



Development of cocoa physical reference samples for training and calibration of sensory evaluation panels: Perspectives from a range of food products

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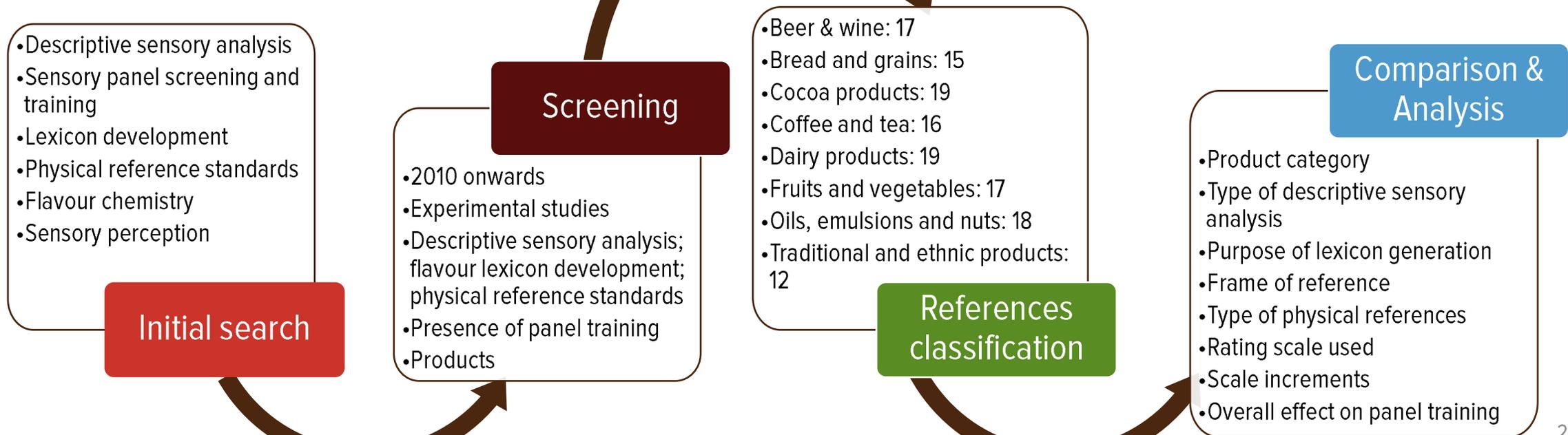
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Objective & Methodology



- Review the use of physical reference samples of different food products, to guide the development of such references for training and calibration of sensory evaluation panels for cocoa products
- 149 articles reviewed



Fundamental concepts



- A physical reference standard is any material (non-food, chemical, food, or combination thereof) that clearly characterizes a specific product attribute, usually beyond the capacity that verbal descriptors provide in aligning a panel to describe and quantify sensory perceptions (Lawless and Heymann, 2010; Muñoz and Civille, 1997; Rainey, 1986).

Crucial for:

- Maximizing language clarity especially in cross-cultural settings
- Minimizing “within panel” variation in rating attribute intensities
- Reducing time for training and calibrating panellists

Results – Method and Purpose

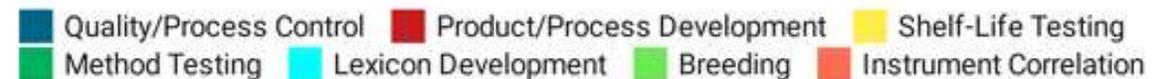
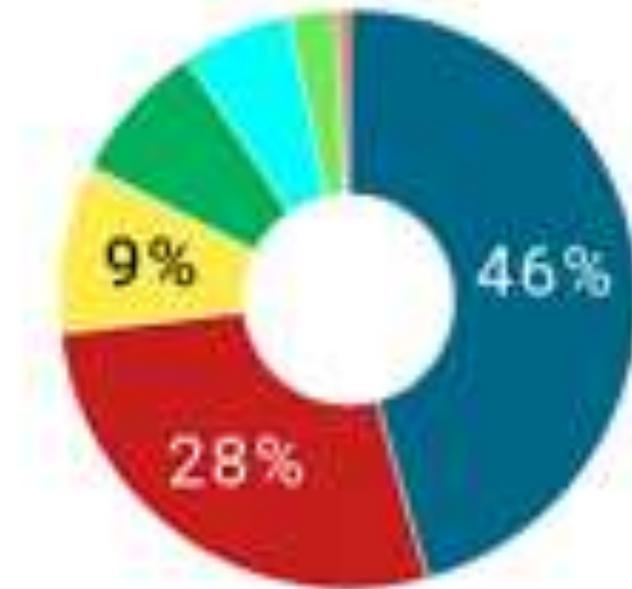


The majority (94%) of these publications involved the use of conventional descriptive analysis as follows:

- Generic Descriptive Analysis/GDA (55%)
- Quantitative Descriptive Analysis/QDA (34%)
- Spectrum™ (4%)
- Flavour Profile/FP (1%).

Purpose of descriptive sensory methods:

- Quality and/or process control (46%)
- Product and/or process development (28%)
- Shelf-life testing (9%)
- Others (17%)

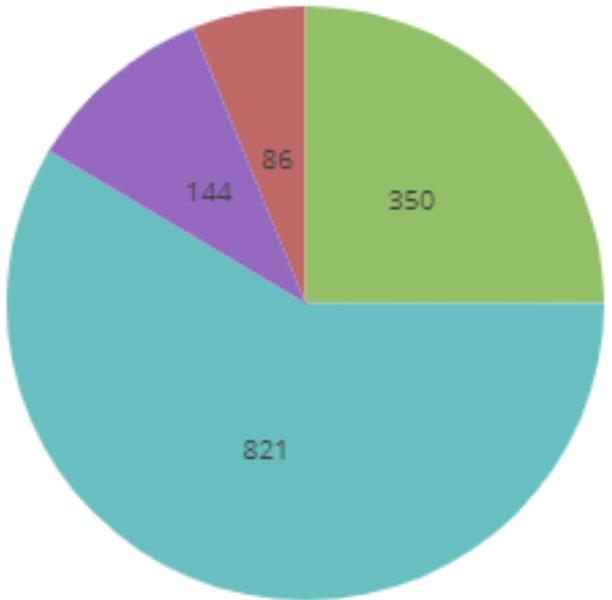
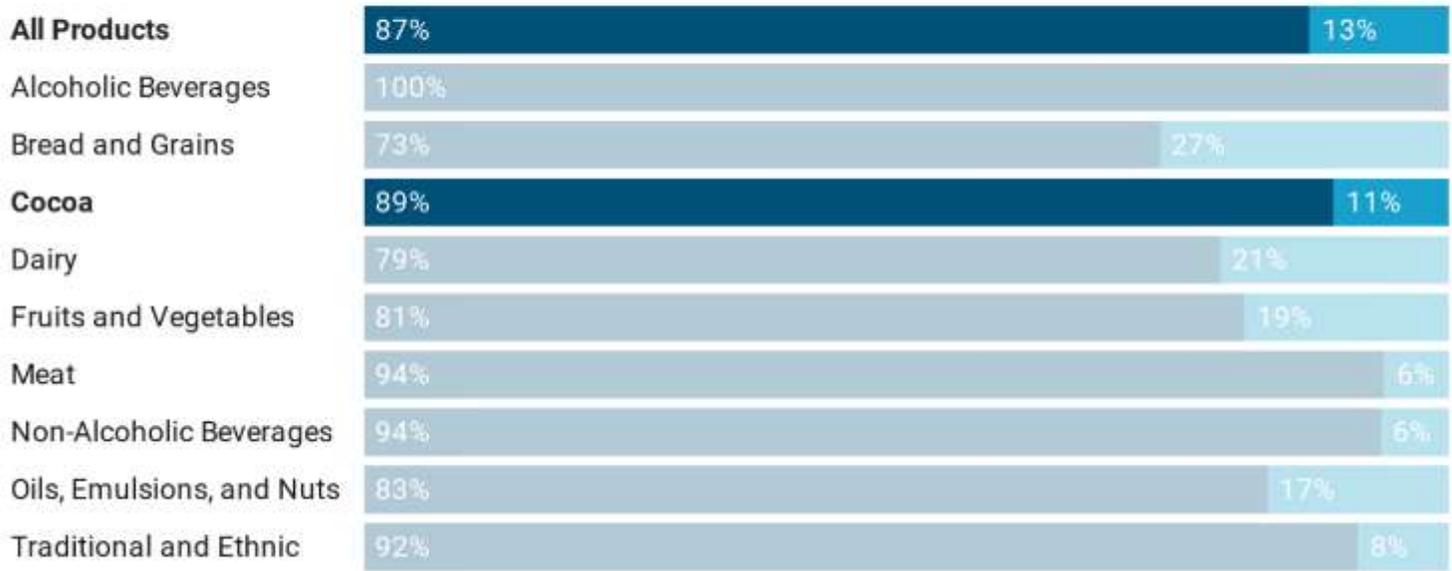


Results - Use and type of references



[Development and/or Use of Physical References?]

■ Yes ■ No

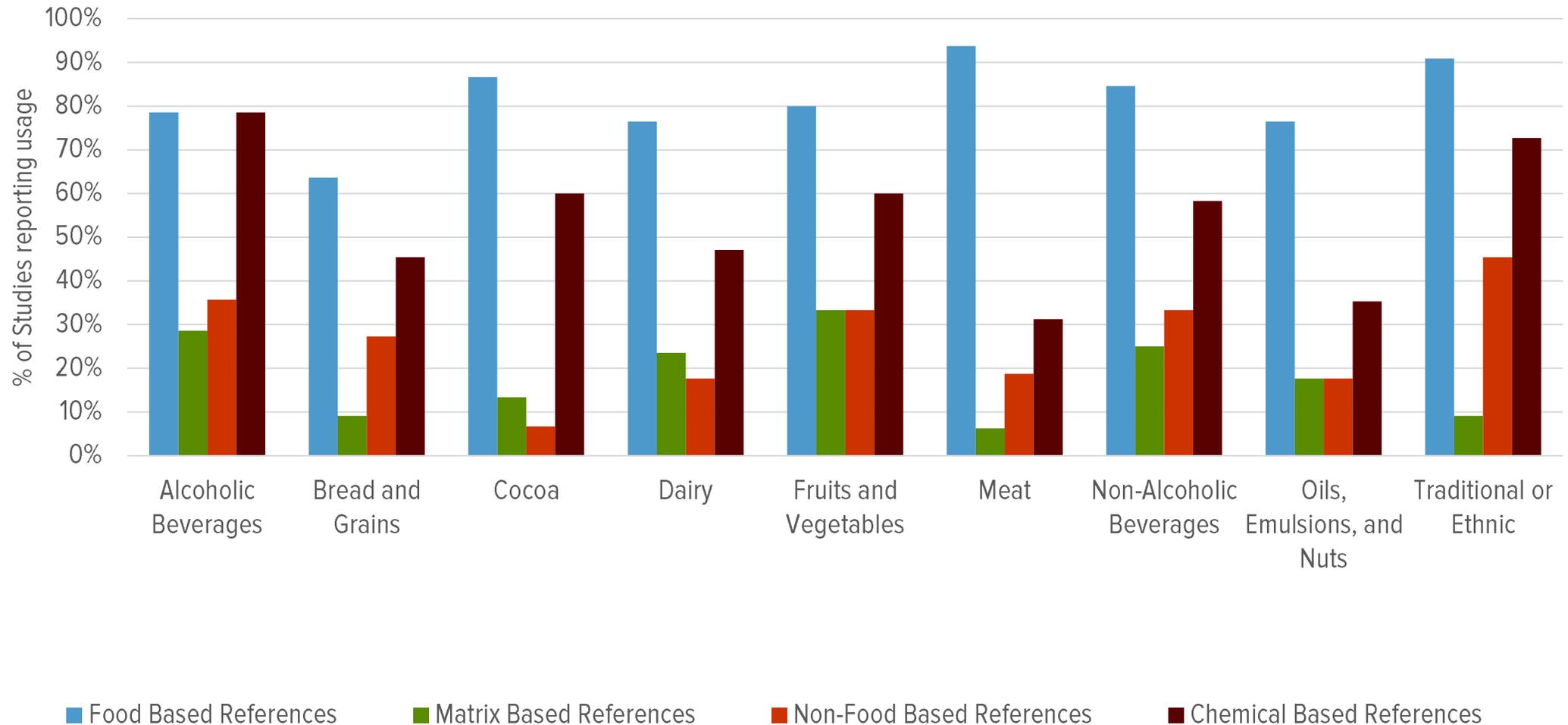


Percentage of studies, according to product category, indicating the development and/or use of physical references during the training phase of descriptive sensory panellists.

Type of references distribution across products



Results - Type of references



Conclusions



- Urgent need in cocoa producing countries to build capacity of national panels for a better understanding of cocoa quality and flavour potential for increased value and profitable production.
- Reference samples are:
 - critical for training and generation a commonly agreed glossary of terms
 - essential to ensure panel's performance in terms of repeatability, discrimination and alignment
- Specific recommendations for the development of cocoa-specific physical references

Pilot – Cocoa of Excellence



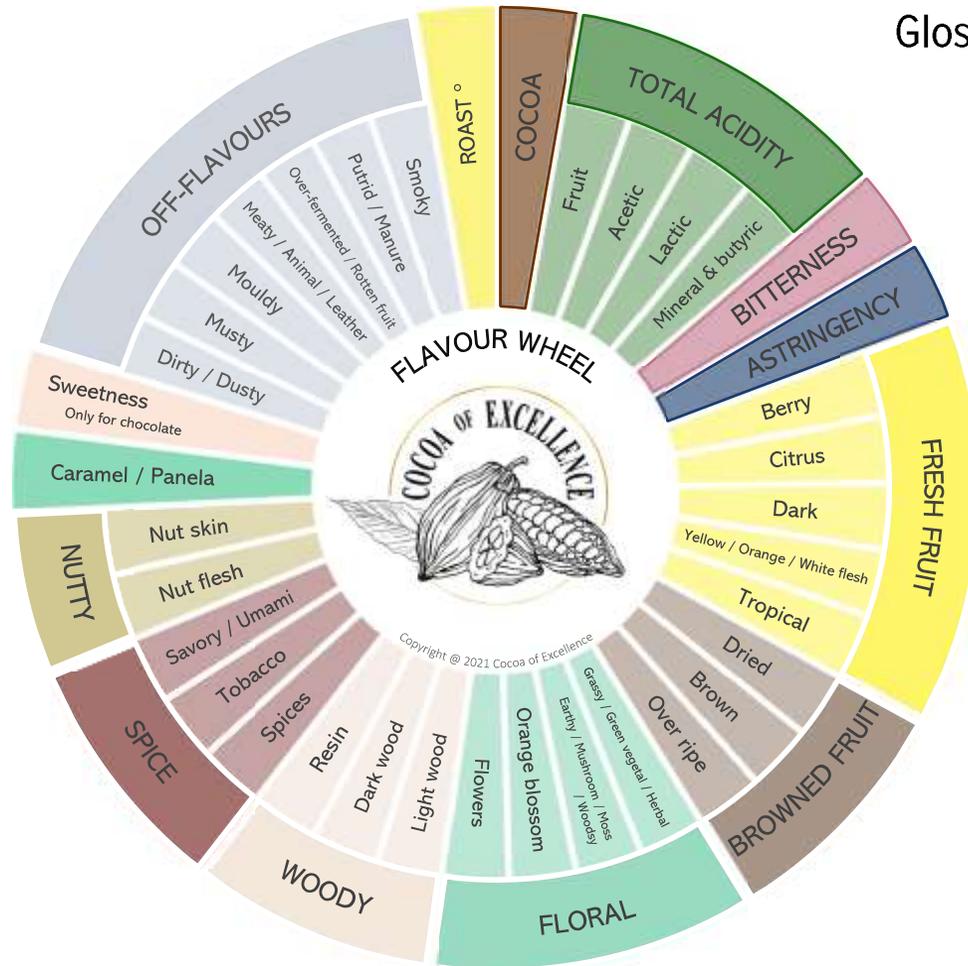
- Objective: Strengthen capacity on quality and flavour evaluation at national level as part of the USDA-funded project MOCCA – Maximizing Opportunities in Coffee and Cacao in the Americas
- Different approaches for beginners and experienced trainees
- In 5 Latin-American countries:
 - Ecuador – 23 experienced
 - El Salvador – 16 beginner
 - Guatemala – 20 beginner
 - Honduras – 16 beginner
 - Peru – 16 experienced



Cocoa of Excellence vocabulary



Glossary



Flavour wheel

Attribute Intensity Scale	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 characterizing the sample
6 to 8	Dominant characterization of the sample
9 to 10	Maximum. Strong intensity. Overpowers some other flavour notes in the sample

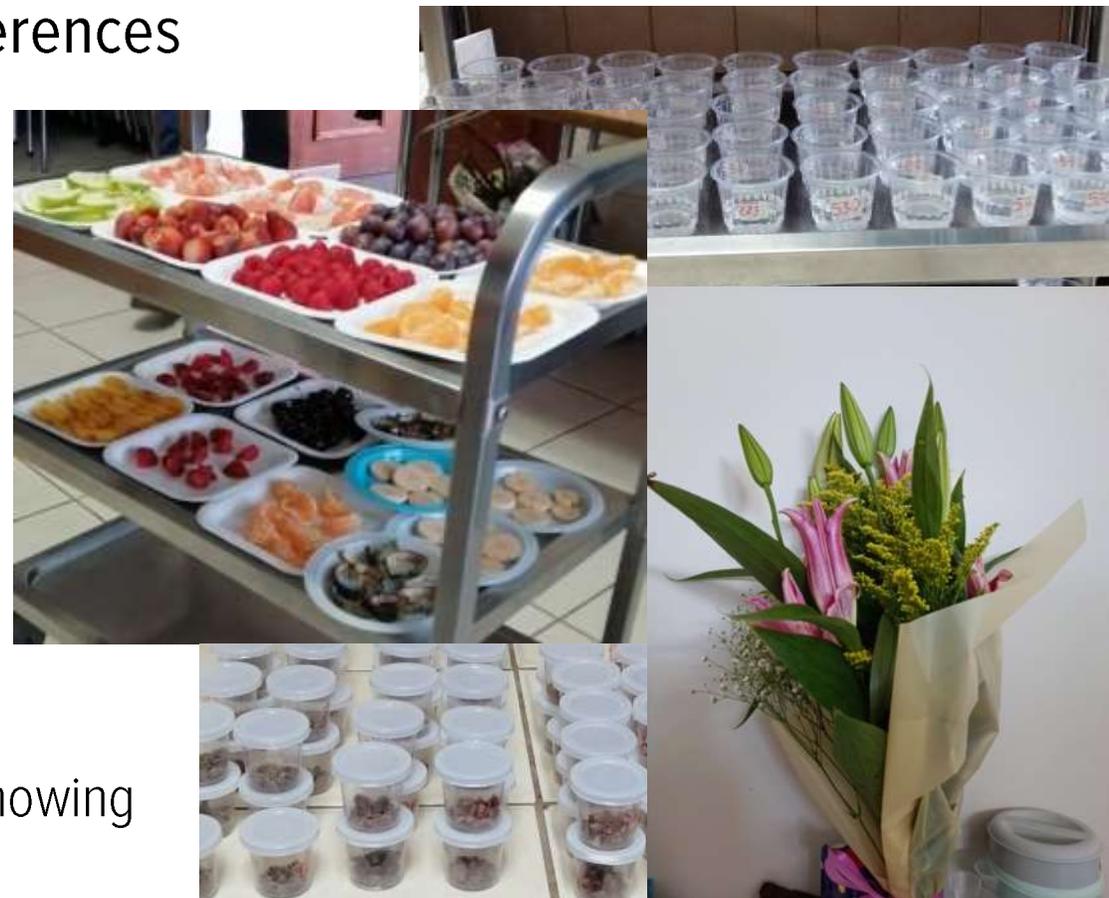
NOTES on examples of origin typical of intensity level

- These examples are for illustrative purposes only and are not meant to be exclusive of any origins/types.
- Specific lots of individual origins can differ dramatically from these frequently encountered values.
- Currently available, widely traded and traditionally known origins and may be reviewed in future editions.

Descriptor	Description	Intensity level	References notes
Cocoa	Typical flavour of roasted cocoa beans that are well fermented, dried, free of defects.	0–2	Under-fermented cocoa, ancient Criollos
		3–5	Appropriately fermented "Nacional" and Papua New Guinean lots
		6–8	Appropriately fermented cocoa, some West African and some Dominican Republic Hispaniolan lots
		9–10	Some West African lots
Acidity	Perception of acidity intensity is particularly dependent on the amount of sample in the mouth. Total acidity is the sum of the following individual acidities: □ Acidity – Fruit: citric or other fruit acids □ Acidity – Acetic: vinegar (can be smelled it in the sample)	0–2	Some well-prepared West African lots
		3–5	Some Ecuadorian, Peruvian and Central American lots
		6–8	Some Dominican Republic Hispaniolan, Papua New Guinean and Malaysian lots

Type of references used

- Chemical based – screening exercises and references
 - Basic tastes: 5
 - Common aromas: ~ 15
 - Off-flavours: ~ 3
- Food based references
 - Core attributes: ~ 7
 - Complementary attributes: ~ 26
- Non-food based references – to smell only
 - Complementary attributes: ~ 13
- Matrix based references
 - Cocoa of Excellence Diversity Kit 22 cocoa liquors showing flavour diversity and showcasing specific attributes
 - Cocoa liquors with off-flavours



Testing training effectiveness

- Questions:
 - Do skills of panellists improve with the training?
 - Does data show an improvement?
- Methodology:
 - Cocoa of Excellence sensory evaluation tools
 - References of all types
 - Panel performance assessment – Panel Check
 - Cocoa liquor profiles
- Participants
 - 10 experienced cocoa liquor tasters
 - New to Cocoa of Excellence methodology
- Samples:
 - 2 sets of 9 blinded cocoa liquors in triplicates
 - Different flavour attributes
 - Different global quality



Results – Individual repeatability

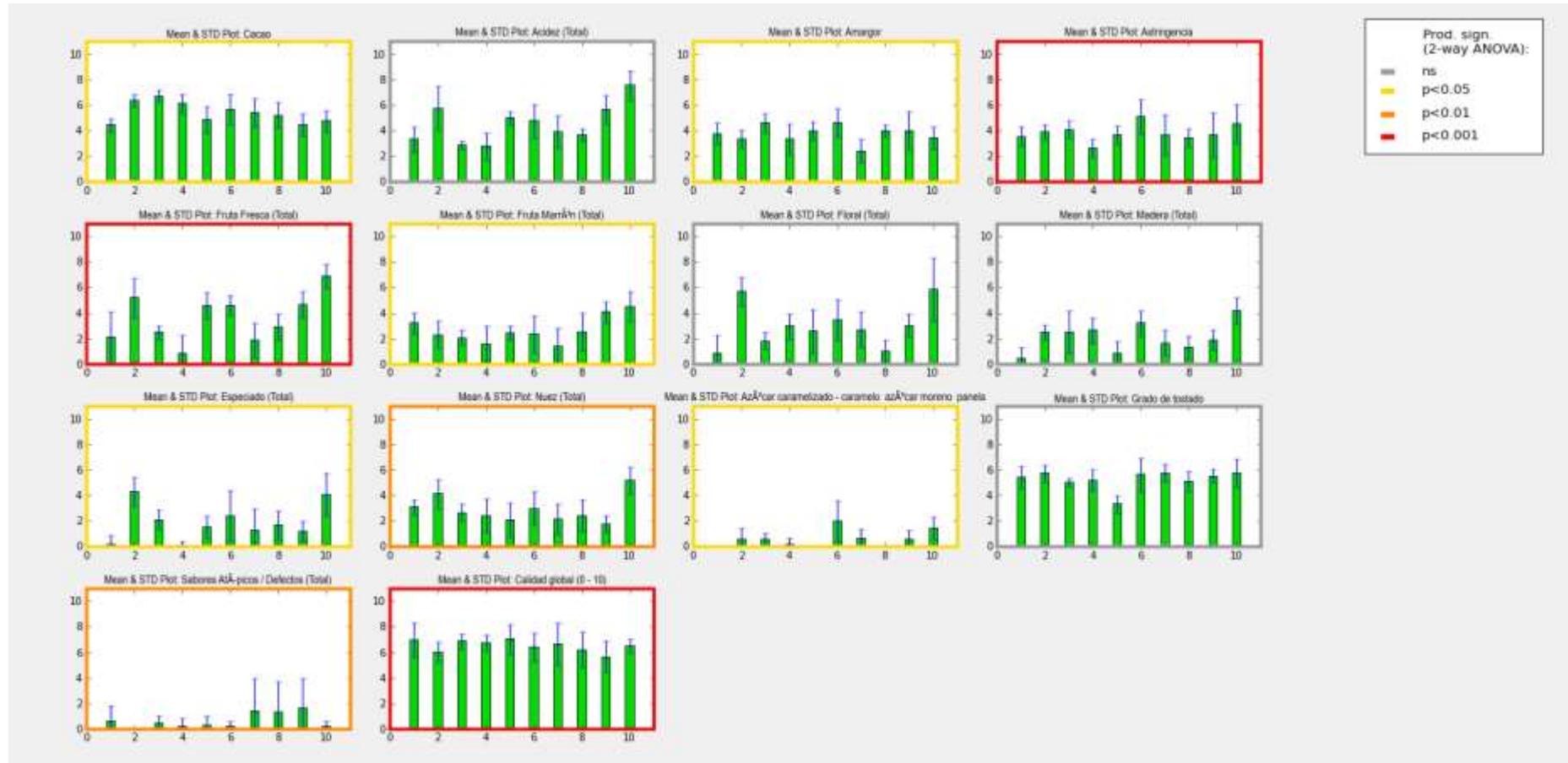
- Repeatability was assessed by the calculation of the Mean Square Error (MSE) for each attribute with Panel Check.
- The lower the MSE, the better the repeatability
- 9/10 individual panellists improved their repeatability after the training

F	March	Sept	March	Sept	MSE value					
Nr. Attribute	MSE value									
1 Cocoa	1	0.78	0.11	0.44	0.44	0	0.67	0.22	3.89	0.22
2 Acid_Total	4	0.33	1	0.33	0.11	0	6.33	0.22	0.89	0.56
7 Bitterness	1.56	0.44	0.78	0.22	0.22	0.11	3	0.89	1.89	0.56
8 Astringency	1.22	1.22	0.56	0.56	1.11	0	2.67	0.78	1.11	0.22
9 FFruit_Total	0.78	0.32	0.22	0.47	1.6	0	3.36	0.77	1.95	0.36
15 BFruit_Total	7.44	1.14	0.44	0.07	1	0	3.04	0.87	1.56	1.22
19 Floral_Total	1.78	0.28	2.41	0.47	2.25	0	2.47	1.52	1.14	0.16
24 Wood_Total	0	0.74	0	0.52	1.65	0	2.22	0.23	0.11	0.22
28 Spice_Total	1	0.98	3.89	0.56	1.11	0	3.42	0.74	1.29	1.44
32 Nutty_Total	4	0.38	0.56	0.17	0.67	0	3.33	0.32	0.78	1.19
35 Panela	0	0.33	3.22	1	0.89	0	2.78	0	1.22	0.67
36 Roast	0.11	0	0.56	0.22	0.67	0	2	0	2.44	0
37 Off_Total	0	2.78	0	0	0.11	0	8.44	0.11	1.11	0.11
46 GQ	0.22	0.56	0.08	0.67	0.25	0	2.94	0.22	2.22	0.08

Nr. Attribute	MSE value									
1 Cocoa	1.22	0.33	0.33	1.67	1.33	0.14	0.89	0.56	0.22	0.33
2 Acid_Total	7.44	0.56	3.22	0.56	2.44	0.44	5.89	0.22	0.33	0.56
7 Bitterness	0.33	0.92	0.33	0.33	0.56	0.11	2.44	0.19	0.22	0.56
8 Astringency	3.89	0.39	1.33	1.89	1.33	0.11	2.33	0.78	0.17	1.11
9 FFruit_Total	0.03	0.2	1.53	0.62	0.88	0.21	9.69	0.23	0.38	0.35
15 BFruit_Total	0.44	0.18	0.9	0.81	4.23	0.63	1.01	0.18	0.53	0.78
19 Floral_Total	0	0.23	1	0.96	1.22	0.16	6.82	0.86	0.11	0.32
24 Wood_Total	11.78	0.34	1.25	0.64	1.42	0.22	0.22	0.25	0.97	0.28
28 Spice_Total	0	0.28	2.44	0.89	2	0.56	11.5	1.19	1.64	0.38
32 Nutty_Total	0.44	0.11	0.69	1.07	1.89	0	0.78	0.32	1	0.38
35 Panela	0	0.11	0	0.11	0	0.33	0	0.44	0	0.33
36 Roast	0.33	0.22	0.11	0.11	1.56	0.11	0.33	0.61	0.19	0.06
37 Off_Total	7.56	0.11	8.33	0.11	1.33	0	2.56	1.78	0.78	0.11
46 GQ	0.56	0.58	3.22	0.67	0.64	0.14	0.08	0.78	0.33	0.28

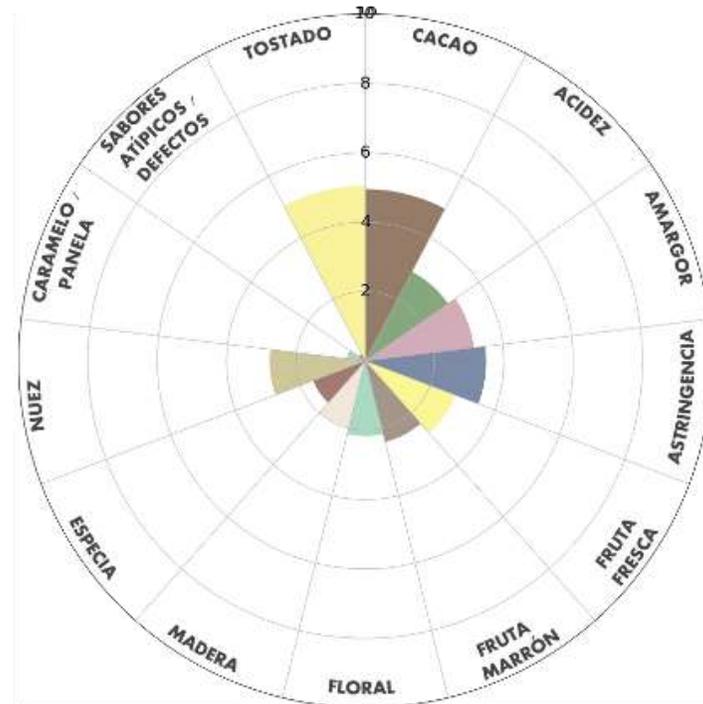
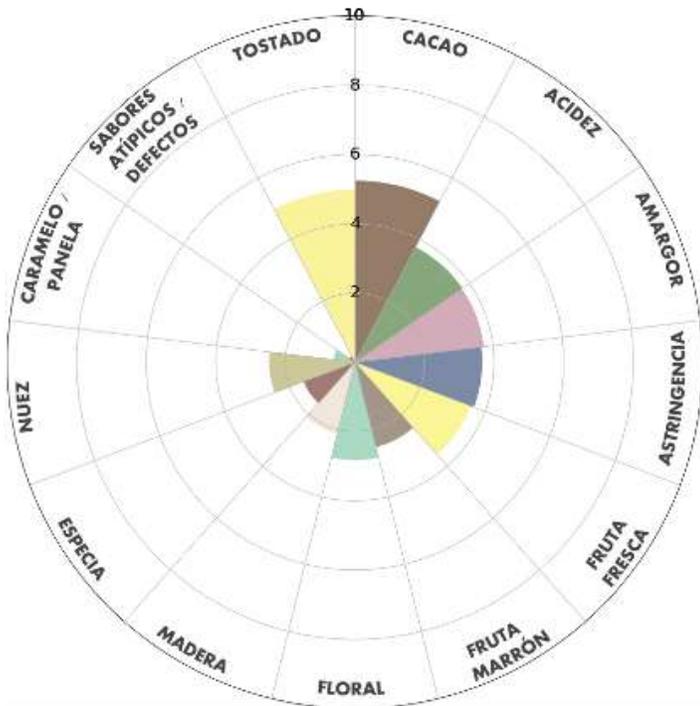
Results – use of scale and discrimination

- The alignment among panellists increased in terms of use of the scale range for most attributes
- Power of differentiation increased for most attributes



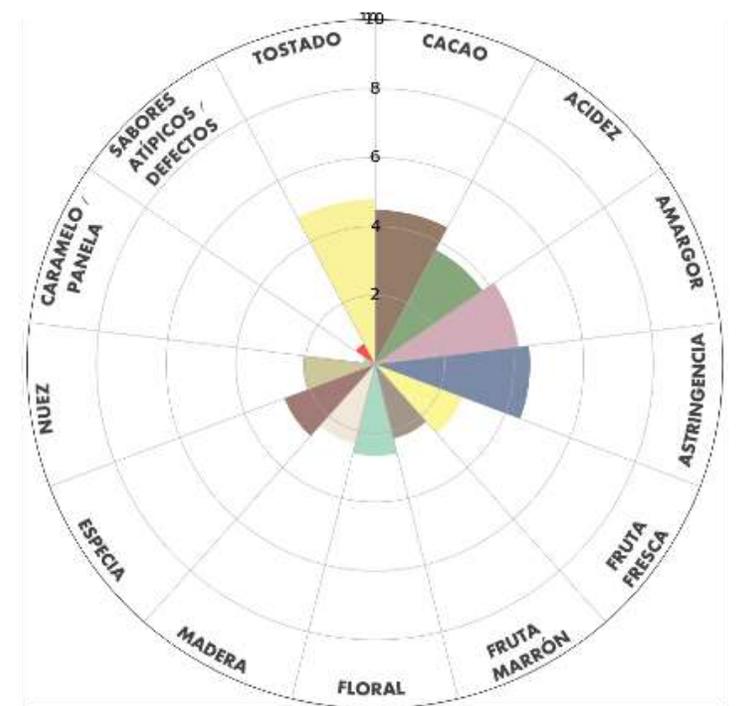
Results – Flavour profiles

D 1009



D 1015

D 1017



Acknowledgements

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Maximizando Oportunidades
en Café y Cacao en las Américas





THANK YOU!

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