

Ch 20. Tools for sensory evaluation

To ensure comparability of results, it is essential to have a common vocabulary and a set of tools that guide the sensory evaluation and recording process. These tools play a crucial role in providing valuable insights into the sensory attributes of a product. Manufacturers, marketers, and researchers can then utilise these insights to enhance the quality and appeal of the product to consumers. This chapter delves into the various tools employed in sensory evaluation. The tools are as follows:

- **Flavour Wheel:** This tool provides a quick and comprehensive overview of a shared vocabulary for flavour attributes and their sub-attributes. It assists in standardising the terminology used during evaluations.
- **Glossary of terms:** A collection of terms with definitions of flavour attributes and sub-attributes. This resource aids in understanding and assessing the intensity of flavours and the global quality of the product.
- **Sensory Evaluation Form:** This form is designed to record the flavour attributes and their intensity scores, global quality assessments, and any additional comments that may be useful for communication with the producers of the cacao bean samples and any users of the product.
- **Tools for Analysis and Visualisation:** These tools enable the analysis and visualisation of flavour evaluations, helping to create a flavour profile for the product.
- **Additional Documentation Guidelines:** This section provides further guidance on documentation practices, ensuring that evaluations are thorough, consistent, and properly documented.

By utilising these tools, sensory evaluations can be conducted in a standardised and systematic manner, allowing for meaningful comparisons and facilitating communication among stakeholders.

20.1 Flavour wheel

A flavour wheel serves as a standardised tool for describing and evaluating flavours, and it exists for various food commodities, including coffee, wine, and olive oil. Its purpose is to facilitate consistent and objective communication and comparison of sensory attributes. By utilising a flavour wheel, consumers, producers, and researchers can effectively identify and describe specific attributes such as acidity, bitterness, fruitiness, spiciness, and other subtle nuances that contribute to the overall sensory experience. This shared vocabulary enhances the understanding and evaluation of flavours in a coherent and structured manner.

The Cacao of Excellence programme developed a flavour wheel (Fig. 20) based on its 12 years of experience evaluating cacao samples from around the world for its Awards competition. Its development involved the collective input of experts in sensory evaluation and in the processing of finished products.

The flavour attributes are divided into three groups:

Core attributes: Flavour characteristics expected to be present in every cacao. They include cacao, acidity, bitterness, astringency, and roast degree.

Complementary attributes: Flavour characteristics that may or may not be perceived in cacao samples. These complementary attributes are described as fresh fruit or browned fruit, vegetal, floral, woody, spice, nutty, and caramel/panela. In the case of dark chocolate, sweetness is also included.

Off-flavours: Characteristics that result from defects and may or may not be perceived in the cacao samples.

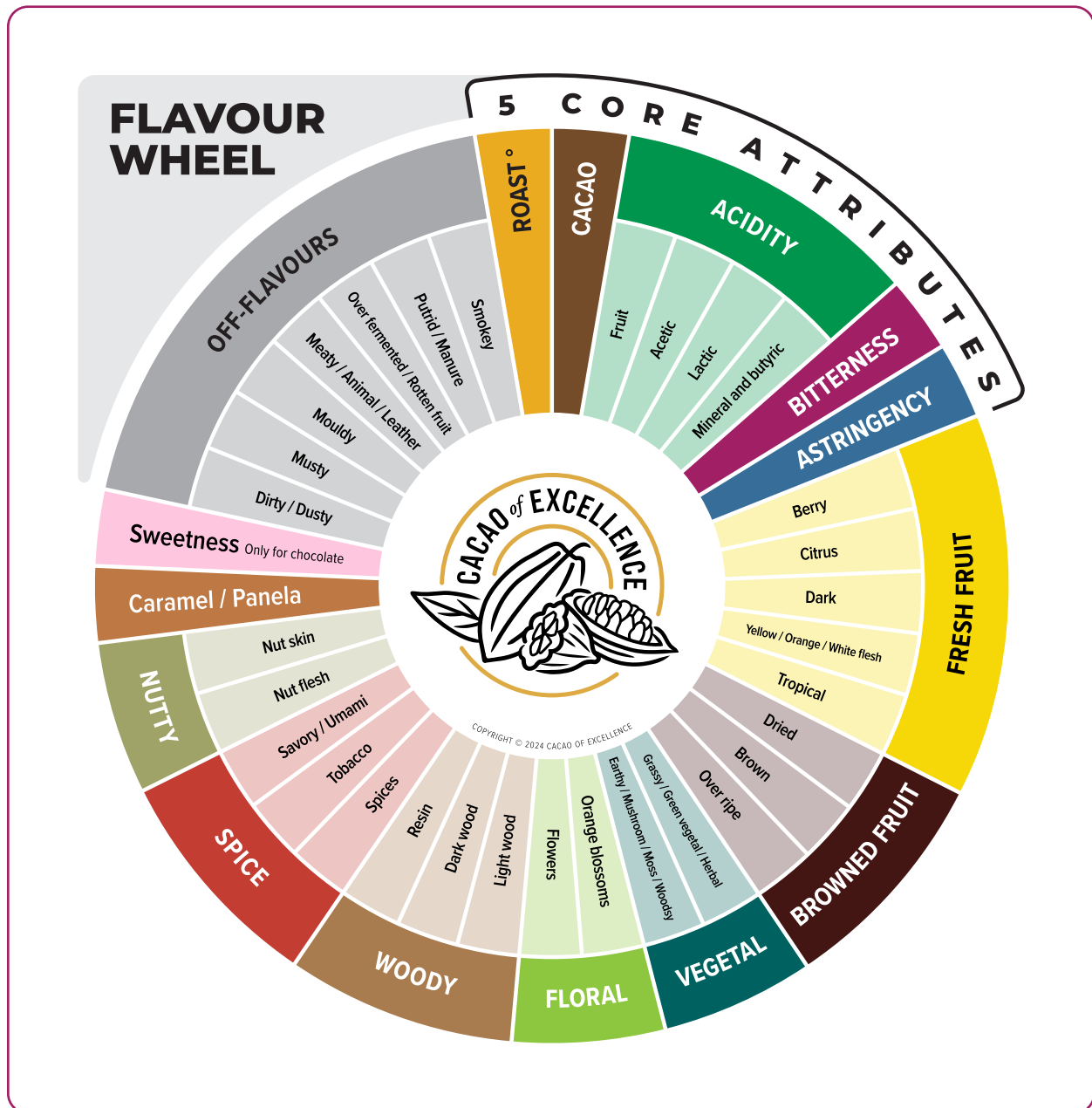


Figure 20. Cacao of Excellence Flavour Wheel (2023).

20.2 Glossary of terms for sensory evaluation

A glossary of terms is a valuable resource that provides a list of flavour attributes along with their definitions.

These flavour attributes and sub-attributes are categorized into core attributes, complementary attributes, and off-flavours. Each of these attributes is assessed using an intensity scale ranging from 0 to 10. The glossary also includes examples of intensity scores (references) to assist evaluators in understanding and applying the scale accurately.

Furthermore, a global quality score is defined, providing a comprehensive assessment of the overall quality of the sample. Table 39 presents a description of each score ranging from 0 to 10, aiding in the interpretation and communication of the sample's evaluation.

Table 38. Cacao of Excellence Glossary of terms for sensory evaluation of cacao beans processed into mass and dark chocolate (Cacao of Excellence 2023).

Attribute intensity scale and meanings:

Intensity Meaning

0	Absent.
1	Just a trace and may not be found if tasted again.
2	Present in the sample but at low intensity.
3 to 5	Clearly characterising the sample.
6 to 8	Dominant characterisation of the sample.
9 to 10	Maximum. Strong intensity. Overpowers some other flavour notes in the sample.

The flavour attributes are divided into three groups:

- 1. Core attributes:** cacao, acidity, bitterness, astringency and roast degree expected to be present in every sample and scored.
- 2. Complementary attributes:** characteristics that may or may not be perceived in cacao samples.
- 3. Off-flavours:** resulting from defects that may or may not be perceived in cacao samples.

Descriptor	Description	Intensity level / Reference notes
Cacao	Typical flavour of roasted cacao beans that are well fermented, dried, free of defects.	0–2 Under-fermented cacao, ancient Criollos.
		3–5 Appropriately fermented “Nacional” and Papua New Guinean lots.
		6–8 Appropriately fermented cacao, some West African and some Dominican Republic Hispaniolan lots.
		9–10 Some West African lots.
Acidity	<p>Total acidity is the sum of the following individual acidities. If the result is ≥ 10 it is rounded to 10 as the maximum:</p> <ul style="list-style-type: none"> • Fruit: citric or other fruit acids. • Acetic: vinegar (can be smelled in the sample). • Lactic: typically occurring in sour milk and yogurt • Mineral and butyric: harsh metallic tasting (mineral) and rancid butter (butyric). <p>Perception of acidity intensity is particularly dependent on the amount of sample in the mouth.</p>	0–2 Some well-prepared West African lots.
		3–5 Some Ecuadorian, Peruvian and Central American lots.
		6–8 Some Dominican Republic Hispaniola, Papua New Guinean and Malaysian lots.
Bitterness	<p>Basic taste, typically perceived in caffeine, coffee, kola nut, some beers and grapefruit.</p> <p>Perception of bitterness intensity is particularly dependent on the amount of sample in the mouth.</p>	1–2 Some ancient Criollos.
		3–5 Well-prepared West African lots.
		6–8 Severely under- and un-fermented cacao.



Descriptor	Description	Intensity level / Reference notes
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Astringency	<p>Astringency could be perceived in two ways:</p> <ul style="list-style-type: none"> • Sharp mouth-drying effect, sharp, perceived between tongue and palate and /or at the back of the front teeth and inside lips and gums – typical of raw nut skins and green banana skins. • Velvety sensation on the sides of mouth and tongue. Typical of tannins in some wines or beers. <p>Perception of astringency intensity is particularly dependent on the amount of sample in the mouth.</p>	<p>I</p> <p>1–2 Some ancient Criollos.</p> <p>3–5 Normal intensity for most cacao.</p> <p>6–8 -</p> <p>9–10 -</p>
		<p>T</p> <p>Sharp-mouth drying Typical of under-fermented cacao.</p> <p>Velvety Typical of appropriately fermented “Nacional”.</p>

Fresh fruit	<p>Total fresh fruit is composed of the following sub-attributes:</p> <ul style="list-style-type: none"> • Berry: red or black currant, strawberry, raspberry, blackberry, acai berry. • Citrus: orange, lemon, lime, grapefruit or generic sensation of citrus-like fruit. • Dark: cherry, plum. • Yellow / orange / white flesh: apricot, peach, pear, banana. • Tropical: passion fruit, pineapple, mango or soursop. 	<p>0–2 Many West African lots.</p>
		<p>3–5 Some Central and South American, well fermented Asia and Pacific country lots.</p>
		<p>6–7 Madagascar, some Central and South American country lots, some Papua New Guinean lots.</p>

Browned fruit	<p>Total browned fruit is composed of the following sub-attributes:</p> <ul style="list-style-type: none"> • Dried: dried apricot, banana, yellow raisin, fig that has undergone an un sulphured drying process. • Browned: dark raisin, dates, prunes. • Over ripe: No longer fresh and severely over-ripe fruit, turning brown inside and outside, as a step towards over-fermentation. 	<p>0–2 Many West African lots.</p>
		<p>3–5 Fully fermented Indonesian and some Caribbean country lots.</p>
		<p>6–8 Some Papua New Guinean and some Caribbean country lots.</p>

Vegetal	<p>Total vegetal is composed of the following sub-attributes:</p> <ul style="list-style-type: none"> • Grassy / Green vegetal / herbal: <ul style="list-style-type: none"> » Grassy – freshly cut grass, young green leaves. » Green vegetal – crushed mature leaves. » Herbal – hay, straw or herbal / dried green, herbs like thyme and rosemary. • Earthy / mushroom / moss / woody: <ul style="list-style-type: none"> » Earthy – smell of dampness rising from soil after rain. » Mushroom – smell of fresh mushrooms. » Moss – damp moss often associated with earthiness. » Woody – leaves and wood on a forest floor. 	<p>0–2 West African lots.</p>
		<p>3–5 Appropriately fermented “Nacional” and some Caribbean country lots.</p>
		<p>6–8 Some Caribbean country lots and some Peruvian lots.</p>

Descriptor**Description****Intensity level / Reference notes**

Floral	Total floral is composed of the following: <ul style="list-style-type: none"> • Orange blossom: orange blossom flavour. • Flowers: jasmine, honeysuckle, rose, lilac, lilies, etc. 	0–2	West African lots.
		3–5	Appropriately fermented “Nacional” and some Caribbean country lots.
		6–8	Some Caribbean country lots and some Peruvian lots.

Woody	Total woody is composed of the following sub-attributes: <ul style="list-style-type: none"> • Light wood: freshly cut cacao wood, white pine wood, maple wood, ice-cream/popsicle wooden stick. • Dark wood: oak, walnut, teak, mahogany. • Resin: pitch of pine or other resinous wood. 	0–2	-
		3–5	Some “Nacional” and many West African lots.

Spice	Total spice is composed of the following sub-attributes: <ul style="list-style-type: none"> • Spices: dried coconut, nutmeg, cinnamon, cloves, cacao mass, tonka, vanilla, black pepper. • Tobacco: dried tobacco leaves. • Savoury/Umami: sodium glutamate, umami. 	0–2	In most origins.
		3–5	In some West African, Central and South American and Caribbean country lots.

Nutty	Total nutty is composed of the following sub-attributes: <ul style="list-style-type: none"> • Nutty – nut flesh: the edible kernel of a light roasted nut – hazelnut, macadamia, pecan, walnut, cashew, almond, Brazil nut. • Nutty – nut skins: the flavour of lightly roasted nut skins – hazelnut, macadamia, pecan, walnut, cashew, almond, Brazil nut. 	0–2	In most origins.
		3–5	Some Central and South American and Caribbean countries’ lots and ancient Criollos.

Caramel / Panela	Aromas reminiscent of caramel, brown sugar and panela (unrefined cane sugar)	0–2	In most origins
		3–5	Some Central and South American and Caribbean countries’ lots and ancient Criollos

Sweetness (only for chocolate)
 Basic taste of white sugar solutions, typically perceived in foods like candies and desserts that contain sugar (or other sweeteners such as aspartame) and also naturally found in other foods like fruits.



Descriptor **Description** **Intensity level / Reference notes**

Roast degree A measure of the extent of the roasting the beans. Significant under or over roasting alters many of the attribute values. 2–3: Low roast
4–6: Medium roast
7: High roast
8–10: Levels of burnt/over-roasted

Off-flavours **Total Off-Flavours** is the sum of any unpleasant characters from the following. If the result is ≥ 10 it is rounded to 10 as the maximum:

- **Dirty/dusty:** not related to texture but to an off-flavour.
- **Musty:** stale, damp, mildew, decaying.
- **Mouldy:** characteristic of mould growth.
- **Meaty/animal/leather:**
 - » Meaty – cured meat, ham, rendered fat.
 - » Animal – dirty animal / farmyard.
 - » Leather – used old leather.
- **Over-fermented/rotten fruit:** decomposing fruit.
- **Putrid/manure:**
 - » Putrid – wet decomposing vegetative matter.
 - » Manure – farmyard animal manure.
- **Smoky:** contamination from the smoke (any kind).
- **Other off-flavours:** rancid, diesel, oil fumes, petroleum, tar, paint, tyres, chemicals, burnt, etc.

0: Absent – clean, well fermented, dried and stored cacao beans.
1–2: Low intensity.
3+: Clearly characterizing the sample as a defect.

Global Quality The **Global Quality** score reflects the overall impression of the: Global Quality scores and meaning below

- expressed flavour potential
- uniqueness of the sample
- balance of flavour and cleanliness of the finish

It celebrates the expression of genetics and terroir diversity through the farmer's knowhow.

Table 39. Meaning of the global quality scores for the sensory evaluation of cacao beans processed into mass and chocolate (Cacao of Excellence 2023).

	Off-flavours	Core attributes	Complementary attributes	Notes
0	Serious off-flavours clearly characterizing the sample as defective	Masked by off-flavours	Masked by off-flavours	Be as specific as possible on the type of off-flavours as this is valuable feedback to the producers
1				Depending on the type, number and intensity of off-flavours, 0 would be the worst case and 3 the least but still bad
2				
3				
4	In low intensity	Seriously unbalanced	Masked by off-flavours and unbalanced core attributes	
5	In low intensity	Unbalanced	Partially masked by unbalanced core attributes	
6	In low intensity or absent	Unbalanced	In low intensity, none outstanding, not in balance to core attributes	Overall plain flavour – mainly characterized by the core attributes and less by the complementary attributes
7	Absence of any	Balanced	One or more are outstanding but not in balance to core attributes	Overall plain flavour – mainly characterized by the core attributes and less by the complementary attributes
8	Absence of any	Well balanced with moderate base cacao flavour	One or more are outstanding, in balance to core attributes and to each other	Overall flavour presents some complexity
9	Absence of any	Well balanced, good base cacao flavour	Many outstanding, in balance to core attributes and to each other	Overall flavour presents a combination of complexity, uniqueness, harmony, brightness, clean finish
10	Absence of any	Well balanced, in low to moderate intensity, good base cacao flavour	Clearly recognizable, many outstanding, in balance to core attributes and to each other	Overall flavour presents a combination of complexity, uniqueness, harmony, brightness, clean finish The sample is of extraordinary quality, rarely seen

20.3 Forms for the sensory evaluation of cacao beans

Sensory data resulting from the evaluation of each sample can be recorded in various formats. The tables and figures below contain examples of forms used for evaluating cacao beans in the forms of unroasted coarse powder, cacao mass, and dark chocolate. For a detailed evaluation, a total score for the sub-attributes can be calculated using the indicated formula (a declining series). This ensures that the total score accurately represents the overall intensity of the flavour attributes and is not simply the sum of all sub-attributes, with the exception for the Total Acidity score, which is calculated as the sum of the sub-attributes. Experts have advised that for this specific core attribute (acidity being a basic taste and non-volatile), scoring the total perception first and then describing each component separately yields a more accurate Total Score.

Sensory evaluation data can be recorded using a Microsoft® Excel® form such as the Cacao of Excellence Sensory Evaluation Form, which provides a user-friendly interface (Figure 21). Additionally, Cacao of Excellence offers a printed version of the evaluation form (Figure 22). The form can be simplified by using the main core attributes only as shown in Table 42.

Table 40. Sensory evaluation form for unroasted cacao beans as coarse powder (Adapted from FCCI).

Sensory evaluation form for unroasted cacao beans as coarse powder

Jane Doe	dd/mm/yy	hh:mm – pm/am	000
Assessor name	Date of evaluation	Time of evaluation	Sample code

.....

SCORE (0-10) Core attributes

_____ **Cacao**

_____ **Acidity** (fruity, acetic, lactic, mineral, butyric)

_____ **Bitterness**

_____ **Astringency**

Complementary attributes

_____ **Fresh fruit** (berry, citrus, dark, yellow/orange/white flesh, tropical)

_____ **Browned fruit** (dried, brown, over ripe)

_____ **Vegetal** (grassy/green, herbal/herbal, earthy/mushroom moss/woody)

_____ **Floral** (orange blossom, flowers)

_____ **Woody** (light or dark wood, resin)

_____ **Spice** (spices, tobacco (dried tobacco leaves), savoury/umami)

_____ **Nutty** (nut flesh and nut skins)

_____ **Caramel / Panela**

Off-flavours

_____ Mouldy

_____ Smoky

_____ Hammy

_____ Dirty/dusty

_____ Musty

_____ Cardboard

_____ Meaty

_____ Rancid

_____ Cheesy

_____ Manure/Animal excrement

_____ Leather

_____ Sweaty

_____ Putrid/wet decomposing vegetative matter

_____ Rotten/decomposing fruit

_____ Ammonia

_____ Petroleum

_____ Rubbery/sulphurous

_____ Metallic

_____ Phenolic

_____ Medicinal

_____ Chemical

_____ **Other off-flavours**

_____ **Other off-flavours description** _____

Global quality score

_____ **Comments** _____

Table 41. Calculations of the total scores for the flavour attributes of the Cacao of Excellence Sensory Evaluation Form.

Calculations of the Total Scores for the Flavour Attributes

	SCORE (0-10)	Core attributes
	_____	CACAO
	_____	ROAST DEGREE
	_____	BITTERNESS
	_____	ASTRINGENCY
TOTAL OF ALL SUB-ATTRIBUTES IF THE RESULT IS >10 IT IS ROUNDED TO 10 AS THE MAXIMUM	_____	TOTAL ACIDITY
	_____	Fruit
	_____	Acetic
	_____	Lactic
	_____	Mineral and Butyric
		Complementary attributes
CALCULATED FIELD: 100% OF HIGHEST SCORE +75% OF 2 ND HIGHEST +33% OF 3 RD +33% OF 4 TH +33% OF 5 TH	_____	TOTAL FRESH FRUIT
	_____	Berry
	_____	Citrus
	_____	Dark
	_____	Yellow / Orange / White flesh
	_____	Tropical
CALCULATED FIELD: 100% OF HIGHEST SCORE +75% OF 2 ND HIGHEST +33% OF 3 RD	_____	TOTAL BROWNE D FRUIT
	_____	Dried
	_____	Brown
	_____	Over ripe
CALCULATED FIELD: 100% OF HIGHEST SCORE +75% OF 2 ND HIGHEST	_____	TOTAL VEGETAL
	_____	Grassy/green vegetal/herbal
	_____	Earthy/mushroom – moss / woody
CALCULATED FIELD: 100% OF HIGHEST SCORE +75% OF 2 ND HIGHEST	_____	TOTAL FLORAL
	_____	Orange blossom
	_____	Flowers
CALCULATED FIELD: 100% OF HIGHEST SCORE +75% OF 2 ND HIGHEST +33% OF 3 RD	_____	TOTAL WOODY
	_____	Light wood
	_____	Dark wood
	_____	Resin
CALCULATED FIELD: 100% OF HIGHEST SCORE +75% OF 2 ND HIGHEST +33% OF 3 RD	_____	TOTAL SPICE
	_____	Spices
	_____	Tobacco (dried tobacco leaves)
	_____	Savoury/umami
CALCULATED FIELD: 100% OF HIGHEST SCORE +75% OF 2 ND HIGHEST	_____	TOTAL NUTTY
	_____	Nut flesh
	_____	Nut skins
	_____	CARAMEL / PANELA
	_____	SWEETNESS (Only for chocolate)
TOTAL OF ALL SUB-ATTRIBUTES IF THE RESULT IS >10 IT IS ROUNDED TO 10 AS THE MAXIMUM	_____	Total off-flavours
	_____	Dirty/dusty
	_____	Musty
	_____	Mouldy
	_____	Meaty/animal/leather
	_____	Over fermented/rotten fruit
	_____	Putrid/manure
	_____	Smoky
	_____	Other off-flavour description
	_____	Global Quality
	_____	Comments on flavour

Cacao of Excellence

Sensory Evaluation Form for Cacao Mass and Chocolate

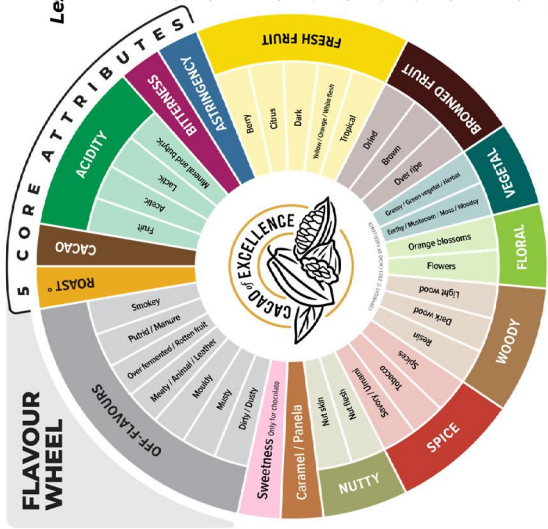
Evaluator:

Sample ID:

Sample info:

Start Evaluation

Recall/Edit



Intensity Scale: 0 1 2 3 4 5 6 7 8 9 10

Less Intense | More Intense

Insert the intensity of each attribute in the corresponding boxes

Click 'Start Evaluation' to enable input to sensory evaluation attributes

Cacao
 Acidity (Total)
 Fresh Fruit (Total)
 Bitterness
 Fruit
 Berry
 Yellow / Orange / White flesh
 Dried
 Grassy / Green vegetal / Herbal
 Orange blossom
 Woody (Total)
 Light
 Spices (Total)
 Nutty (Total)
 Caramel / Panaola
 Off-flavours (Total)
 Dirty / Dusty
 Over-fermented / Rotten fruit
 Smoky
 Sweetness (only for chocolate)
 Mouldy
 Meaty / Animal / Leather
 Putrid / Manure

Roast Degree: Lactic Mineral / Butyric

Dark: Dark

Tropical: Tropical

Over ripe: Over ripe

Earthy / Mushroom / Moss / Woodsy: Earthy / Mushroom / Moss / Woodsy

Flowers: Flowers

Resin: Resin

Savory / Umami: Savory / Umami

Nut skins: Nut skins

Other: Other

Description:

Additional positive qualities

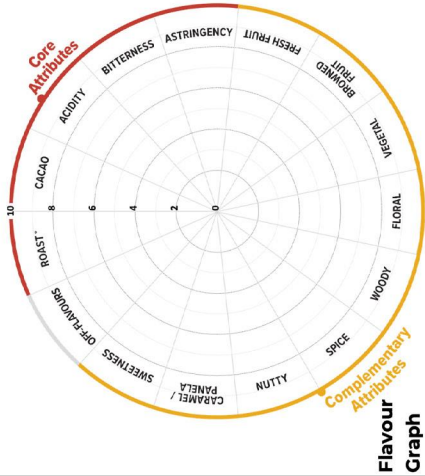
← Add selected quality (for Global Quality >= 7)

Global Quality: 0 1 2 3 4 5 6 7 8 9 10

Overall Flavour comment

Feedback to producer

End Evaluation



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Figure 21. User interface of the Cacao of Excellence Sensory Evaluation Form with the total scores of flavour attributes calculated (Cacao of Excellence 2023).



Cacao of Excellence

Sensory Evaluation Form for Cacao Mass and Chocolate

Evaluator _____ Date _____
 Sample ID _____ Time _____
 Sample Info _____

Cacao Mass **Chocolate**

Instructions: Insert the intensity values of each attribute in the and mark with a the perceived sub-attributes.

Intensity Scale

← 0 1 2 3 4 5 6 7 8 9 10 →
 ← Less Intense More Intense →



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- Cacao**
- Acidity**
 - Fruit Acetic Lactic
 - Mineral / Butyric
- Bitterness**
- Astringency**
- Fresh Fruit**
 - Berry Citrus Dark
 - Yellow / Orange / White flesh
 - Tropical
- Browned Fruit**
 - Dried Brown Over ripe
- Vegetal**
 - Grassy / Green vegetal / Herbal
 - Earthy / Mushroom / Moss /Woody
- Floral**
 - Orange blossom Flowers
- Woody**
 - Light Dark Resin
- Spice**
 - Spices Tobacco
 - Savory / Umami
- Nutty**
 - Nut flesh Nut skins
- Caramel / Panella**
- Sweetness (only for chocolate)**
- Roast Degree**

- Off-flavours**
 - Dirty / Dusty Musty
 - Mouldy Meaty /Animal /Leather
 - Over-fermented / Rotten fruit
 - Putrid / Manure Smoky
 - Other-Off-flavour _____
- Description** _____

0 1 2 3 4 5 6 7 8 9 10

Global Quality

Flavour comments

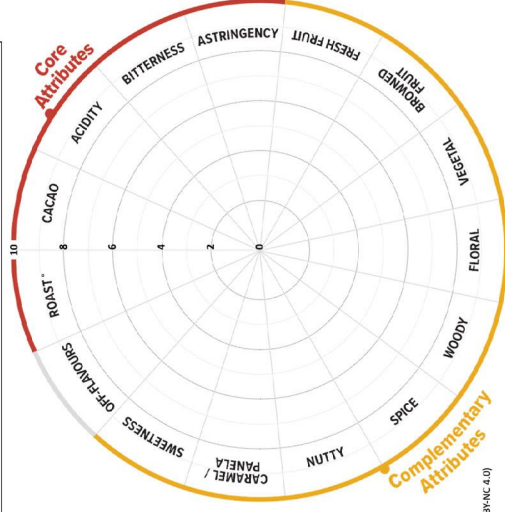


Figure 22. Format for the printed version of the Cacao of Excellence Sensory Evaluation Form (Cacao of Excellence 2023).

Table 42. Simplified list of flavour attributes for sensory evaluation of cacao beans processed into mass and chocolate (Cacao of Excellence 2023).

Cacao of Excellence - simplified list of flavour attributes for sensory evaluation of cacao beans processed into mass and chocolate 2023

_____ Jane Doe _____ dd/mm/yy _____ hh:mm – pm/am _____ 000
 Assessor name Date of evaluation Time of evaluation Sample code

.....

Score (0-10) Attributes

- _____ **Cacao**
- _____ **Acidity** (fruity, acetic, lactic, mineral, butyric)
- _____ **Bitterness**
- _____ **Astringency**
- _____ **Fresh fruit** (berry, citrus, dark, yellow / orange/white flesh, tropical)
- _____ **Browned fruit** (dried, brown, over ripe)
- _____ **Vegetal** (grassy/green, herbal/herbal, earthy/mushroom moss/woody)
- _____ **Floral** (orange blossom, flowers)
- _____ **Woody** (light or dark wood, resin)
- _____ **Spice** (spices, tobacco (dried tobacco leaves), savoury/umami)
- _____ **Nutty** (nut flesh and nut skins)
- _____ **Sweetness (only for chocolate)**
- _____ **Caramel / Panela**
- _____ **Roast degree**
- _____ **Off-flavours** (dirty/dusty, musty, mouldy, meaty / animal / leather, over fermented / rotten fruit, putrid / manure, smoky, other)
- _____ **Off-flavours - others**
- _____ **Global Quality**

Comments on flavour _____



20.4 Sensory evaluation data analysis and panel performance

20.4.1 Visualisation of flavour profile data

The result of the sensory evaluation can be expressed as a flavour profile for each cacao sample, showing the attributes and sub-attributes intensity, any off-flavours and a global quality score as well as comments. For conventional sensory flavour profiles, the results are obtained by the statistical analysis of data generated by several assessors (panel) evaluating the same samples and flavour attributes. Therefore, results of all individuals assessors in a panel is the mean and standard deviation of all the scores. And the means are used to build a flavour graph that can be visualised in different forms.

Some examples are:

- Line graphs (Figure 23).
- Bar graphs (Figure 24).
- Radar plots or spider graphs (Figure 25).
- Cacao of Excellence flavour profile plots (Figure 26).

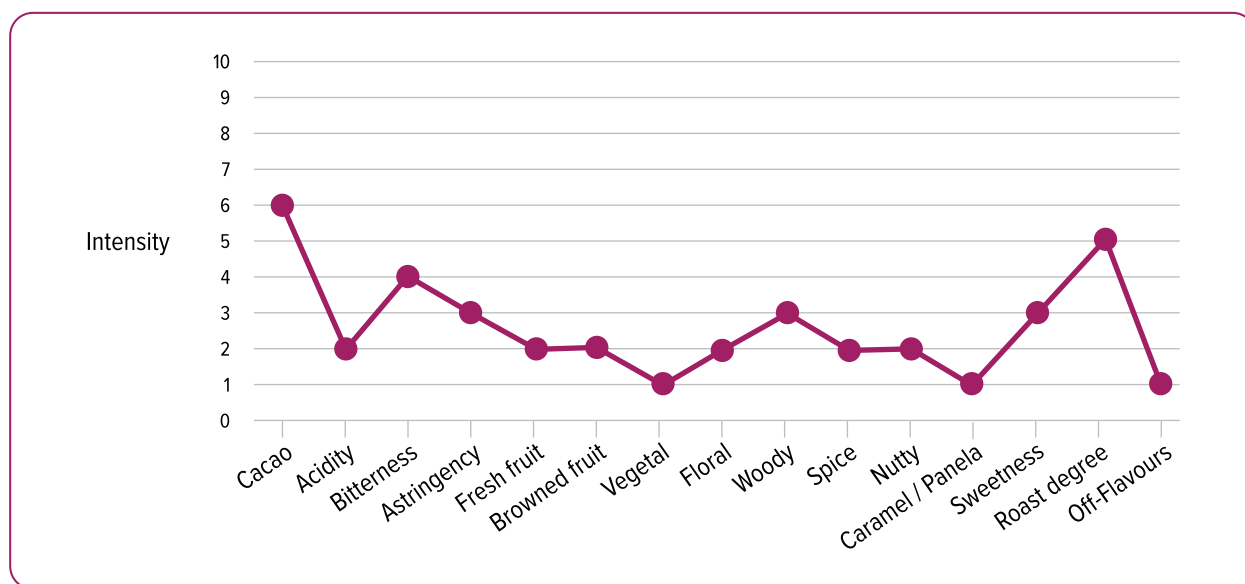


Figure 23. Example of a line graph for a cacao mass flavour profile (Bioversity International, 2023).

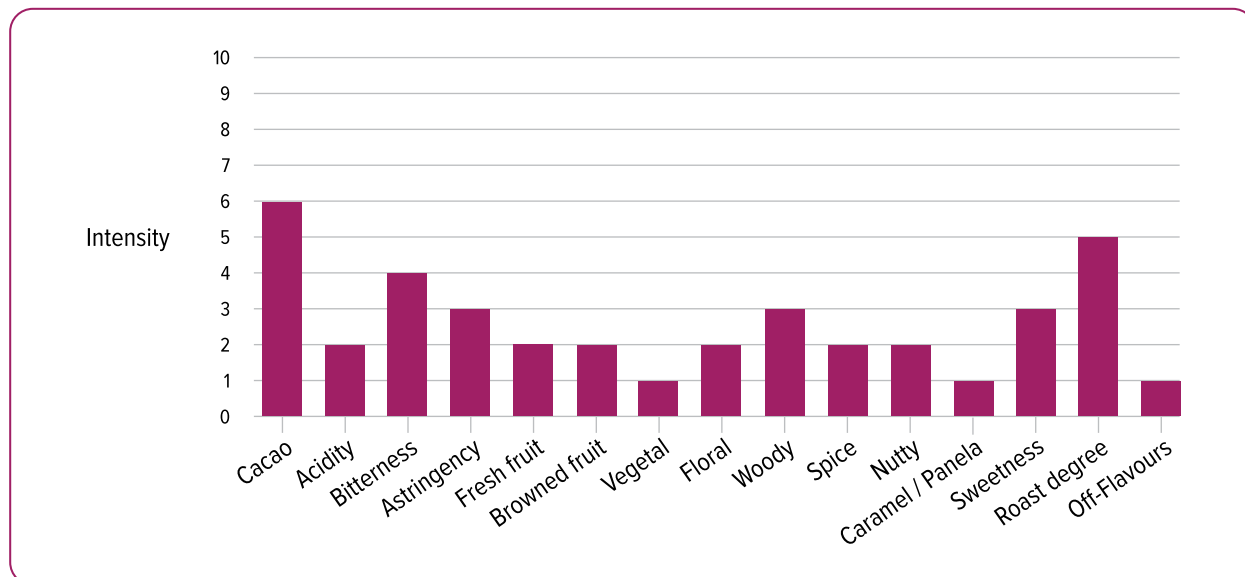


Figure 24. Example of a bar graph for a cacao mass flavour profile (Bioversity International, 2023).

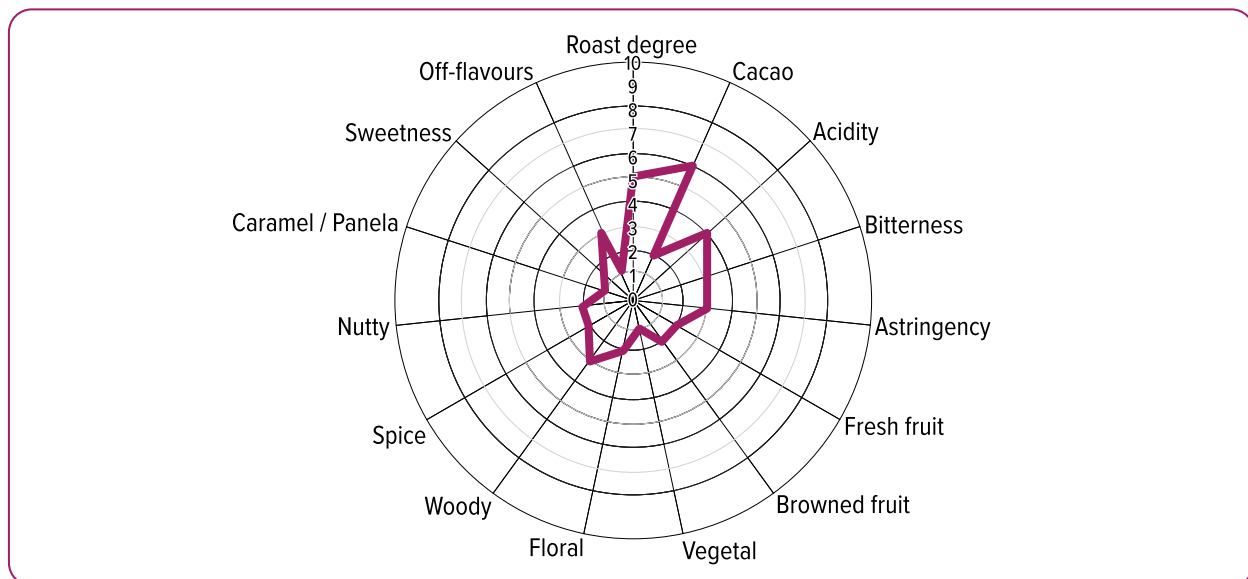


Figure 25. Example of a spider/radar graph for a cacao mass flavour profile (Bioversity International, 2023).

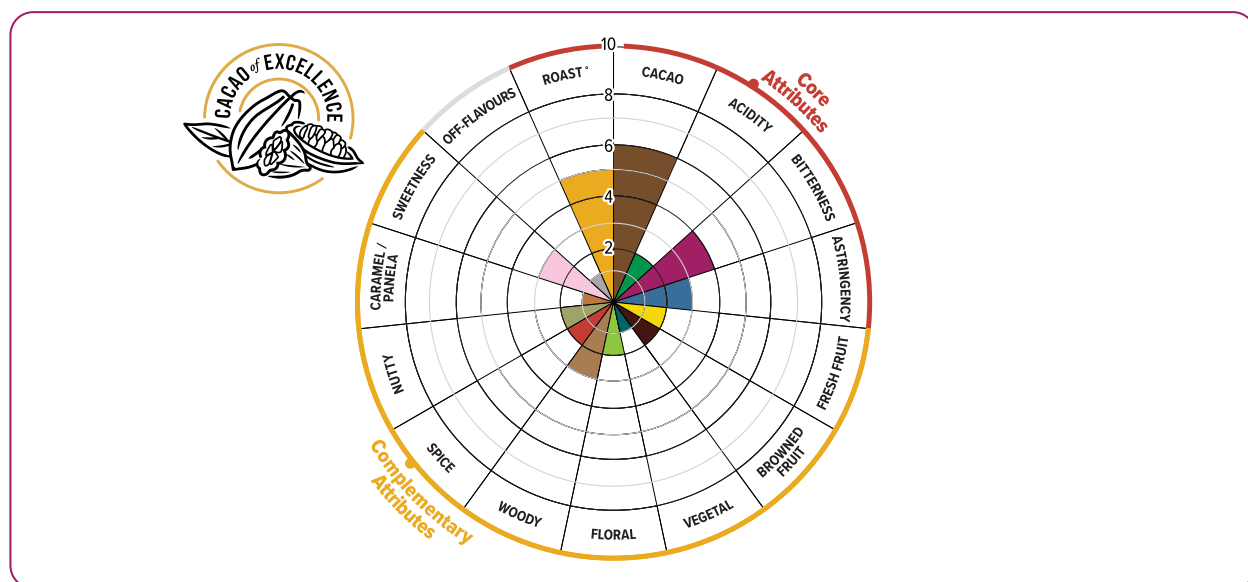


Figure 26. Example of the Cacao of Excellence flavour profile (Bioversity International, 2023).

20.4.2 Considerations on sensory profiling obtained by consensus

For sensory evaluation flavour profiles based on consensus (as defined by ISO 13299:2016), once the assessors have completed their individual evaluations, the panel leader or facilitator tabulates the results and moderates a discussion to address any differences in evaluation. If necessary, samples can be re-evaluated by the panel to reach a group consensus. A minimum of 4 assessors is required for this process. It's important to note that there is generally less reproducibility across panels and over time compared to quantitative flavour profiles that are obtained by calculating the mean and standard deviation of all panel members' scores (as described in Section 20.4.1).

20.4.3 Performance analysis of sensory evaluation panel members

To ensure the consistency and reliability of sensory evaluation panels, it is crucial to analyse and monitor their performance. This helps determine if they are aligned in their evaluations, possess the ability to discriminate between samples effectively, and exhibit repeatability when assessing the same sample blindly.

Performance analysis can be achieved through the evaluation of blind replicates and an adequate number of samples. Several software packages, such as Panel Check (panelcheck.com), are designed for this purpose, focusing on assessing panel performance in terms of discrimination, repeatability and alignment among assessors. Additionally, they provide sample flavour profiles (refer to Figure 23) and offer descriptive and exploratory statistical analyses.

This information is valuable for providing objective feedback to panel members and for monitoring improvements in specific flavour attributes, scale utilisation, and any other areas that may require further alignment.

20.4.4 Documentation of sample processing and sensory evaluation conditions

An accurate and detailed description of the process of converting the cacao beans into cacao mass or chocolate and any additional information is essential in order to interpret the results of the sensory evaluation for comparison among samples and to communicate the results to cacao value chain stakeholders.

In addition to the flavour profiles of the evaluated samples, it is important to record the conditions in which the sensory evaluation was carried out as this affects the interpretation of the results. The robustness of the evaluation process can be assessed based on various factors, including the type of panel, the number of assessors, the use of replicates, and the inclusion of reference samples for calibration purposes.

Tables 43 and 44 presents an example of the information that should be recorded on the process of converting cacao bean samples evaluated into cacao mass or chocolate and the conditions of sensory evaluation.

By diligently documenting such information, organisations can enhance the reliability and traceability of their sensory evaluations, enabling them to make informed decisions based on the collected data.

Table 43. Information to be recorded for cacao sample processing.

Cacao samples processing information	
Date of the sample preparation	_____
Name of person that prepared the samples	_____
Location of the sample preparation	_____
Amount of beans processed per sample	_____
For cacao mass - physical state for evaluation (melted or solid)	_____
For chocolate - physical state for evaluation (melted or solid)	_____
Type, brand and model of roasting oven	_____
Temperature and time of roasting	_____
Type, brand and model of grinder used	_____
Number of samples evaluated	_____
Number of unknown samples evaluated	_____
Replicates (number times each cacao mass sample is evaluated)	_____
Use of reference samples for calibration (yes/no or number)	_____
Use of blind control samples (yes/no or number)	_____
Comments	_____

Table 44. Information to be recorded for a sensory evaluation.

Sensory evaluation conditions

Date of the sample evaluation _____

Panel or individual evaluation _____

If a panel – name of the leader/facilitator _____

If a panel – number of assessors in the panel _____

If an individual - name of the assessor _____

Location of panel member (all in the same place or virtual) _____

Training level of assessors (advanced, intermediate, beginner) _____

Type of sensory profile (quantitative or consensus) _____

Number of sessions to evaluate all unknown samples _____

Time interval between samples _____

Comments _____

