. Given that the production of OTA is a biological hazard, the moisture content, physical quality and 'shelf-life' of the beans clearly require control. Clearly the input and output commodities of different stakeholders could be different and this needs to be specified.

| FORM 1 | |
|--|--|
| Product name | Green arabica coffee (<i>Coffea arabica</i>) |
| Important product characteristics (e.g. Aw, pH, etc) | <12% m.c. (db); <150 defects in 300g |
| How the product is to be used | To be blended, roasted and repackaged before sale - boiling water extraction into beverage |
| Packaging | 1. Bulk loaded in containers: 22t 2. Stacked in containers: 60kg sisal sacks, 18t |
| Shelf-life | 1 year |
| Where the product will be sold | Domestic roaster/exporter warehouse |
| Labelling instructions | Keep in cool and dry environment; |
| Special distribution | None |

Form 2:

The function of Form 2 is to explicate all the materials that come together in the final form of the product. The example of the exporter of green coffee is very simple, but in value added coffee products there may be other ingredients. Once listed, possible adverse interactions can be assessed.

Chemical stability of the packaging exposed to the product (take aluminium with an acid product, for example) must be evaluated. As mentioned above, butter is added to roasted coffee in some places thus microbiological hazards associated with dairy products, *Listeria*, for example, could come into the reckoning. What are not included in this table are materials that may have come into contact with the product but are not ingredients. Wash water, for example, would not be listed here – it is dealt with elsewhere.

| FORM 2 | | |
|---------------------|---|--------------------------|
| RAW MATERIAL | PACKAGING MATERIAL | OTHER INGREDIENTS |
| Dry coffee cherry | 60kg sisal stitched sacks or lined / unlined containers | None |



Product name:

This needs to be concise but accurate. Merely 'coffee' does not contain enough information to make reliable assessment of hazards possible. An exporter may be shipping 'green robusta coffee (*Coffea canephora*)' or, if he has added value, it could be various coffee products such as roast and ground or soluble coffee in retail or catering packs.

The packaging aspects are dealt with below. These products all have different features that require separate consideration. Robusta may have been processed differently and its intended use may also be different. If the product has been roasted, this means that the anti-microbial control affected by the high temperatures of roasting has been applied and any new contamination, especially if followed by conditions conducive to microbial growth, could present a hazard to the consumer. An exporter may be shipping monsooned coffee or, occasionally, 'aged' coffee can be found in speciality coffee shops, and these may be more likely to have a too high moisture content or microbial load compared to normally produced coffee.

Important product characteristics:

The information here should include any particulars whether or not directly related to safety. In the 'product characteristics' field any characteristics of significance to the hazard for which the HACCP evaluation is being prepared, other features that may be used in general quality and features used to distinguish a particular product from other similar products are included.

Moisture content is a clear example of a risk factor, controlling as it does the out-growth of micro-organisms. The specifications of arabica coffee and a level of defects are examples of general description information. Research may change our view of such descriptors so, perhaps the level of defects or of some specified defect such as contamination by husk, may be shown to have implications for OTA risk. In this case, these must be specified. Of course, any aspect that does so must be recorded but physical aspects that distinguish the product from other similar products should be recorded here for completeness and as a matter of definition.

Moisture content and maximum defect rates are obvious ones but perhaps the particular enterprise deals only in 'bold' beans (an aspect which has no connection to OTA risk) so 'beans retained on screen 17' should be included in the 'product characteristics'. Soluble coffee products may specify particle size distribution, caffeine content or additive quantities (butter or cocoa butter, for example, is added to roast coffee in some parts of the world). Additives are dealt with in more detail in Form 2, above.

Intended use ('how the product is to be used'):

Once the intended use is clearly identified, industrial activities or consumer use that affects development of known hazards become more clearly defined and can be determined with some confidence.



For example, roasting of coffee has a profound effect on coli-form bacteria and OTA-producing fungi but much less affect on any OTA that may be present. In some cases, intended use can affect the evaluation significantly. If, for example, the input coffee was bought for 'monsooning', the storage in sacks in conditions of very high humidity, high standards for the input coffee would be indicated. Consideration of subsequent storage and transport may also be affected by this processing step. Further down the production chain, any other industrial process that adds water back into the product such as decaffeination by water extraction requires scrutiny and the issue of blending coffee, especially for the bulk and soluble coffee markets, is problematic.

There is a lack of transparency in this area but from a technical point of view, even very low quality coffee is not destroyed and may have a higher risk of OTA contamination than main crop. Though low quality commodity or 'filler' coffee should be visible in the 'Product Characteristics' the impact of such mixing is not be easily judged. The location of the roasting step, a barrier at which microbial load is removed and probably some OTA (if present) is destroyed, is important. Brewing or dissolution in boiling water may be of relevance depending on the position of the stakeholder who is developing the HACCP plan and provides a final if less rigorous barrier to food poisoning organisms than does roasting.

Packaging:

This is related to shelf life as described below but includes the prevention of the introduction and / or development of hazards during the implicit passage of time and change in location. Although dried, coffee still contains a considerable amount of water which if it becomes unevenly distributed could allow local development of fungi.

Coffee transport can be divided into three components: regional; interregional; international. International transport is exclusively of green coffee and typically involves relocation from the humid tropics to the north temperate zone on the sea. Coffee is containerised and rarely or never shipped in holds any longer. The coffee is either loaded into containers in bulk or in sisal sacks, with or without plastic liners. Stacking in containers should be done for stability while avoiding the formation of vertical shafts that could act as 'chimneys'.

Regional transport may include other forms of coffee, depending on where dehusking is conducted, but characteristically employs open vehicles from motorcycles to small trucks to heavy lorries. Most commonly this is done in sacks, often woven polythene, and changes in climatic conditions are not an element of this leg of coffee transport though rainfall certainly is. Interregional transport is typically by road though rail transport, especially from landlocked nations, is known. In rail transport, the coffee is largely containerised and not re-loaded before being placed onboard ship. In road transport, usually the coffee is in sacks and the quality of the lorry varies greatly. Some of these journeys can be very significant in terms of time and often a change in ambient conditions from tropical highlands to lowlands is involved.

Storage takes place in the producer and consumer countries. The period and conditions of storage act with the initial commodity conditions to determine an



outcome of the storage. The lower temperatures in the consumer countries reduce potential growth rates but also may mean that dew point is exceeded at a given humidity.

Migration of contaminants from packaging material into foods is a problem that food technologists must avoid. This situation arose some years ago in the coffee sector: hydrocarbons were found to migrate from jute bags used to package green coffee for export into the coffee. The source of the contamination was traced to the batching oils used to lubricate the jute fibres for processing. Since then food-grade jute bags have been developed which do not contain hydrocarbons. Coffee processors must ensure that the bags they use are food-grade. Only the use of vegetable dyes for labelling is acceptable.

Shelf life:

Product stability reflects certain inherent properties of the commodity allied to preservation and storage / packaging technology. Usually products become unpalatable before they become dangerous. Microbial load influences microbiological stability and what is sometimes called the 'inoculum effect' refers to the observation that very high microbial load can overcome control measures. Killing by exposure to heat bears a semi-logarithmic relation to exposure time thus if initial contamination is too many factors of ten above planned levels, some proportion of cells may survive.

In other scenarios, by mechanisms that are not clear, a level of organic acid or water activity usually sufficient to stabilize a commodity fails apparently due merely to weight of numbers of a high inoculum. In cases of coffee products where modified atmosphere stabilizes the product, the longevity and properties of the packaging will affect shelf life. Gas migration rates, stability in sunlight or resistance to mechanical puncture example these considerations. The hygroscopic nature of soluble coffee is much greater than that of green coffee thus special provision for such products is required. Likewise, coffee loses its general quality after roasting much faster than green coffee and this loss is accelerated if the surface area is increased by grinding. Microbial growth is also faster under these circumstances if sufficient water becomes available.

Labelling instructions:

Use this field to set down any special instructions to ensure proper use and avoidance of the introduction of any incompatible materials. In the case of green coffee exports, this will be inclusion of instructions to avoid re-wetting through careless handling, for example, 'store in cool, dry place'.

For other processed products for the retail market instructions for the safe handling of the product by the consumer would be included, such as 're-seal and refrigerate after opening', depending on the nature of the product and its intended use.



Special distribution:

This important inclusion is to assist in an accurate risk analysis by identifying the likely consumer or user group. Some hazards pose more serious risks to certain parts of the population, thus many food-borne pathogens pose a greater risk for infants and the ill or the elderly than the population as a whole.

Thus if a product is used preferentially by one 'at risk' population, let us say baby food, the level of assurance must be higher to achieve the same safety factor. With OTA in coffee it may be that kidney patients are more susceptible to the effects of OTA in the same way that hepatitis victims are to aflatoxin but in practice there is little to apply to coffee here.

