Coffee: *terroirs* and qualities

Christophe Montagnon, Scientific Editor

éditions Quæ

Coffee, *terroirs* and qualities

Coffee, *terroirs* and qualities

Christophe Montagnon, Scientific Editor

Translated by Peter Biggins

CIRAD

The MOCA group, which focused on mountainous regions and agrarian communities, was founded in 1990 on the initiative of two researchers from the University of Toulouse-Le Mirail. It used to be an officially acknowledged research group (GDR-CNRS) employing a dozen researchers. Its aim was to analyse the socio-economic and geographical aspects of Arabica coffee production, insofar as they play a role in developing territories, as well as local and national societies. In the 1990s, its work particularly concentrated on analysing producer reactions to supply chain liberalization and to deregulation of the coffee market. The MOCA group published thematic studies in the journals Géodoc and Caravelle, and has published, among others, three books edited by Karthala: *Paysanneries du café des hautes terres tropicales* (1994), *Caféicultures d'Afrique orientale* (1998), and *La fleur du café*, caféiculteurs de *l'Amérique hispanophone* (2000). It has produced several films on coffee growing (Kilimanjaro, Venezuela, Brazil, Costa Rica and Cuba). In 2007, The MOCA group will publish a synthesis of its work, in a special issue of *Etudes rurales* journal.

The Agricultural Research Centre for International Development, CIRAD, is a French agricultural research centre working for development in developing countries and the French overseas regions. Most of its research is conducted in partnership. CIRAD has chosen sustainable development as the cornerstone of its operations worldwide. This means taking account of the long-term ecological, economic and social consequences of change in developing communities and countries. CIRAD contributes to development through research and trials, training, dissemination of information, innovation and appraisals. Its expertise spans the life sciences, human sciences and engineering sciences and their application to agriculture and food, natural resource management and society. CIRAD has seven research departments: annual crops; tree crops; fruit and horticultural crops; animal production and veterinary medicine; forestry; territories, environment and people; and advanced methods for innovation in science. It is split into 62 units: 36 internal research units, 20 joint research units, 3 cooperative research units and 3 service units. It employs 1 820 people, including 1 050 senior staff members, and has an annual operating budget of 200 million euros.

The scientific editor is grateful for the invaluable work of three people without whom this book could not have been what it is. The translator Peter Biggins, the editor Nicole Pons, who kept us on our toes and made sure we respected deadlines, and the graphic artist Delphine Guard-Lavastre. Many thanks to all three!!!

Cover
Plantations in southern Merida, Mexico © B. Charlery de la Masselière
Coffee harvesting in Guatemala © ANACAFE

ISBN ~~10: 2-7592-0028-0~~
~~ISBN 13: 978-2-7592-0028-~~3

Contents

Foreword

This is a book of meetings, a book of discussions over a good cup of coffee.

Meetings between men and women who study coffee growing from different angles: a geographical, socio-economic viewpoint on the one hand, and an agronomic and technological viewpoint on the other hand. This is the meeting between the MOCA group and CIRAD researchers.

Together, they observe another meeting?the meeting between human societies and coffee growing?and the resulting landscapes. A comparison of these visions and experiences, which are different and complementary, led to the idea of a book that would focus on the notions of qualities and *terroirs*: symbols of the conjunction between man and coffee, but also levers for a modernized organization of the coffee supply chain, which would ensure the sustainability of the crop through balanced exchanges between producers and consumers.

The first part of this book describes the mutual relation between qualities and territories. From that relation *terroirs* are born. The plural use of the words "qualities" and "territories" reflects the complexity of the concepts involved. There is not just one but several coffee qualities. The notions of territories and terroirs evolve over time, whilst the mountains where Arabica coffees are produced are mosaics of different territories.

Coffee, like wine, is the epitome of a convivial drink. The comparison between coffee and wine seems tempting, especially when speaking about qualities and terroirs. Caution, though... We shall discover in this part of the book the consequences of a major difference between wine and coffee: the clear separation between production zones (humid intertropical zone) and the zones where coffee is consumed (primarily industrialized countries). Conviviality around wine brings together producers and consumers, conviviality around coffee usually only brings together consumers.

The second part of the book takes a look at the place of quality and *terroirs* in policies to revive coffee growing in producing countries. Such revivals are taking place in a context of crisis in the coffee production sector, with very low prices, and impoverishment of producers. We shall discover here again the specificities of coffee growing and their consequences.

Much food for thought arises from this part of the book. Here is some of it. Income from coffee is traditionally and specifically earmarked to pay for children's education. The aim is for those children to become civil servants, or doctors, but not coffee growers. Is not the reproducibility of coffee growing in generation terms therefore inherently jeopardized? Coffee

is both a source of income for farmers and a source of foreign currency for the State. Might there be a conflict between those two expectations on a national level? The concept of *terroirs* entails the attachment of a population to a territory in the long term. Is it compatible with the migratory tradition of coffee growing in some countries, such as Brazil? Such deliberations need to be entered into before organizing a supply chain and introducing revival policies. Even a success story such as the Federacion Nacional de Cafeteros de Colombia has its limits in a serious crisis period. The third part of the book describes, among other things, a few situations testing qualities and *terroirs*. We have chosen four aspects that seem to us to be characteristic of concrete situations encountered in terms of coffee qualities and terroirs.

In the first situation, a country or region banks on quality on the Arabica coffee market, for which qualitative differentiation already exists: the case of Burundi. In the second situation, faced with the crisis, a country or region recognized for the quality of its coffee cannot maintain that quality: it is the case of some regions in Cameroon. In the third situation, varietal improvement enters the quality game, but needs to achieve a balance between economic and ecological sustainability on the one hand, and the need for quality on the other hand: the case of *C. arabica* breeding in Central America and the Caribbean. Lastly, in the fourth situation, everything needs to be (re)defined and (re)invented in *terroir* and quality terms: the case of the Robusta market.

This book does not claim to be exhaustive. In particular, it does not deal with farmer organizations and the cooperative movement, or with the legal aspects of protecting origins. Few data are available today for comparing the costs and added value associated with quality coffee production, though some of the chapters in this book provide a glimpse of some interesting answers. Surveys and databases on the remuneration paid to producers for quality, taking into account the social attributes (fair trade coffee) and environmental attributes (organic coffees, etc.) of coffee quality will be a major challenge in the coming years.

By pooling different types of expertise, this book sets out to be a reference and to serve as a basis for considering the perception of qualities and *terroirs* in their human and agricultural dimensions.

Christophe Montagnon

Qualities and territories: a reciprocal relationship

The qualities of a coffee

Jean-Jacques Perriot, Fabienne Ribeyre,
Christophe Montagnon

According to the Oxford English Dictionary, quality is the "degree of excellence of a thing (of good quality, of poor quality), a characteristic trait". It can also be "a general excellence, a distinctive attribute or faculty". The notion of quality therefore appears to be extremely wide and vague. In economic terms, quality is conceived as a set of attributes or characteristics applied to the product in a broad sense (smell, colour, packaging, place of sale, etc.), but also the production process (e.g.: ethical, equitable, ecofriendly). In this chapter, we shall be considering quality from a sensory, technological and chemical viewpoint. Quality is considered more in economic terms in the next chapter.

What does quality mean in the world of coffee? Should we speak of quality or qualities? To answer that question, we shall be examining in this chapter the opinions of five stakeholders in the coffee supply chain: producers, exporters, importers, roasters and consumers. We shall then go on to discuss how origin affects quality.

Coffee quality criteria

Producers

The first stakeholder upstream in the supply chain is the producer. Producers are mostly interested in the profitability of their farms, which is often estimated from the productivity of their plantation. Producers seek high-yielding varieties that are disease and pest resistant, and profitable crop management sequences.

Producers often carry out post-harvest treatment of coffee cherry themselves. Depending on the environment (climate, water availability), their technical skill and level of investment, they choose either "dry processing" or "wet processing".

Dry processing is simple to carry out: it is enough to spread out cherries on a cemented area or on mats, turn them and protect them from moisture until completely dry. Dry cherries are then hulled.

Wet processing requires more work, equipment and technical skill. Coffee cherries are placed in tanks of water to remove bits of wood, leaves and floating cherries. Only cherries that do not float must be pulped. Pulped seeds are then fermented, either dry or in water, for 16 to 48 hours depending on climatic conditions. Once fermented, the coffee has to be washed abundantly to remove any trace of mucilage. After drying, the parchment will be removed. The cost of wet processing is therefore higher than dry processing, but it gives a coffee whose quality may well lead to added value on the market.

Coffee quality criteria for producers are therefore primarily economic in many cases. They often only perceive the notion of coffee quality through the price paid for their product. Apart from a few exceptions, producers are not coffee consumers; in particular, they do not consume their own production. This is a crucial characteristic of the coffee market, unlike the wine market.

Exporters

Product collection is often ensured via a network of middlemen. Mixing may occur over the entire length of the middleman chain and complicate product traceability, right up to the moment it reaches the exporter.

First and foremost, exporters have to honour orders and therefore ensure their supplies: their main objective is to have enough of the product to export. In terms of coffee characteristics, exporters systematically check the moisture content of the product, which must not exceed 12.5% according to the new ICO (International Coffee Organization) agreements that came into force on 1 October 2002. A higher content can lead to a deterioration in the characteristics of the coffee during storage, and to sanitary risks. Prior to any price negotiating, exporters also determine two major parameters: the colour and smell of the coffee. They deduce from the colour what treatment the coffee has been subjected to (dry processing or wet processing), along with the drying and storage conditions. The coffee must be free of undesirable odours, such as a mouldy smell. Exporters sometimes carry out a quick visual check to determine the number of defects. They are particularly vigilant for black beans (dusty, earthy tastes), waxy beans (over-fermented, alcoholic tastes), broken beans (burnt tastes) and parchment beans (earthy or burnt tastes). Exporters often sort and calibrate green coffee. For some origins considered to have specific characteristics, they also taste batches to assess their sensory quality and guide their choice towards buyers interested in a given taste.

Coffee quality criteria for exporters are regular supplies in quantity and quality, compliance with physical norms for coffee and, of course, advantageous buying and selling prices. Exporters are only interested in sensory quality if it enables them to negotiate a premium.

Importers

Importers, like exporters, also need to honour orders and therefore assign great importance to regular supplies. Importers also check moisture content. Origin is a major quality attribute for importers as, with experience, it is possible to attribute a certain number of constant quality characteristics to each origin. For some origins, importers are ready to pay more for large beans (grades 16 and over), which are reputed to give a better than average liquor. On the other hand, small beans (of the same origin) may be a sign that unripe fruits have been harvested and therefore an indicator of a defective cup (green taste, astringency).

Importers often carry out sensory tests on the samples received. They are ultimately seeking stable characteristics over a large volume, depending on the price of course, which is often more down to an acquired reputation than to the intrinsic characteristics of the product.

Coffee quality criteria for importers are similar to those for exporters: regular supplies and physical conformity. Being slightly further downstream than exporters, importers take origin into account on an international scale and apply price differences between producing countries. Lastly, importers, who are closer to the consumer, check cup quality more systematically.

Roasters

Roasters want a coffee with stable sensory characteristics that meet customer expectations at a given price. Batches are analysed on receipt to check the moisture content, bean size and number of defects. Each batch is then tasted to find out whether it corresponds to the typicity sought for each origin.

Roasters sometimes use coffees of pure origin, but they usually work with blends, to ensure a constant taste. That enables them to replace one origin with another if a quality problem occurs in a country, or if prices rise for a given origin. The recipes often involve 6 or 7 different coffees. The roasting method (fluidization or convection) temperature and duration also influence the end product. Some economic parameters are very important depending on the form in which the coffee is sold. For instance, extractability is of paramount importance for instant coffee production.

Coffee quality criteria for roasters are the origin and the physical and sensory characteristics associated with it. Some technological qualities are paramount, such as extractability for instant coffee. Roasters count on blends to overcome supply problems as much as possible. Cup quality is paramount, but so is the price.

Consumers

Consumers are at the end of the supply chain. Their criteria when making a choice are the price and the brand, but that choice is strongly influenced by marketing and advertising. The quality indicators carried by advertisements are: the species (Arabica or Robusta), the origin and type of roasting, and increasingly the social and environmental conditions of production (organic, fair trade, etc.). For the moment, consumer choice is not affected by any food safety issues that might be linked to coffee.

Once consumers have chosen a coffee, they are attached to the taste stability of that product, without always being aware of their own role in maintaining that stability. Indeed, the sensory characteristics of their coffee are greatly influenced by the way the beverage is prepared: type of machine, physico-chemical characteristics and temperature of the water, extraction time and pressure,...

Consumer tastes vary from one country to another, and from one region to another; for example, it is impossible to define a European taste. Italians prefer a coffee that has more body and is more bitter than the Germans and Swedish. The French traditionally appreciate a coffee that has body and is bitter with slight acidity. That preference is to do with history and the importing of robusta coffee (bitter and full-bodied) from former French colonies. Fruity coffees are beginning to be sought after, though consumers are often unable to describe the flavours perceived. Coffees with off-flavours (notably over-fermented) are often poorly appreciated. But habits are created and those tastes may one day become a characteristic of coffee, such as the rioy taste (corked taste in wine) sought after in northern France. The South of France generally prefers coffees with more body than the North. Moreover, some brands change their recipe according to the regions of France.

Coffee quality criteria for consumers are difficult to pinpoint as they are often dictated by marketing. In addition, quality criteria vary from one country or region to another. The general trend is the increasing concern with social and environmental aspects.

Quality: a contrasting vision

The quality criteria taken into account by the different stakeholders in the coffee supply chain clearly reveal several approaches to quality. It is risky summarizing these different approaches (Table 1) as there are some substantial nuances. We do not focus here on the ways quality attributes are assessed, as they will be described in the next chapter.

Table 1. Relative importance of the different quality criteria for stakeholders in the coffee supply chain.

The economic aspect, the price, is common to all the links in the chain. Quantity, in terms of supply regularity, concerns the middlemen between producers and consumers, as do physical characteristics. Consumers perceive the physical aspect in the increasingly marginal case of coffee sold in bean form. Sensory characteristics, including their stability, become increasingly important approaching the consumer in the chain. Only roasters are concerned by technological characteristics linked to ground coffee, and particularly instant coffee production. Origin is considered, either rightly or wrongly as we shall discuss later, as an indirect indicator of product quality and it is used as such by importers, roasters and consumers. Lastly, social and environmental aspects are taking on increasing importance for those primarily concerned, namely producers, but also for consumers: roasters are seeking to fashion themselves a positive image in that respect.

Quality criteria	Producers	Exporters	Importers	Roasters	Consumers
Economic	+++	+++	+++	+++	+++
Quantity		+++	+++	++	
Physical characteristics		+++	+++	++	
Sensory characteristics		+	++	+++	+++
Technological characteristics				++	
Origin			++	+++	++
Social and environnemental	++			+	++

Three rows in table 1 attract attention. Physical and sensory characteristics are of concern throughout the supply chain, to varying degrees, except to producers, quite simply because they are not rewarded, or only slightly rewarded, for those characteristics by buyers/exporters. Of course, there are some exceptions but, as a general rule, it is not economically in producers' interests to bother about the physical quality, and especially the

sensory quality, of their product. Technological processing characteristics are only of interest to roasters. Those characteristics are sometimes confidential, including the assessment protocol, and roasters choose not to divulge their evaluation of those criteria to outsiders.

The three intermediate stakeholders, importers, exporters and roasters, have quite similar appreciations of quality and vertical concentrations are frequently seen, moreover. Consumers do not see things in the same way, but all the efforts of the intermediate stakeholders are geared towards the ultimate satisfaction of the customer-consumer. Only producers seem to be disconnected from the quality chain, through lack of information and/or remuneration. Who loses out most from such a situation? Producers who could procure additional added value by taking into account the quality sought by the market? Or the middlemen who have to find the desired quality where it exists rather than obtaining it by giving producers precise specifications? Here again, there is no one-size-fits-all answer. It seems in the general case that producers are the losers and that middlemen only supply producers with precise specifications, and adequate remuneration, when they have no choice.

Is origin a relevant sensory quality?

The rising popularity of origin coffees could be beneficial to producers by adding local added value to the raw material. But what is known about the link between origin and coffee quality? Is the origin an indicator of end?product taste?

Origins and quality: where our knowledge stands

The sensory quality of a coffee depends on the structure of the bean and the balance of the chemical components contained in green coffee. Roasting uses those chemical components to develop those of roasted coffee. Factors affecting the structure and chemical composition of green coffee, and consequently the sensory characteristics of the beverage, are numerous and eminently local (soil, climate, height above sea level) or linked to local traditions (varieties, crop management, shade, harvesting method, post-harvest processing, etc.).

The effect of the variety on coffee quality is well known, even though few scientific studies have examined it precisely (Montagnon et al., 1994; Moschetto et al., 1996). The effect of different crop management sequences, and of diseases and insects, has been reviewed by Decazy (1994).

Several authors have reported a relation between shade or height above sea level and beverage quality (Avelino, 2001; Guyot et al., 1996; R. G. Muschler, 2001). Shade and an increasing height above sea level have a similar effect on coffee quality: large beans, and an acidulous flavoursome beverage (Guyot et al., 1996). The height above sea level and shade would seem to slow down bean ripening and affect the physiology of the plant (Guissant, 2002).

Harvesting quality is essential for the sensory quality of a coffee. Picking unripe beans leads to a deficit in sugars and a surplus of chlorogenic acids: the beverage then has less flavour, with a green taste (freshly mown grass), astringency and harshness. Harvesting slightly overripe beans can give fruity tastes, but severe overripeness leads to a loss of aroma linked to the degradation of sugars and the appearance of overfermented aromas. The earliness of the harvest is dictated by local factors such as traditions, socio-economic constraints (theft, new school term, etc.) and climatic risks that push producers to harvest earlier.

Post-harvest processes play a definite role in the ultimate flavour quality of a coffee. They contribute to either promoting or altering the potential of the harvested coffee. Washed coffees (wet processing) are always milder (less bitter and more acid) than natural coffees. Thesis work is currently being conducted at CIRAD, testing two hypotheses to explain this difference between wet and dry processing: elimination of compounds linked to bitterness and/or the effect of fermentation on acidity. The quality of water used to wash and transport coffee also seems to influence the outcome of post-harvest treatment. Poor quality water (low pH, rich in organic matter) or water loaded with minerals (Fe+++ content over 5 mg/l) can lead to the development of off-tastes (Barel and Jacquet, 1994).

The duration and quality of drying, then storage, depend on the climate. If beans take up moisture again during storage and transport, they turn white and lose some of their sensory characteristics.

Local factors therefore affect coffee quality, but roasting is usually carried out in consumer countries. Depending on the type of roasting (temperature, duration) the characteristics of the coffee will not be expressed in the same way. If it is light, the beverage will be acid and lacking flavour. Medium roasting (French) will give a coffee with much more body, and with balanced bitterness and acidity. Dark roasting (Spanish) will give a much more bitter coffee, sometimes with burnt tastes. Lastly, water-proof packaging helps to preserve those characteristics right up to the consumer.

How do brand, type and origin indicate taste?

Origin is increasingly being used in France by the major commercial

brands, particularly to court consumers. The country (Brazil, Colombia, Kenya) is most often used, but also the region (Antigua, Popayan, Bahia) or sometimes the actual plantation (the case in the USA, notably for estate coffees). We studied the sensory characteristics of 20 products bought in French supermarkets to determine whether the differences advertised on the packs corresponded to true sensory differences for the consumer. We classed the products in six types: Colombia, Organic, Mild, Espresso, Gourmet and Decaffeinated, and three supermarket brands SB1, SB2, SB3 plus one national brand (NB) for each type.

The coffees were prepared by infusion and tasted by eleven qualified tasters. A principal components analysis (PCA) was carried out on the following sensory criteria: acidity, bitterness, body, green, harsh, sour and flavour quality (figure 1). The first two axes represented 65% of the variability. The first axis opposed flavour quality, body and bitterness to sour and green. The second axis opposed acidity and harshness. On this graph, the coffees were grouped more according to brand than to origin (Colombia) or other types. Only the decaffeinated coffees were fairly well grouped. On the other hand, the samples of the national brands did not resemble each other. Irrespective of type, including Colombia, the supermarket brands were acid with little body (SB1), low acidity and harsh (SB2) and intermediate (SB3). Worth noting was the scattering of coffees labelled as Colombian coffees.

In our study, the supermarket brand was a more relevant indicator of taste typicity than any other attribute, including origin, in this case Colombia. A customer wishing to find a Colombia typicity would have been disappointed. That might be explained either by heterogeneity in quality in Colombia, or by a preponderant influence of roasting.

Conclusion

Coffee has many qualities, which are considered differently by the various stakeholders in the supply chain. Coffee qualities vary depending on the origin of the green coffee. Such differences are observed between different countries, but also on a regional level in the same country. The quality potential of green coffee therefore depends on its terroir. Current systems do not always enable good traceability of coffee origin, or differentiated buying depending on the quality supplied by a grower.

Adding value to coffee based on origin requires it to be of benefit to the entire supply chain, from producers in economic terms, to consumers in sensory terms. In order to achieve that, it is necessary to relate the quality attributes that are important for each stakeholder, such as sensory characteristics and the price paid to the producer, but also the volume produced,