COFFEE BEAN PROCESSING

Where does coffee come from?

Coffee bean processing starts with growing the beans. Coffee beans are grown on tropical, evergreen trees. These trees grow a fruit known as coffee cherries which contains two flat seeds; the coffee beans. Coffee trees are grown in large nurseries, away from direct sunlight. It can take up to four years for a newly planted coffee tree to grow cherries and seven to nine months for the cherries to mature for harvesting. Coffee trees are commonly found in Ethiopia, Brazil, Colombia, Vietnam, Indonesia and Guatemala. Brazil is the largest exporter of coffee, producing over 2.5 billion kilograms of coffee in 2014.

How are coffee beans harvested?

When the coffee cherry is a bright, deep red colour, it is ready for harvesting. There are two types of coffee harvesting methods available – strip picking and selective picking. Strip picking removes all of the cherries off the branch mechanically, while in selective picking only the ripe cherries are harvested by hand leaving the unripe cherries on the tree. The latter is more labour intensive and costly but does result in higher profits for producers because of the high quality beans harvested and less wastage. Strip harvesting is a quicker and more cost effective method to complete, but results in various levels of cherry maturation requiring more post-harvest processing technologies.

How are coffee beans processed?

Coffee beans have a high moisture content of 60 to 70%. For effective processing, coffee beans need to be dried to a moisture content below 11%. Dry processing involves spreading the fresh coffee cherries over a large surface such as asphalt or cement to dry in the sun. The cherries are turned throughout the day and covered at night for protection. All layers of the coffee bean, including the skin and mucilage are dried. Once drying is complete, the cherries are peeled (hulled) and prepared for shipment. This process can take up to 20 days to complete.

Wet processing, on the other hand, removes the outer layers of the cherry surrounding the coffee bean prior to the drying stage. First, the pulping machines separate the pulp from the skin, then flotation is used to separate the ripe beans from the unripe beans. Ripe beans are heavier, so they will sink, while lighter unripe beans float. Rotary drums are then used to separate the beans by size. The beans are then transported to water fermentation tanks to soak for 12 to 48 hours, to dissolve any remaining mucilage; the flesh of the coffee cherry which is responsible for the overall flavour profile of the bean. The remaining beans are rinsed and ready for drying. The coffee drying process can be completed on large tables or beds in the sun, as with the dry method, or by using large mechanical tumblers or other machinery.

The next step in coffee bean processing is milling. Once the coffee beans are dried to a moisture content no higher than 11%, hulling machinery removes the skin or parchment layer on the bean. Then the beans are sorted by size and weight using screens or air jets. At this stage, defective beans are removed. Deficiencies can be classified by size, colour, over fermentation or insect damage. These milled beans are known as green coffee and are ready for export.

Tasting, roasting, grinding and brewing are the remaining steps required before enjoying a hot cup of coffee.

1 http://www.worldatlas.com/articles/top-coffee-producing-countries.html
What are mechanical drying methods for coffee beans?

While the traditional method of sun drying is still very popular and common, because of the large amount of space required and the long drying times, the need for mechanical coffee drying methods has increased over the years.

Hybrid Drying Terraces
This utilizes a conventional drying terrace, with a ventilation system incorporated. Below the terrace, a sub-surface ventilation and aeration duct are installed, using drying air that is heated by charcoal to dry the coffee beans spread across the terrace. This allows drying to continue when the sun is not shining (ex. during rainy days and at night).

Rotary Drums
A horizontal, cylindrical rotating drum using a constant flow of warm air dries the coffee beans as they move from one end of the rotating drum to the other. This method requires large amounts of air and has a high energy consumption. While drying is faster than traditional methods, energy costs are higher.

Indirect Heat Exchangers
Relatively new to the coffee bean industry are indirect heat exchangers. These are vertical, modular, enclosed drying machines that flow the coffee beans by gravity from top to bottom between a series of hollow, stainless steel plates. Hot water flows concurrently within these plates, heating the coffee beans by conduction. A small amount of air flow is used to remove the moisture given off by the beans. The coffee beans flow in a slow and controlled movement down between the plates, ensuring that all beans are evenly dried to the required moisture content. As the air input requirements are minimal, this is an extremely energy efficient method that allows for a significantly increased throughput. The coffee beans are not exposed to new sources of contamination from air, water, or insects, resulting in a high quality processed bean. This indirect heat exchanger technology also opens the door for using heat recovered from other parts of the processing plant.

Statistics
In August 2016, world coffee exports grew 9.5% compared to the same month the previous year and in 2015, 152.2 million 60kg bags of coffee were consumed. Global coffee consumption has been growing approximately 2% every year since 2011. Within these staggering statistics, coffee producers need new and efficient methods of harvesting, drying and processing coffee beans to increase their export capacity and meet the growing demand for coffee.