

# An Original Decision-Support Tool for Adding Value to Coffees

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## SUMMARY

Producing countries are seeking to add value to their coffees and an original method has been developed to meet their requirements. It uses sensory categories based on descriptive profiles linked to different kinds of data. It culminates in zoning that facilitates product recognition and marketing. The method can be used to propose several country-scale scenarios. Scenarios are constructed taking into account technical, but also social, political and organizational constraints. Each of the proposals offers advantages in terms of clarity and ease of implementation, but they also have drawbacks, such as the exclusion of some producers. Other zoning possibilities can be imagined, depending on available data and the objectives fixed.

## RÉSUMÉ

Une meilleure valorisation des cafés est recherchée dans les pays producteurs. La méthode originale des scénarios a été mise au point pour répondre aux demandes de ces pays. Cette méthode utilise des catégories sensorielles basées sur des profils descriptifs associés à des données de différentes natures. Elle aboutit à une zonification facilitant la reconnaissance et la commercialisation des produits. La méthode permet de proposer plusieurs scénarios à l'échelle d'un pays. La construction des scénarios prend en compte différentes contraintes techniques mais aussi sociales, politiques, organisationnelles. Chacune des propositions présente des avantages en termes de lisibilité, de facilité de mise en oeuvre mais aussi des inconvénients comme l'exclusion de certains producteurs. D'autres zonifications peuvent être imaginées en fonction des données disponibles et des objectifs fixés.

## INTRODUCTION: CONTEXT

Market segmentation is currently being seen for many products, especially for coffee. Such segmentation corresponds to the joint requirements of consumers and producers. Consumers wish to procure a particular product for different reasons:

- A gourmet seeks a product capable of providing new taste sensations,
- A discerning consumer feels the need for information on the product used, its origin, its manufacture, its production conditions (*terroir* and traceability concepts),
- An unconventional consumer seeks to stand out from other consumers by not consuming products known to everyone.

Producers seek to make the most of the fruit of their labour, in order to stabilize and improve their income in a context of fluctuating commodity prices, or to diversify their activity.

The coffee market needs differentiated products providing certain guarantees which can be provided by geographical indications and quality labels, etc.

CIRAD is called upon to assist in characterizing coffees, by providing tools for adding value to differentiated products on both the general market and the specialty coffees market. The demand usually comes either from institutional partners in producing countries, or from agricultural organizations, such as cooperatives, whose members are directly involved.

A few examples indicate the reasons for such demand:

- The Dominican Republic is seeking to establish the renown of its coffee and return some coherence to designations,
- The island of Réunion is seeking to revive its coffee sector with a view to diversification and substitution for geranium growing, which has been experiencing productivity problems for several years,
- Laos is seeking international awareness and recognition of its products and their originality,
- Indonesia wants to protect its designations (Kintamani, Bali coffee) and prevent others from using them.

This demand is being met through projects with social, legal, commercial and technical components. The differentiation of coffees has to be established on a sound scientific basis.

The proposed approach makes it possible to tackle scientific issues associated with the product and provide decision-makers with a decision-support tool. It is based on the construction of descriptive sensory profiles which culminate in uniform coffee categories. A comparison with different types of data makes it possible to identify the main quality determinants. Those elements, which give coffees their characters, are of different kinds: the variety grown, the environment (such as height above sea level, soil properties, rainfall), and post-harvest processing procedures.

Irrespective of the objective expressed when a request for assistance is received, the initial stages are similar:

- Characterization of the product and its quality attributes,
- A study of coffee category determinants,
- Establishment of differentiated production zones.

This novel approach proposes different zoning scenarios to help decision-makers to choose the most appropriate way of setting in place signs of recognition or quality to add value to products.

## **MATERIALS AND METHODS**

The first stage in the approach consists in getting to know the product and describing it. This initially involves rational sampling. The sampling plan is defined according to objectives, the production structure in the country considered, and prior knowledge of the variables affecting sensory quality.

Based on prior knowledge, the sampling protocol is designed to study the effect of chosen factors on sensory characteristics. Some factors are standardized to facilitate the study. For example:

- Height above sea level: several samples per altitude range,
- Variety: several samples per main variety,
- Harvesting year: replication over several years,
- Harvesting date: sampling during the harvest peak only,
- Post-harvest: a single standardized protocol or several compared protocols.

It is a matter of establishing a product profile using physical analysis techniques and sensory evaluation.

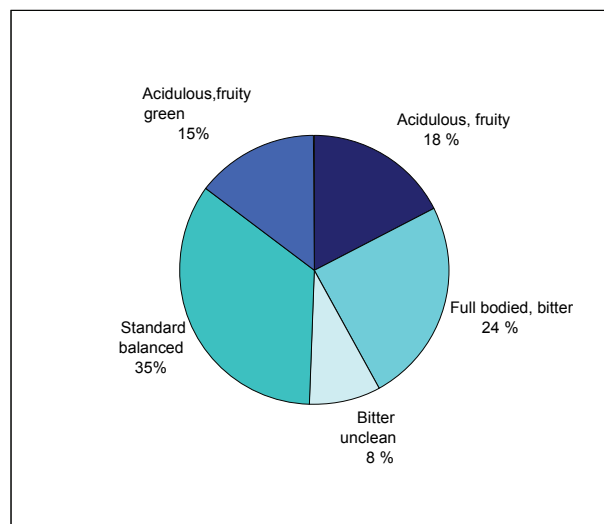
Physical analyses reveal the physical qualities of the product:

- Existence of foreign bodies,
- Bean colour,
- Bean integrity (existence or not of damaged beans),
- Distribution in the different grades.

Sensory attributes are scored during tasting sessions:

- Flavour intensity,
- Acidity,
- Bitterness,
- Sourness,
- Astringency,
- Fruitiness,
- Woodiness, etc.

This set of descriptive attributes is used to establish the product profile.

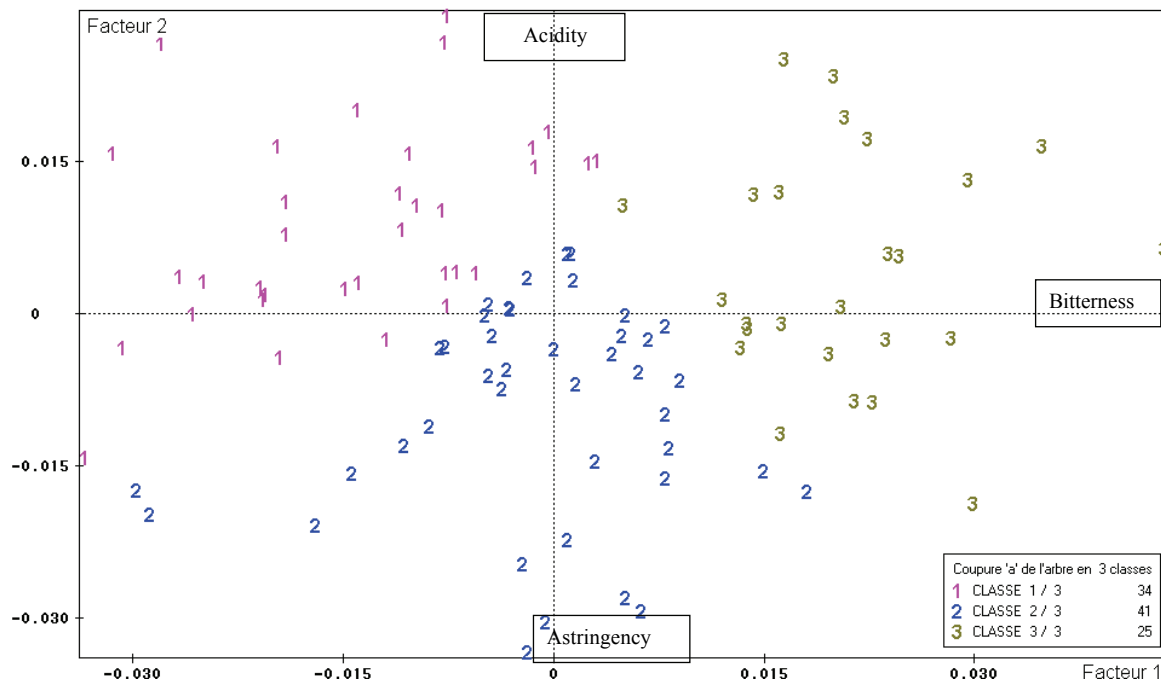


**Figure 1. Example of coffee distribution in uniform groups on a country scale over two harvesting years.**

The evaluation techniques are standardized. They are based on ISO standards where they exist. Sensory evaluation is carried out by a panel of at least five trained people. That minimum number of five panel members is necessary to statistically analyse scoring

coherence. These tasters belong to the local coffee supply chain. They need to receive full training enabling them to carry out a repeatable assessment of the coffee profiles to be tested. An appropriate training module has been developed by the CIRAD team. Training such a panel subsequently enables the supply chain to control coffee characteristics.

The quality of sensory evaluation is essential. It makes it possible to trace the profile of the coffee and will form the “hard core” of the subsequent statistical analyses. After checking the coherence of the sensory profile results by analyses of variance, sensory groups are created by a principal components analysis (PCA), then by classification (clustering and dynamic clouds). Analyses of variance reveal that each group has a particular physical and organoleptic profile.



**Figure 2. Example of sensory group representation on a PCA.**

The second stage consists in studying determinants of the coffee categories or groups. This stage calls for major data gathering and statistical analyses. The sensory evaluation data, the “variables to be explained”, are cross-checked against different types of data (environment, soil, post-harvest processing, etc.), “explanatory variables” from compiled databases.

The databases must be as far-reaching as possible to cover all the situations encountered in the zone in question (country, region, etc.). To achieve that objective, a survey has to be conducted, in addition to sampling, in order to gather data on the explanatory variables. Studies already undertaken show that coffee tree variety is important but it cannot be analysed separately from the cropping system (pruning, fertilization, etc.). The same applies for the height above sea level, which is linked to the environment – temperature, aspect and sunlight, etc.).

The plots or plantations from which the samples are collected must be clearly georeferenced. Precise data must be collected, in particular:

- Soil, with sampling and analysis (chemical composition and texture),
- Height above sea level,

- Aspect,
- Meteorology (temperatures, rainfall, sunlight, evapotranspiration, wind speed).

Cultural practices play an important role. The data required for the analyses concern:

- The harvest (yield, date, method, quality),
- The phytosanitary treatments carried out,
- Soil amendments applied by the producer (chemical and/or organic fertilizers),
- Pruning methods.

Post-harvest processing methods need to be accurately known:

- Individual or group processing,
- Dry processing (without pulping prior to drying) or wet processing (pulping),
- The time taken for each phase, in the case of comparison,
- Drying method,
- Storage method (parchment or green coffee).

All the data are entered in a single base in which information is provided on each variable for each sample.

The sensory groups created during the characterization phase will be compared to the explanatory variable data using appropriate statistical methods (Correlations, analyses of variance, Khi2). The Hierarchical Answer Tree method is used to class the influence of factors.

The third stage consists in determining differentiated production zones and creating scenarios. The geographical distribution of the sensory groups makes it possible to determine zones where coffees are uniform. Their boundaries depend on quality determinants. Based on privileged criteria (socio-economic, geographical, sensory, etc.), several types of zoning can be considered, which leads to several scenarios.

## **RESULTS AND DISCUSSION**

Zoning scenarios are proposed in accordance with the results and depending on requirements. When establishing signs of recognition, specifications have to be respected for each scenario. Scenario construction takes into account different technical constraints, but also social, political and organizational restraints.

We propose 3 zoning constructions. The first proposal relies on associating the coffee with the image the producing country conjures up in consumer countries, based on its exotic charm, culture and traditions, its protected environment. The aim is to market all the coffees in the country under the same quality sign. This is the case encountered for small countries with a strong public image.

Specifications need to be drawn up so that the commercial and sensory quality of the product is guaranteed. Technical constraints are therefore imposed on producers wishing to use the quality sign created. In this case, the specifications do not entail any territorial restriction. No producer is excluded.

The second proposal is to establish groups of coffees based on precise knowledge of the environment, production techniques and the organization of local stakeholders in the supply chain. This territorial break-down leads to the definition of fairly extensive zones (e.g. a valley) in which the coffees are often more uniform with a more marked identity than in the previous scenario. Sensory characteristics play a not insubstantial role and are taken into account in the specifications corresponding to this type of scenario. These are more restrictive than in the global scenario. In this case, the specifications become restrictive for producers. A producer not located in the defined zone will not be able to claim the quality sign that is set in place. Social management of this scenario can prove tricky.

In the third proposal, zone construction is based on sensory data. Coffees are divided into clearly distinct sensory groups, with the product groups corresponding to restricted zones. The specifications will be based on the sensory characteristics of the product, which will exert strong technical and geographical constraints. In zoning terms, it is a difficult scenario to implement. It may not correspond to the current break-down (cooperative, administrative, catchment area, etc.). This scenario makes it possible to define the most differentiated coffees. It is particularly suited to small zones producing an original coffee earmarked for the niche markets in sufficient quantity (cooperative covering a village or set of villages).

Each of the proposals offers advantages in terms of clarity and ease of implementation... but also some drawbacks, such as the exclusion of certain producers. Other types of zoning can be imagined depending on the data available and the objectives fixed.

This method calls for considerable information gathering (sampling with a command of post-harvest processing, and a survey) and data validation. Some data are particularly difficult to obtain in a reliable manner (e.g. yields). The method therefore has to be adapted to the available data and, sometimes, variables that are generally correlated to missing variables (e.g. height above sea level and temperature) have to be used.

This method describes the potential of the coffee over a zone. For marketing, it is then necessary to take into account the variability associated with each producer and with the harvesting year. Samples can then be tested by the locally-trained sensory panel to validate the match between coffee products and the expected profile. This makes it possible to monitor product characteristics over time.

Differentiation of coffee categories can be confirmed by tasting sessions involving buyers, which enables traders and roasters to match market expectations with the proposed products.

## CONCLUSION

Comparing the advantages and disadvantages of each type of zoning provides a decision-support tool. The choice of zoning type and specifications is left to stakeholders in the coffee supply chain of the country in question, and has to be determined in line with the recognition being sought. This original method provides a scientific basis for designing production zones, since it is based on statistical analyses. It can be used to define *terroirs* suited to quality coffee production, considering the coffee tree in its environment, along with cultural practices and farmer know-how.

This method is founded on sensory aspects, but other criteria can be taken into consideration to meet the demand for particular quality signs linked to the environment, such as organic agriculture, rain forest, etc.