Zurich University
of Applied Sciences

Life Sciences and
Facility Management

Canephora vs. Arabica

Impact of species on flavour and taste

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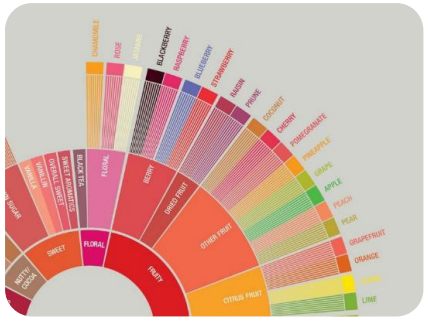
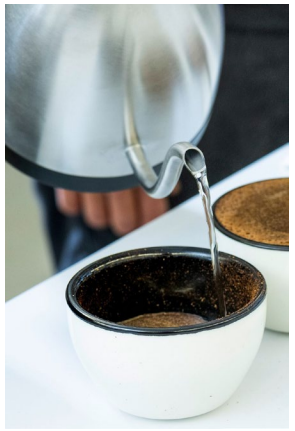
Q-grader Arabica, Authorized SCA Trainer in green coffee

Introduction Trends in coffee species and processing

Comparison of Aroma of Arabica and Canephora

- Roasting impact on roast induced compounds
- Post-harvest processing impact
- Species impact

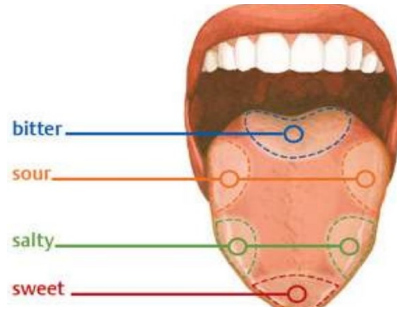




Cupping exercise

Taste:

- Bitterness
- Acidity



Arabica: *Coffea arabica*

Robusta: *C. canephora*

Eugenioides: *C. eugenioides*

Liberica: *C. liberica var. liberica*

Racemosa: *C. racemosa*

In addition:

Coffea stenophylla, C. brevipes, C. congensis

C. pseugozanguebariae, C. liberica var. dewrevrei

Images from: A database of Wild Coffea Species (https://doi.org/10.23708/JZA8I2).

Image credit: Antony Watson

Parchment-dried coffee

(also referred to as **washed process**, wet process)

Pulp removed by mechanical means.
Mucilage is removed through fermentation.

Complex, clean coffee, well-balanced, pronounced acidity.

Image credit: Brazil Fazenda Alta Vista

Mucilage-dried coffee

(also referred to as **pulped natural process**, honey process)

Pulp removed by mechanical means.

Mucilage dried on parchment.
Fermentation during the drying phase.

Diverse flavour profiles.

Image credit: Antony Watson

Fruit-dried coffee

(also referred to as **natural process**, sun-dried process)

Whole cherries dried.

Fermentation inside the cherry during drying phase.

Yields bold, sweet and fruity (even fermented) flavours

Novel fermentation practices have appeared

Coffee producers: master of post-harvest processing.
Importance of fermentation, e.g. carbonic maceration naturals, addition of microorganisms.
“Survival” of green coffee flavours was already postulated in 1995 (Holscher and Steinhart 1995).

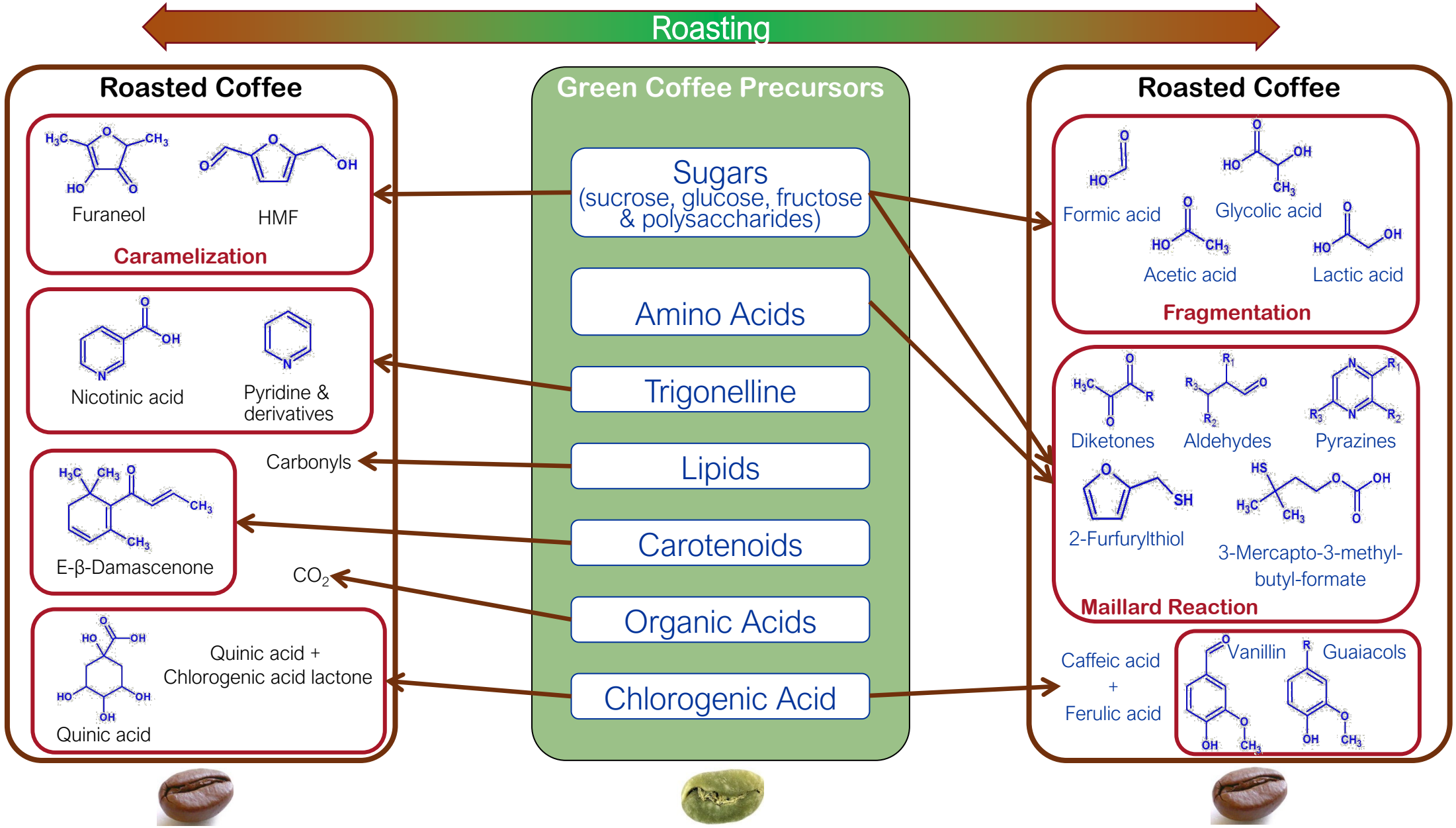
Fermentation in cherry (48 h), washed coffee.

Traditional processing, washed coffee.

Source: Beck, B. (MSc Thesis, ZHAW)

Source: Kaffeemacher.de

Roasting as most important step to generate flavour compounds in coffee



Coffee investigated in study

Robusta Uganda Kaweri yeast assisted natural

Arabica Nicaragua cherry fermentation natural

Coffee for today's cupping

Robusta Uganda Kaweri yeast assisted natural

Arabica Honduras cherry fermentation anaerobic

Impact of species and processing on flavour formation and flavour composition

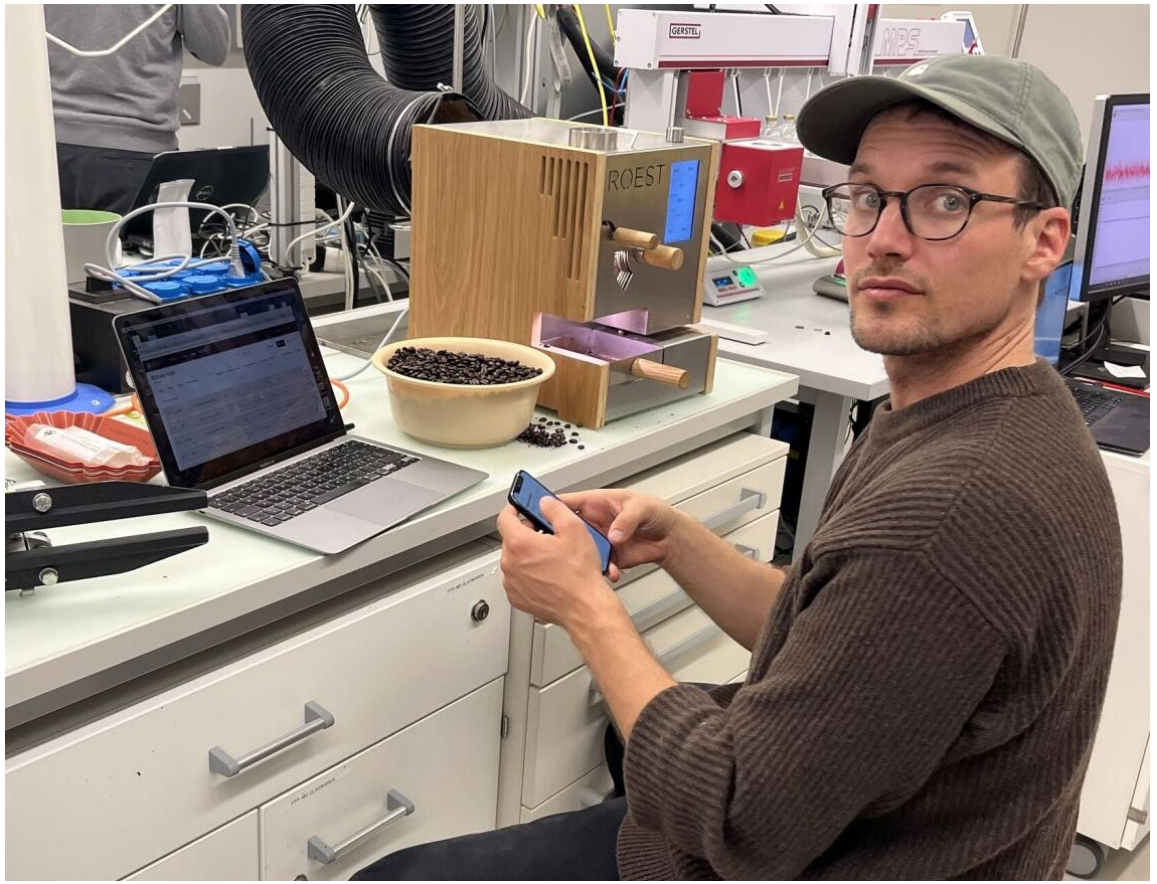
Robusta – Uganda
Natural

Yeast assisted in cherry fermentation for 2 days

Arabica – Nicaragua
Natural

In cherry fermentation for 3 days

Roasting impact – study 2022



Known impact of coffee roasting

Key differences in green beans

- Arabica with more sugars
- Canephora with more chlorogenic acids

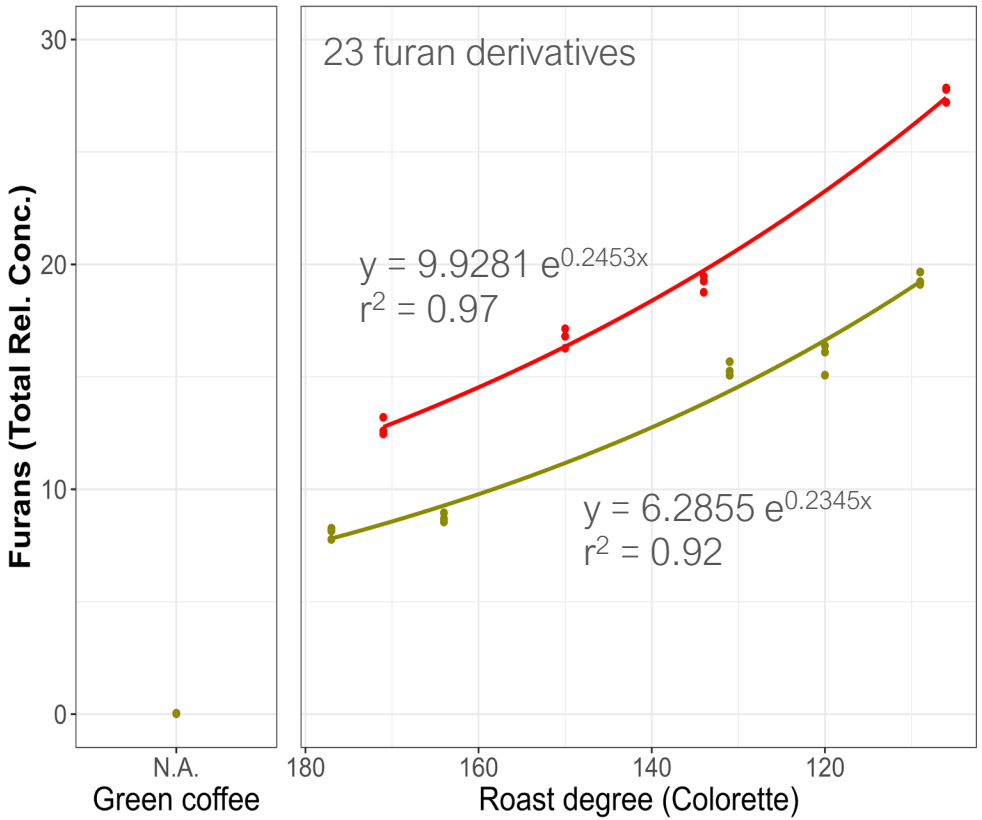
	Content (% db)	
Constituents	**Arabica**	**Canephora**
Polysaccharides	46 - 53	34 - 44
Sucrose	6 - 9	3 - 7
Lipids	15 - 18	8 - 12
Trigonelline	0.6-1.2	0.3 - 0.9
Organic acids	2 - 2.9	1.3 - 2.2
Proteins	8.5 - 12	8.5 - 12
Caffeine	0.8 - 1.4	1.7 - 4.0
Chlorogenic acids	6.7 - 9.2	7.1 - 12.1
Minerals	3 - 5.4	3 - 5.4

Source: The Science and Craft of Coffee, (2017)

Furans

Roast impact on furans

- Arabica with more furan derivatives
- Similar formation rates

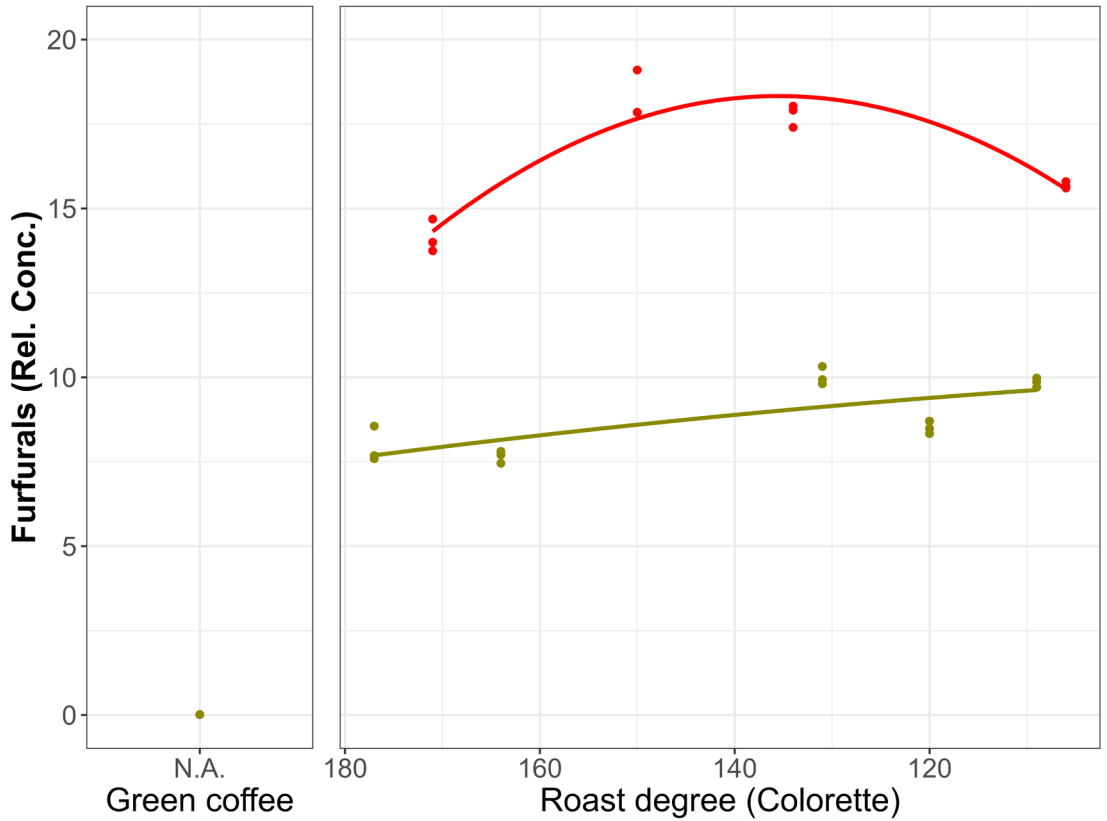


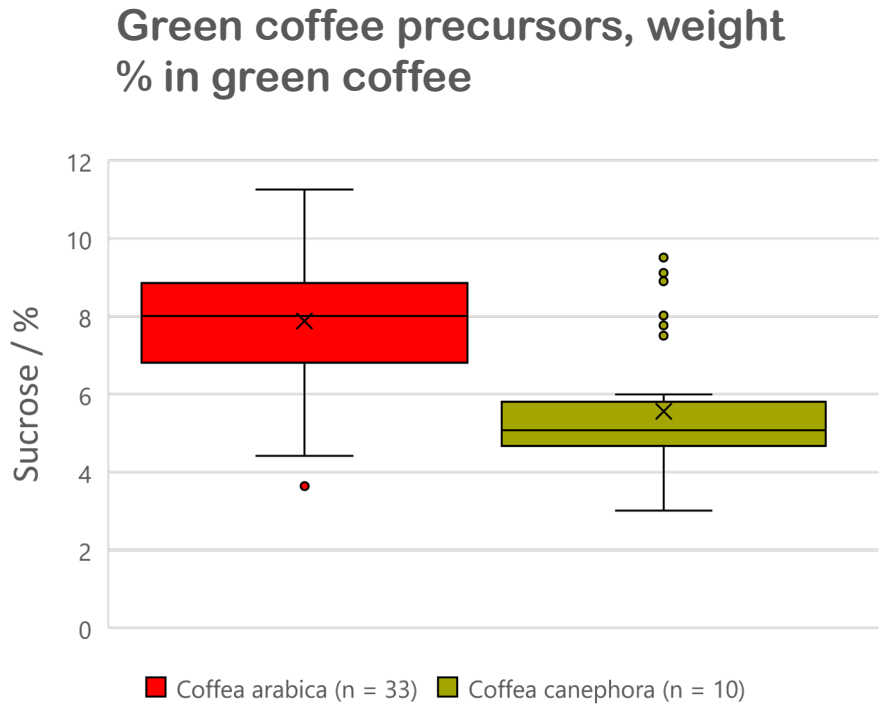
Flavour: sweet, nutty

Sucrose is a known precursor of furfurals

More furfurals in Arabica roasted coffee

Higher content of sucrose in Arabica



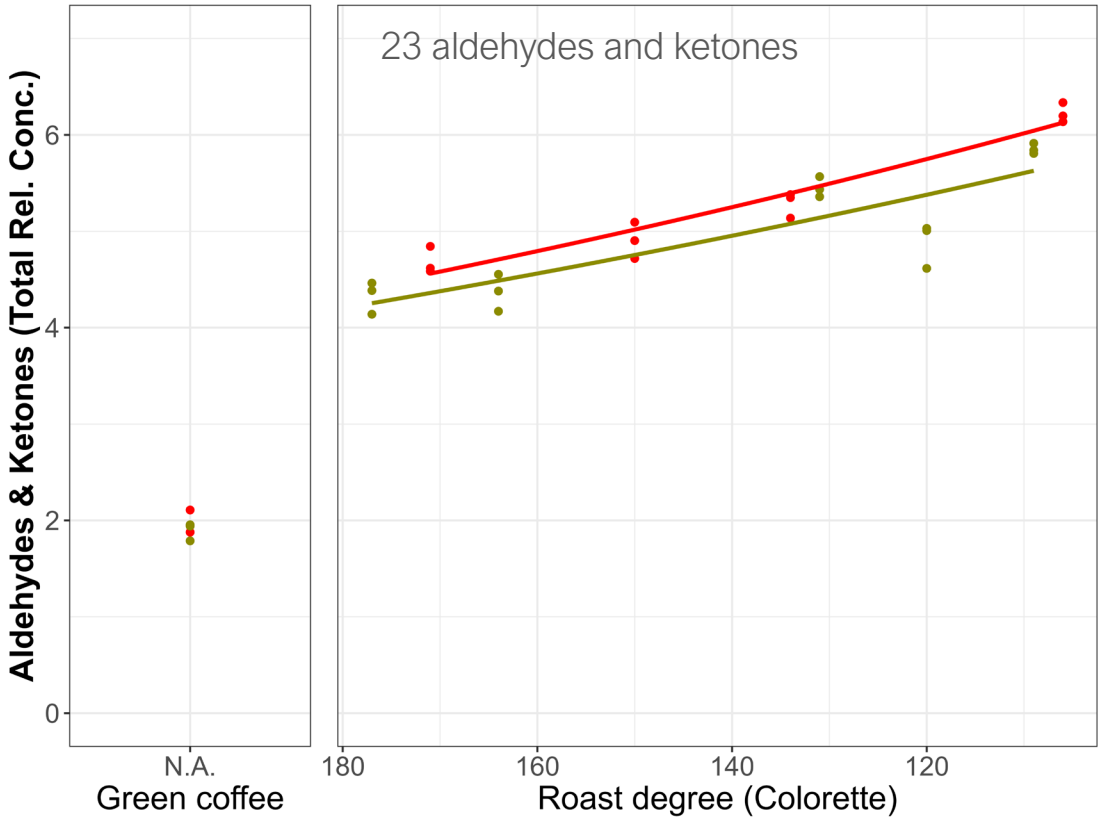


Flavour: Caramell-like, sweet

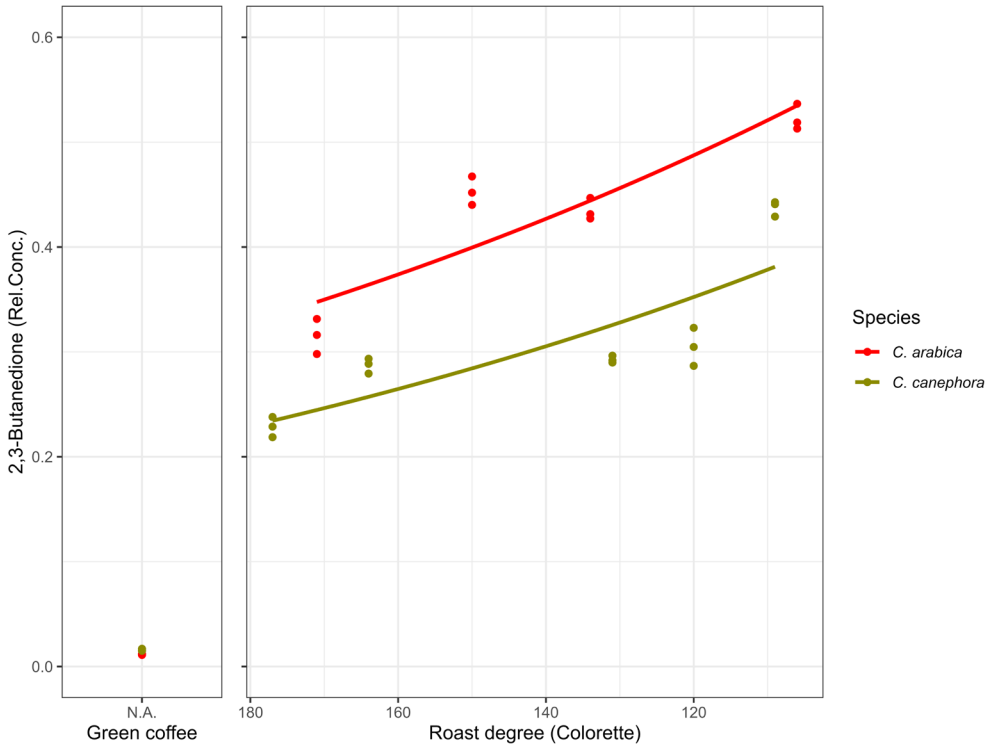
Roast impact on ketones and aldehydes

Similar levels of aldehydes and ketones in both species

2,3-Butanedione higher in Arabica.



Flavour: fruity, malty, cocoa, green

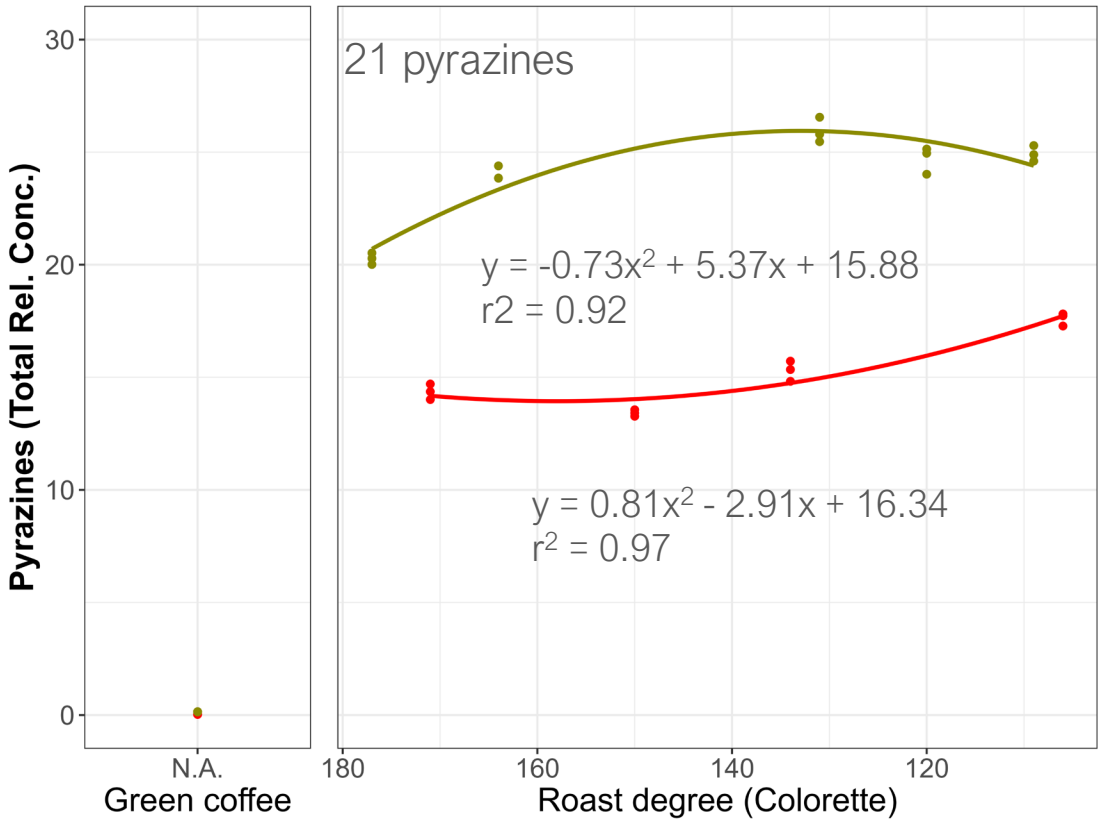


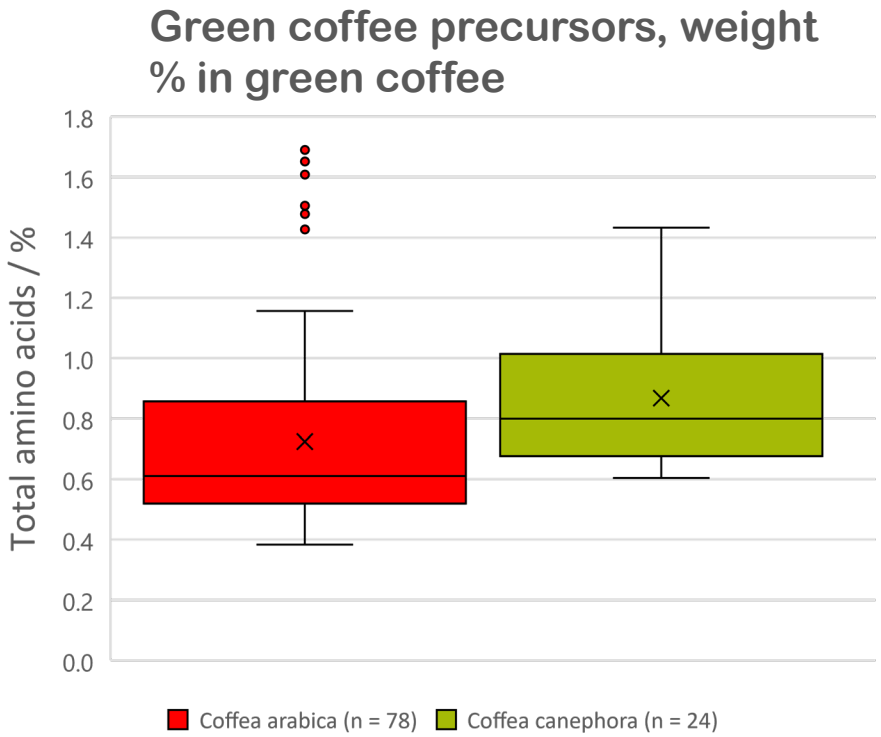
Flavour: buttery, creamy, butterscotch

Roast impact of pyrazines

Pyrazines higher in Canephora than Arabica.

Canephora with higher content of free amino acids



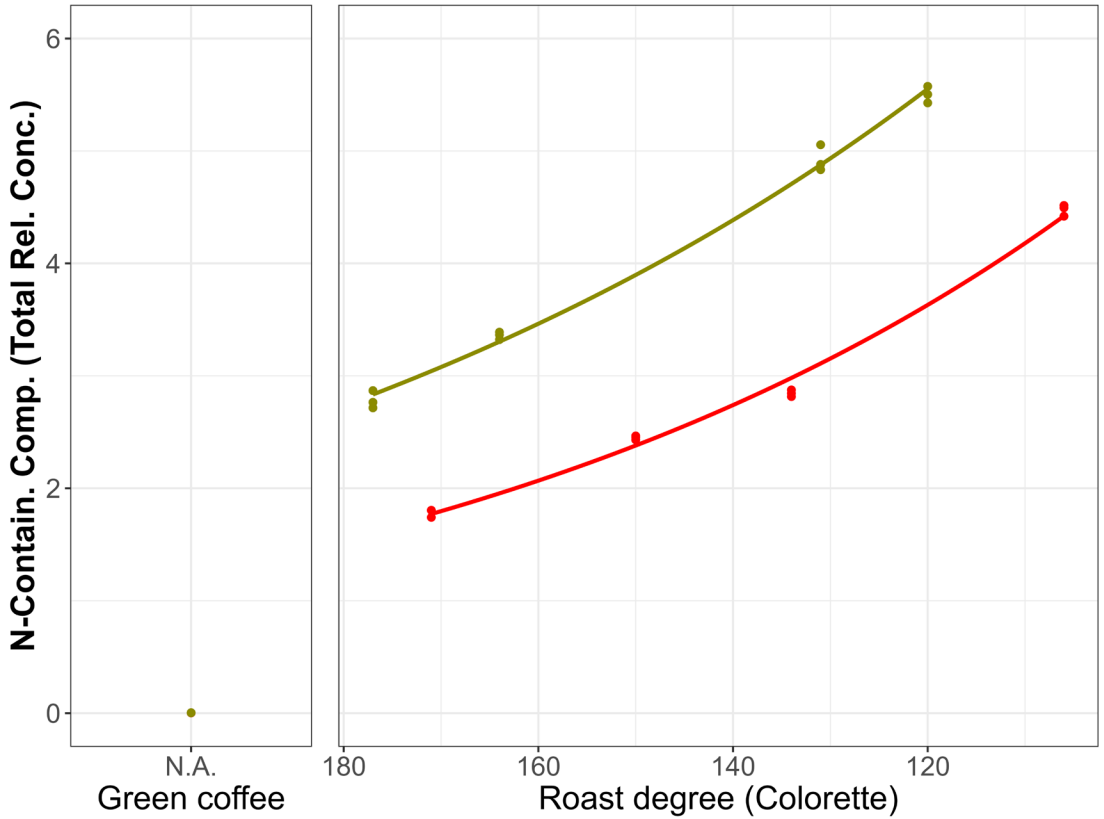


Macheiner et al 2021, Luigi et al 2009

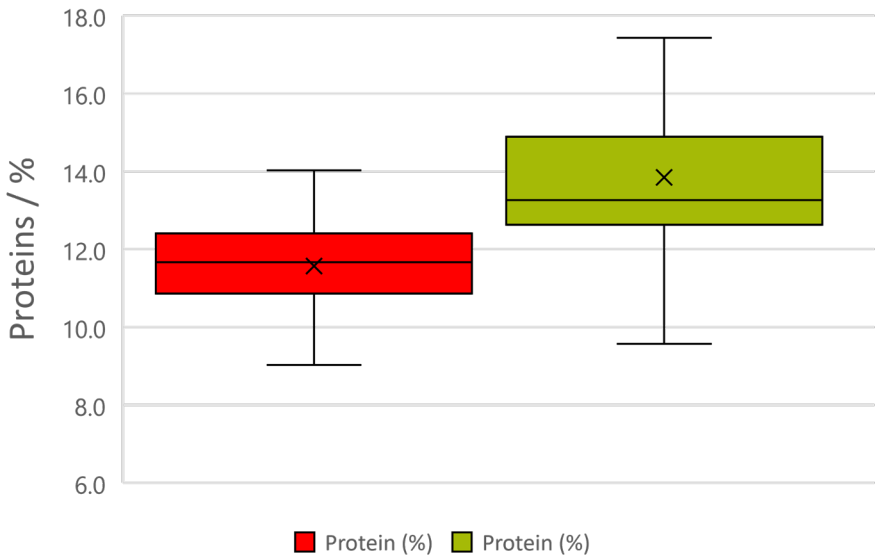
Flavour: Nutty, peanut, cereal, musty, earthy, cocoa

Roast impact on other N-containing heterocycles (e.g. pyridines, pyrroles, pyrazoles)

N-containing compounds higher in Canephora.
Higher protein content than Arabica



Green coffee precursors, weight % in green coffee



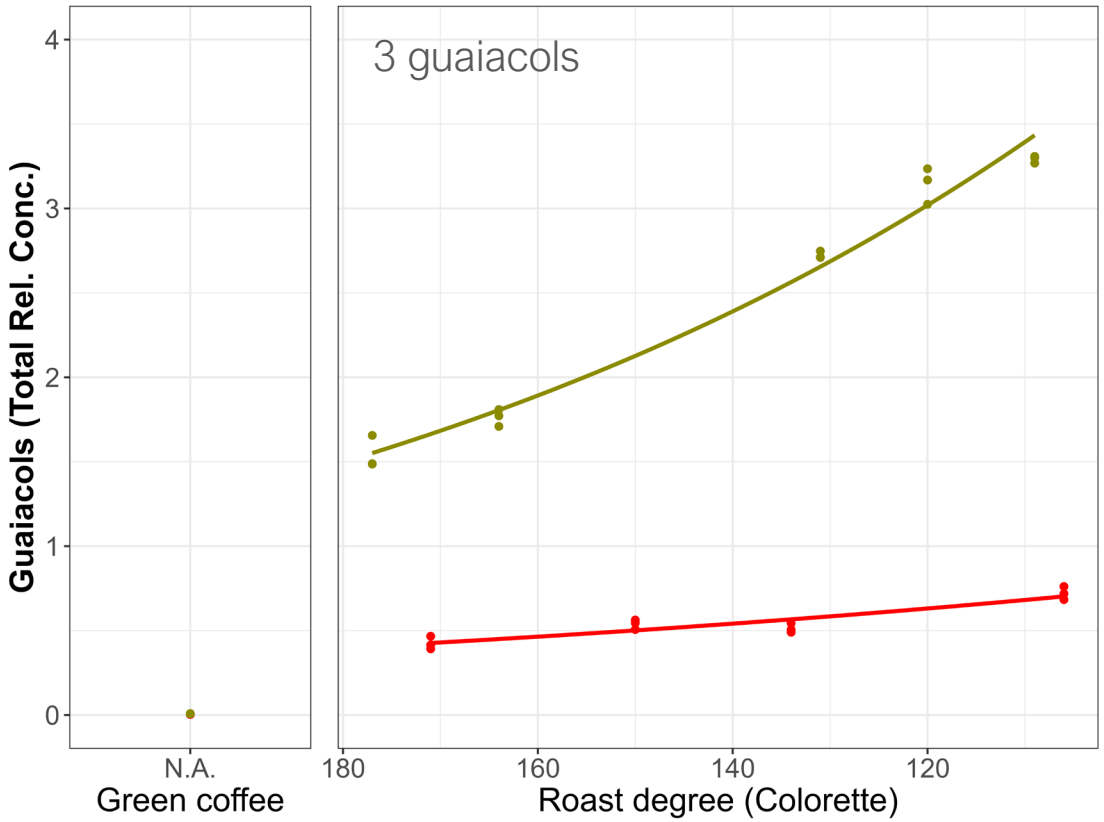
Macheiner et al 2021, Luigi et al 2009

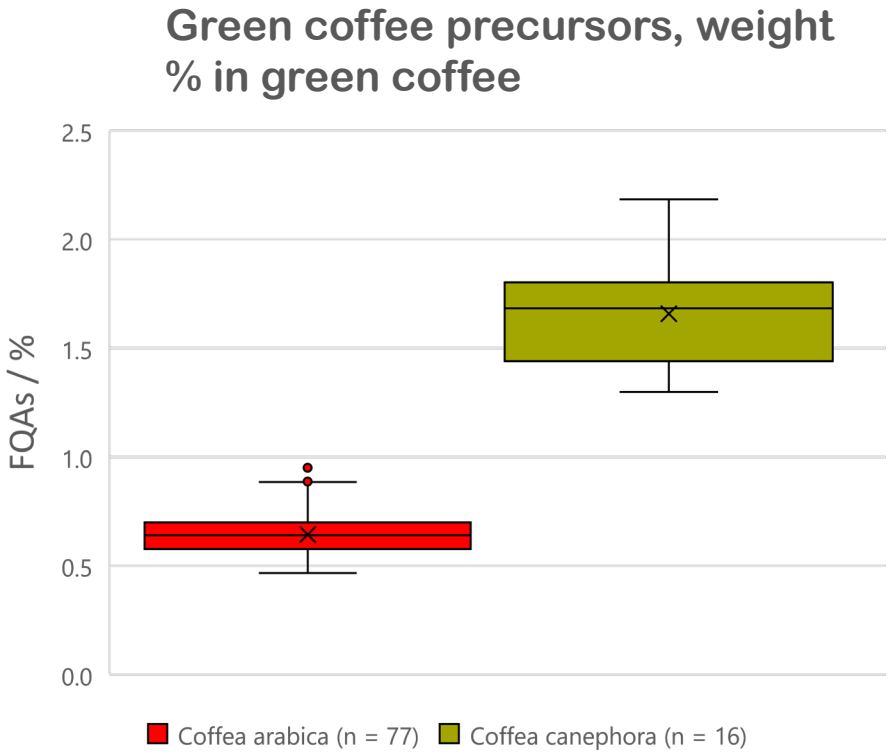
Flavour: Roasted, cooked, burnt, fishy

Chlorogenic acid degradation products

Roasting produces more guaiacols in Canephora

Precursors FQAs higher concentrated in Canephora.



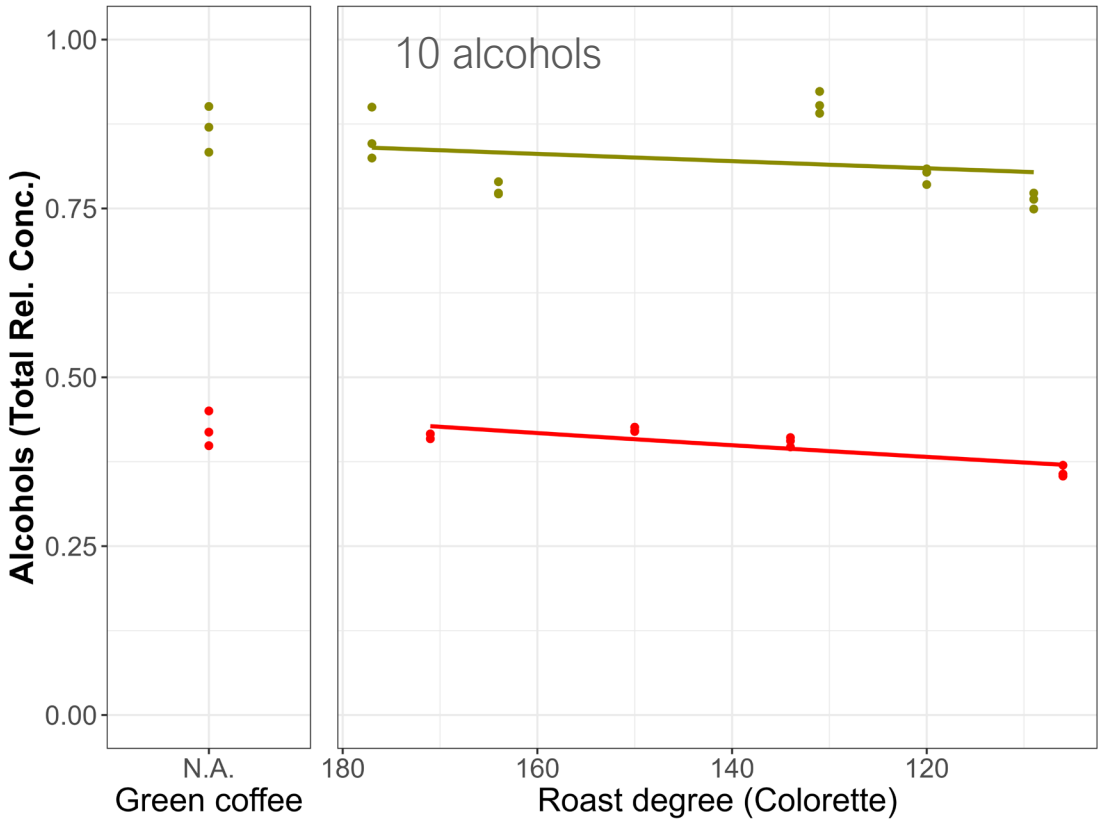


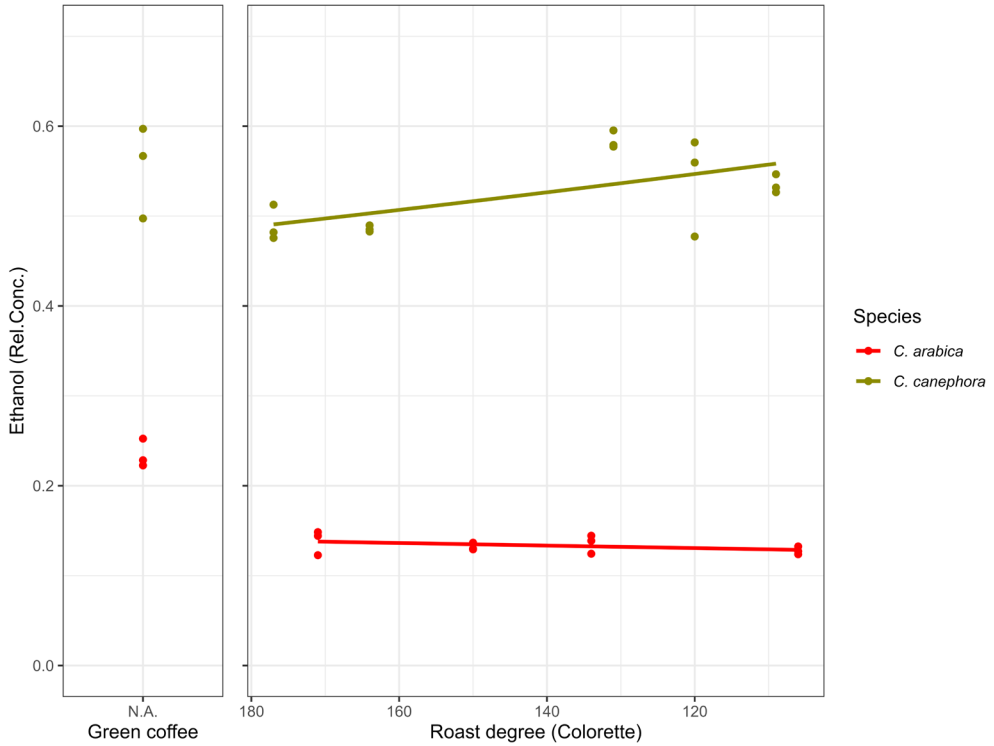
Flavour: Phenolic, smoky, meaty, spicy (clove, vanilla)

Processing impact – study 2022

Fermentation related compounds in the coffees with long fermentation times.

Canephora with higher levels of ethanol.
High diversity of esters, much more esters in Canephora, many methyl and ethyl esters

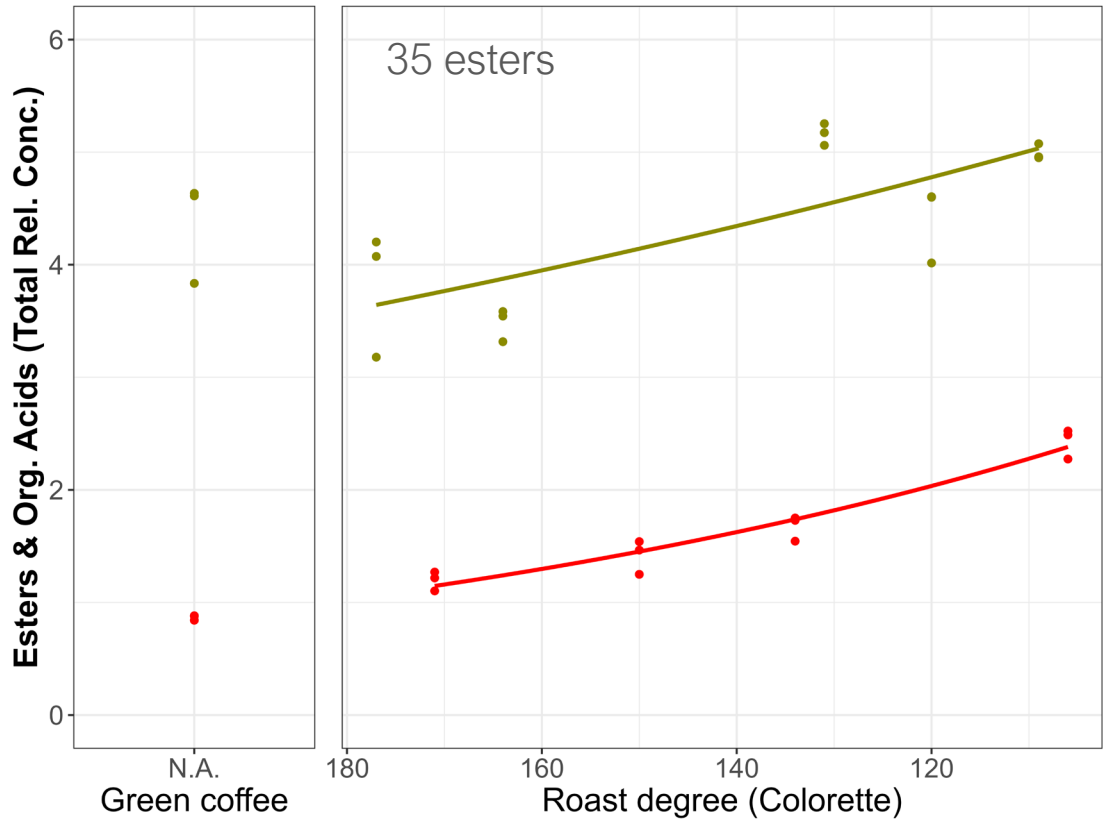


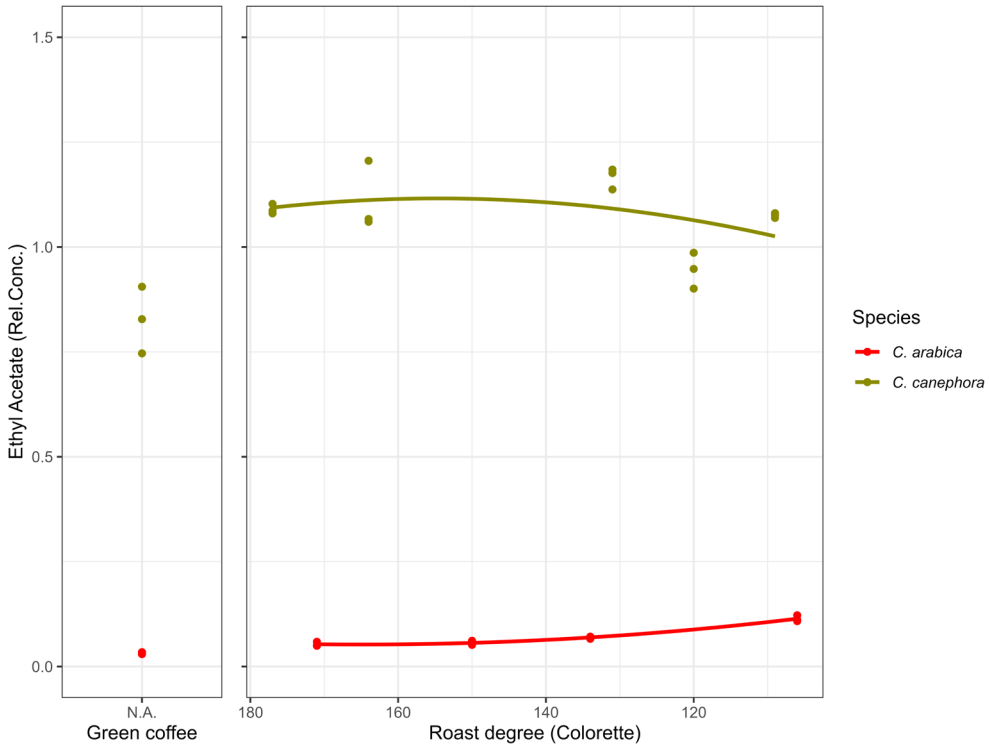


Flavour: Etheral, alcoholic

Fermentation related compounds in the coffees with long fermentation times.

Canephora with higher levels of esters
High diversity of esters, e.g. ethyl acetate. Much more esters in Canephora, many methyl and ethyl esters





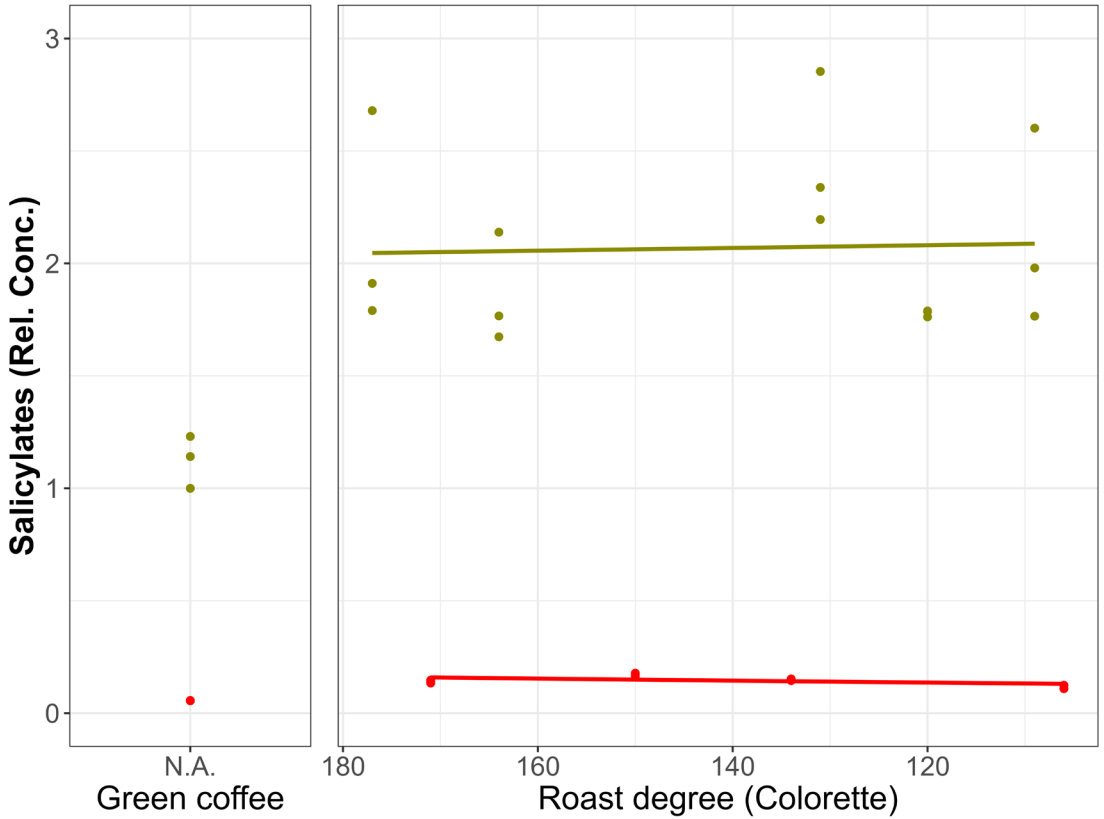
Flavour: fruity, sweet

Species impact – study 2022

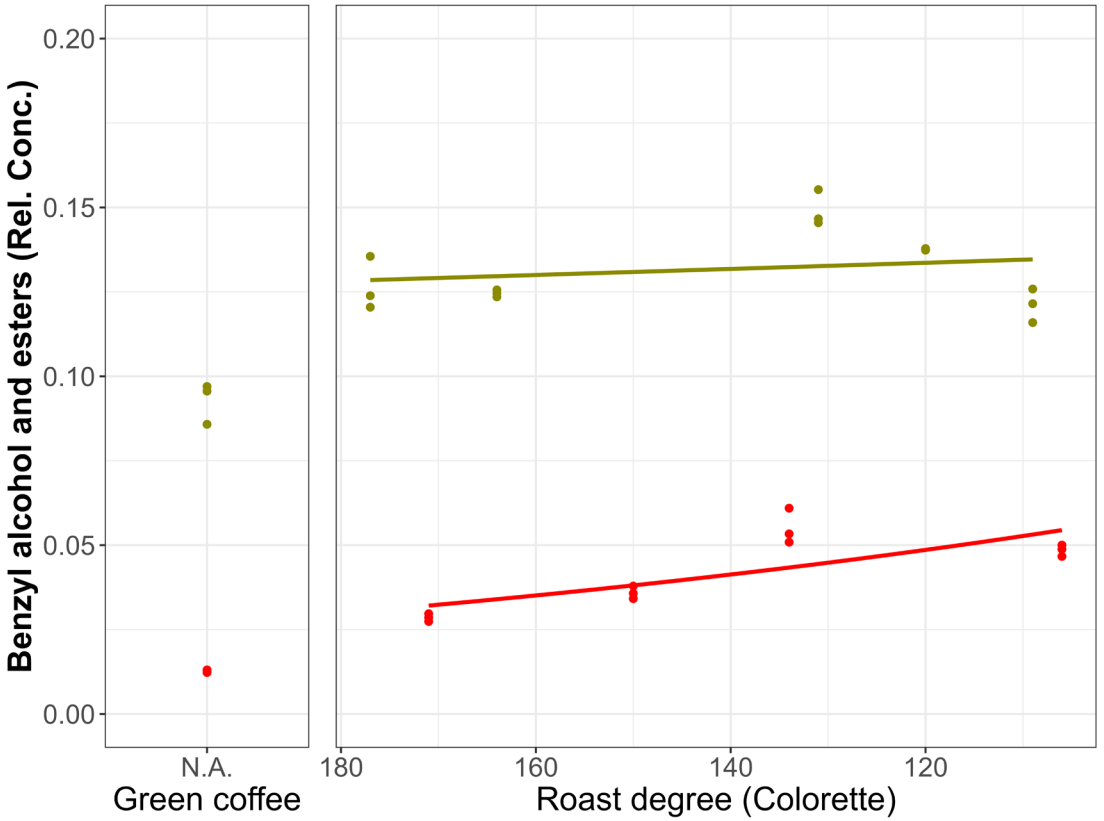
Benzyl alcohol /Benzyl alcohol esters

Methyl salicylate and Ethyl salicylate higher in Canephora.

Benzyl alcohol and ester formation (Benzyl acetate, Benzyl formate) during roasting.



Flavour: wintergreen minty, sweet



Flavour: floral, fruity, sweet

Impact of roasting

- Arabica with higher amounts of furans and furfurals: Sweet, caramell
- Canephora with higher amounts of pyrazines, pyrroles, pyridines, guaiacols
- Green coffee composition of precursors able to explain species differences:
  - More sugars in Arabica
  - More proteins in Canephora

Light roasted coffee can reduce impact of roast induced flavour attributes?

Impact of processing

- Canephora with clear impact of fermentation related compounds in green and roasted coffee

Impact of species

- Canephora contains more salicylates as well as Benzyl alcohol and Benzyl alcohol esters
- Ester formation during roasting is likely

Cupping

Three roast degrees of two species

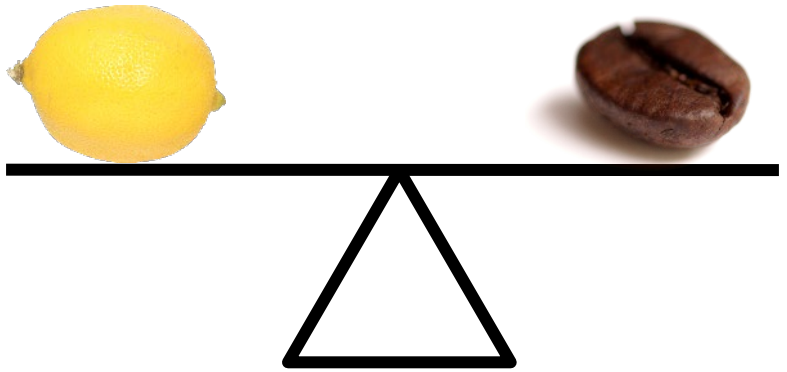
Canephora – Uganda
Natural

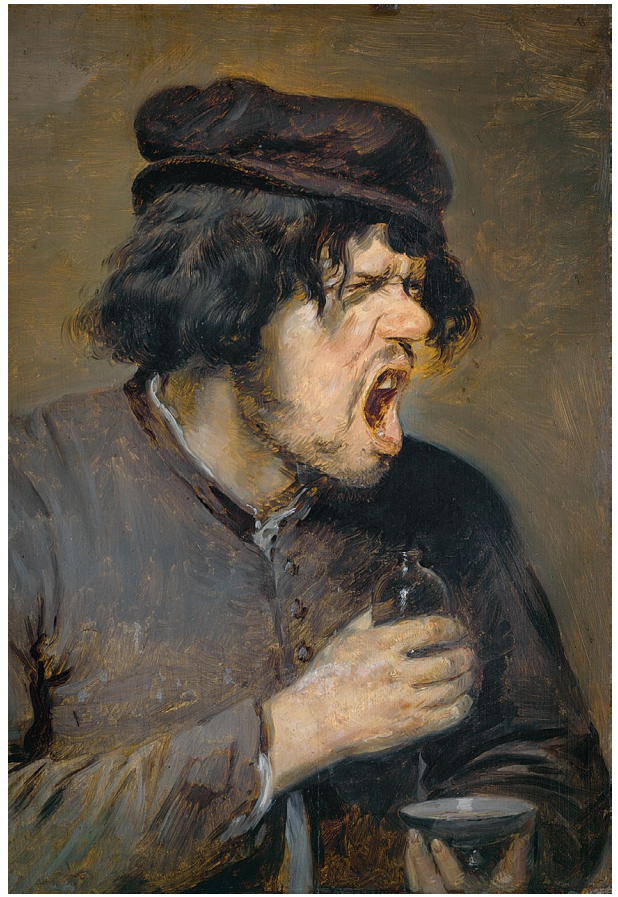
Yeast assisted in cherry fermentation for 2 days

Agtron G: 86 (too light) 76 (light), 63 (SCA)
Col 4: 191, 175, 148

Arabica – El Salvador
Natural

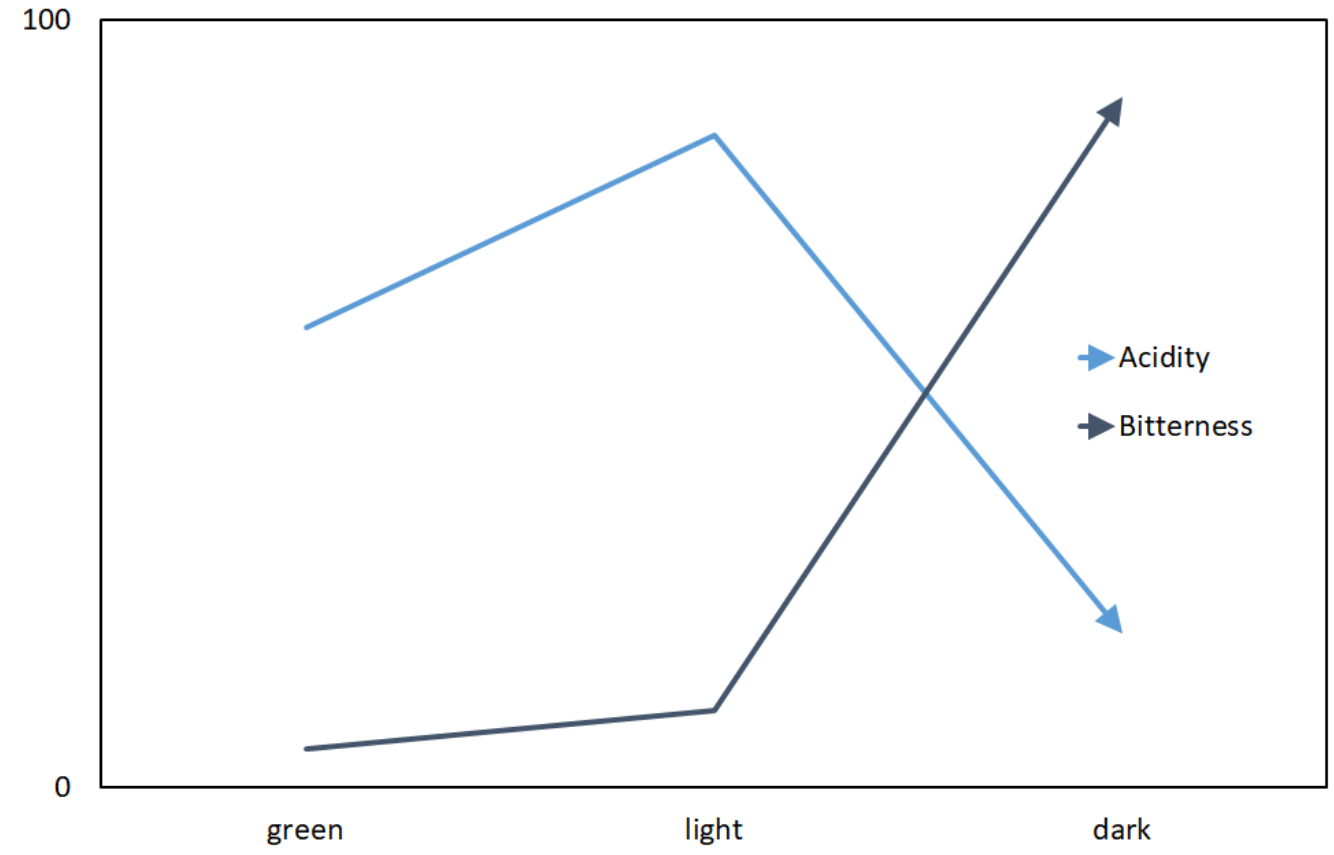
In cherry fermentation for 3 days





The Bitter Draught 1636/1638 by Adriaen Brouwer

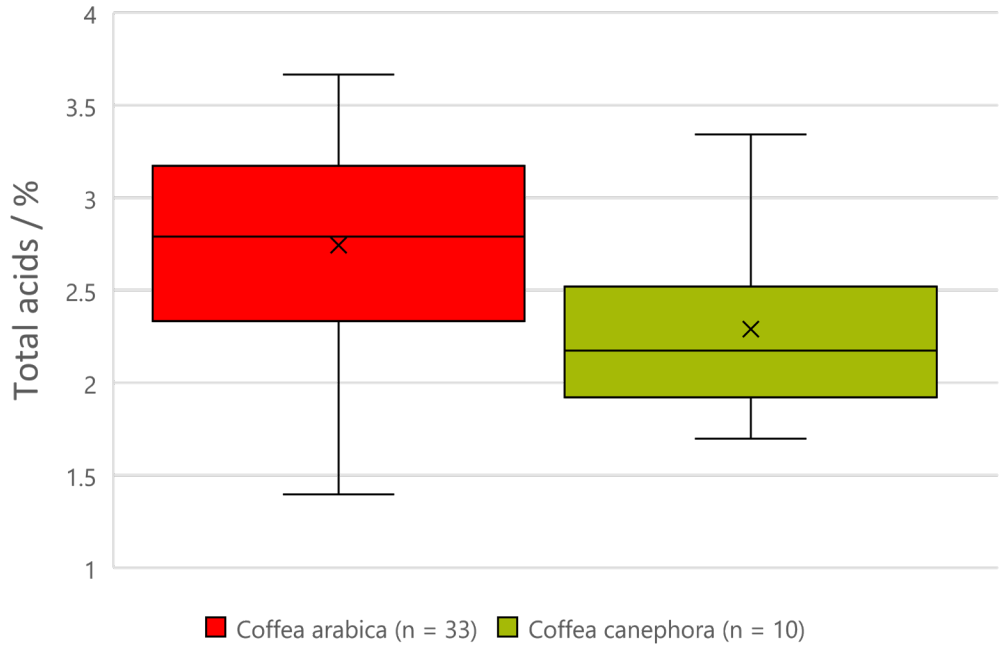
Acidity vs. Bitterness

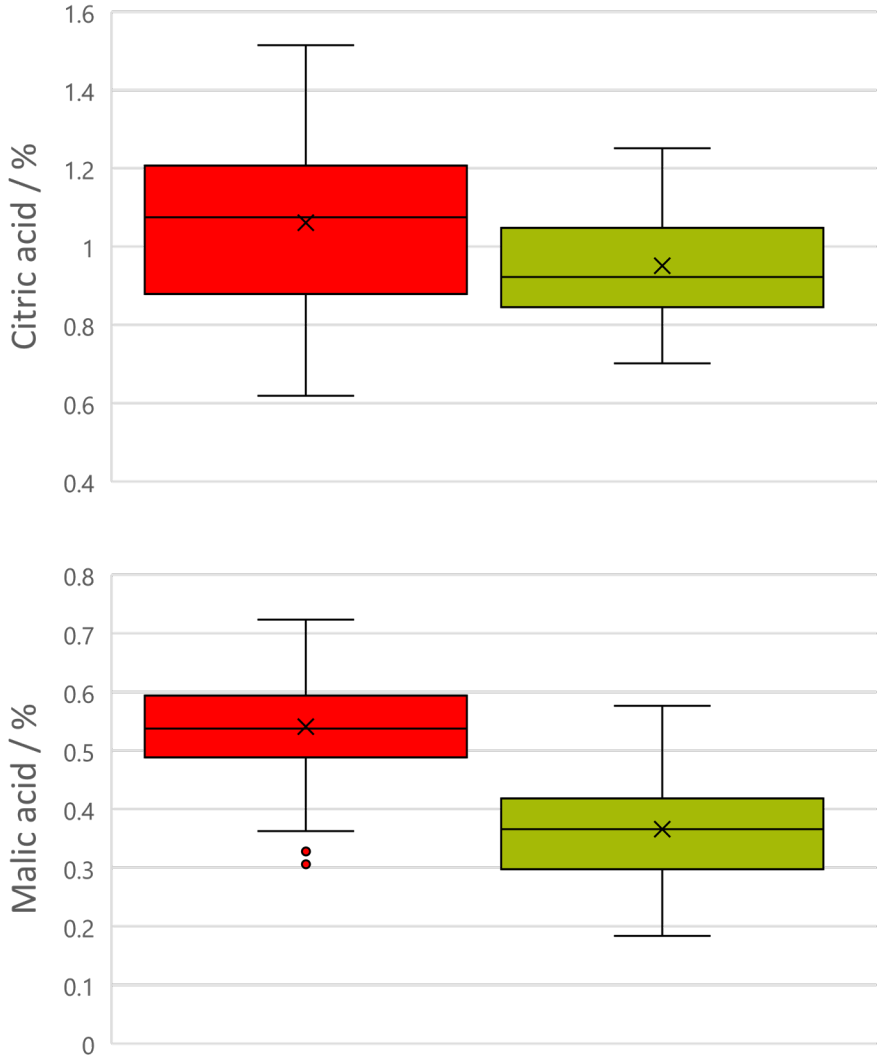


Arabica with higher acidity

Higher level of organic acids in green beans of Arabica green coffees

On average malic acid is 50 % higher in Arabica



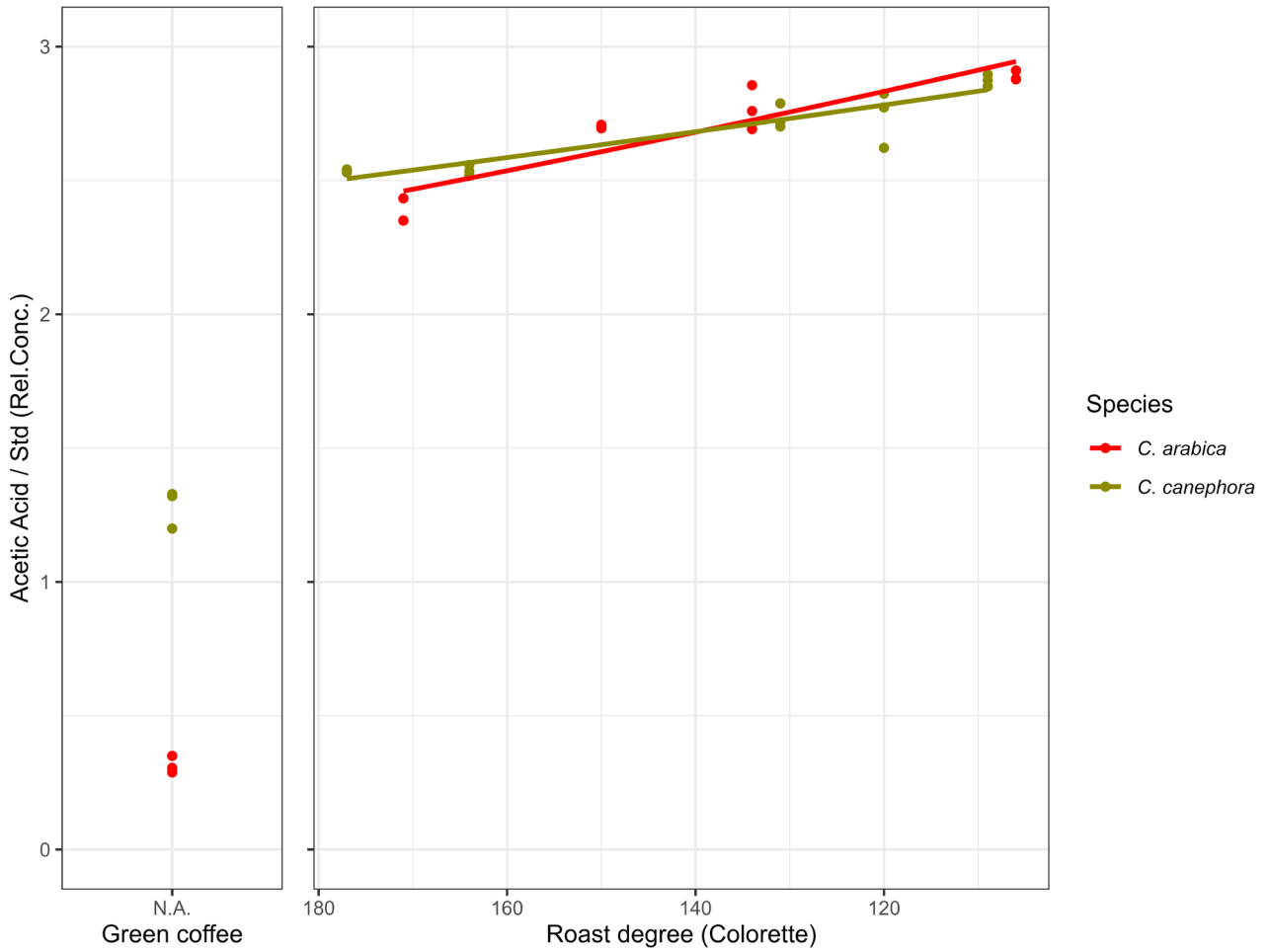


Acetic acid in roasted coffee

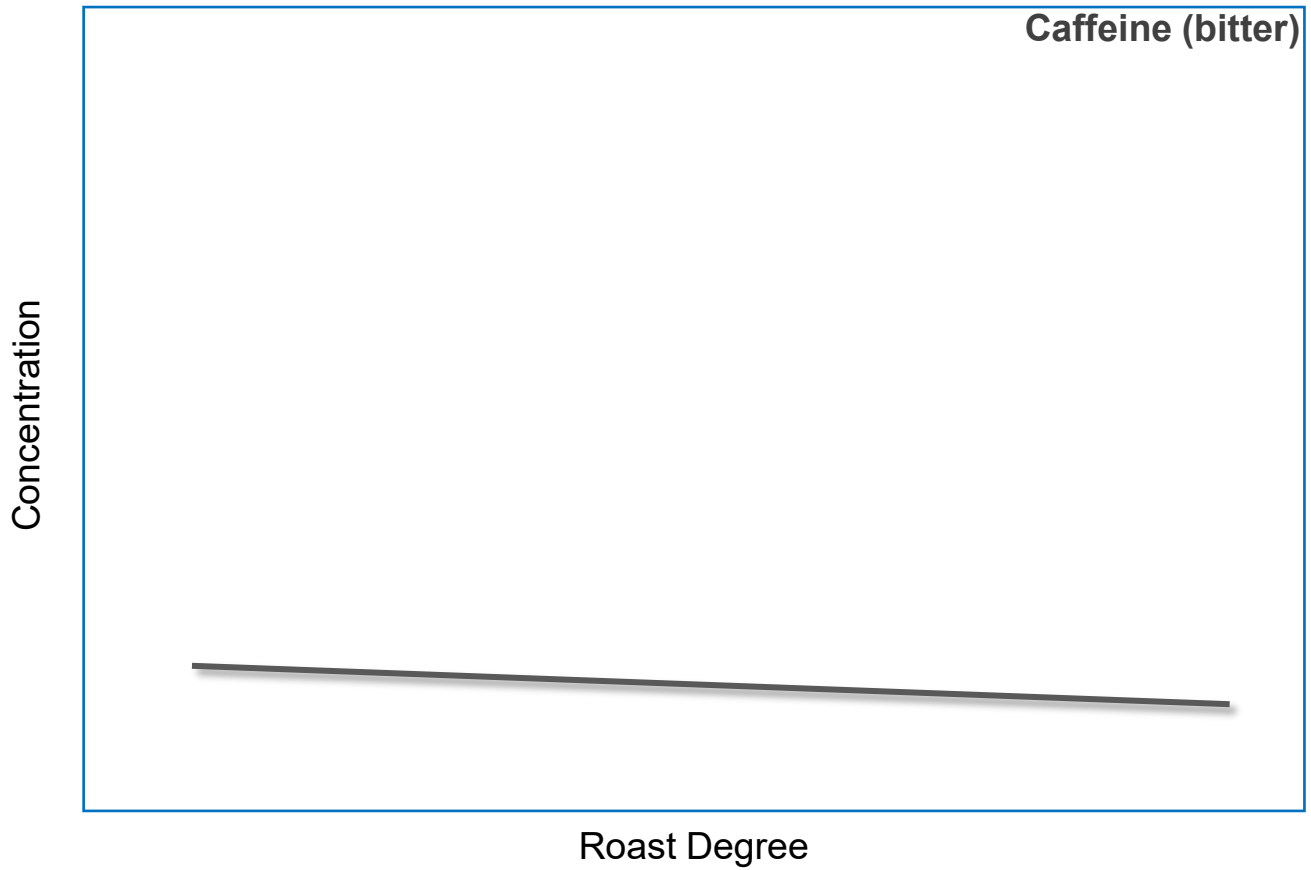
Similar levels of acetic acids in our two study coffees (not the ones we cupped)

But fermentation signature clearly visible in Canephora

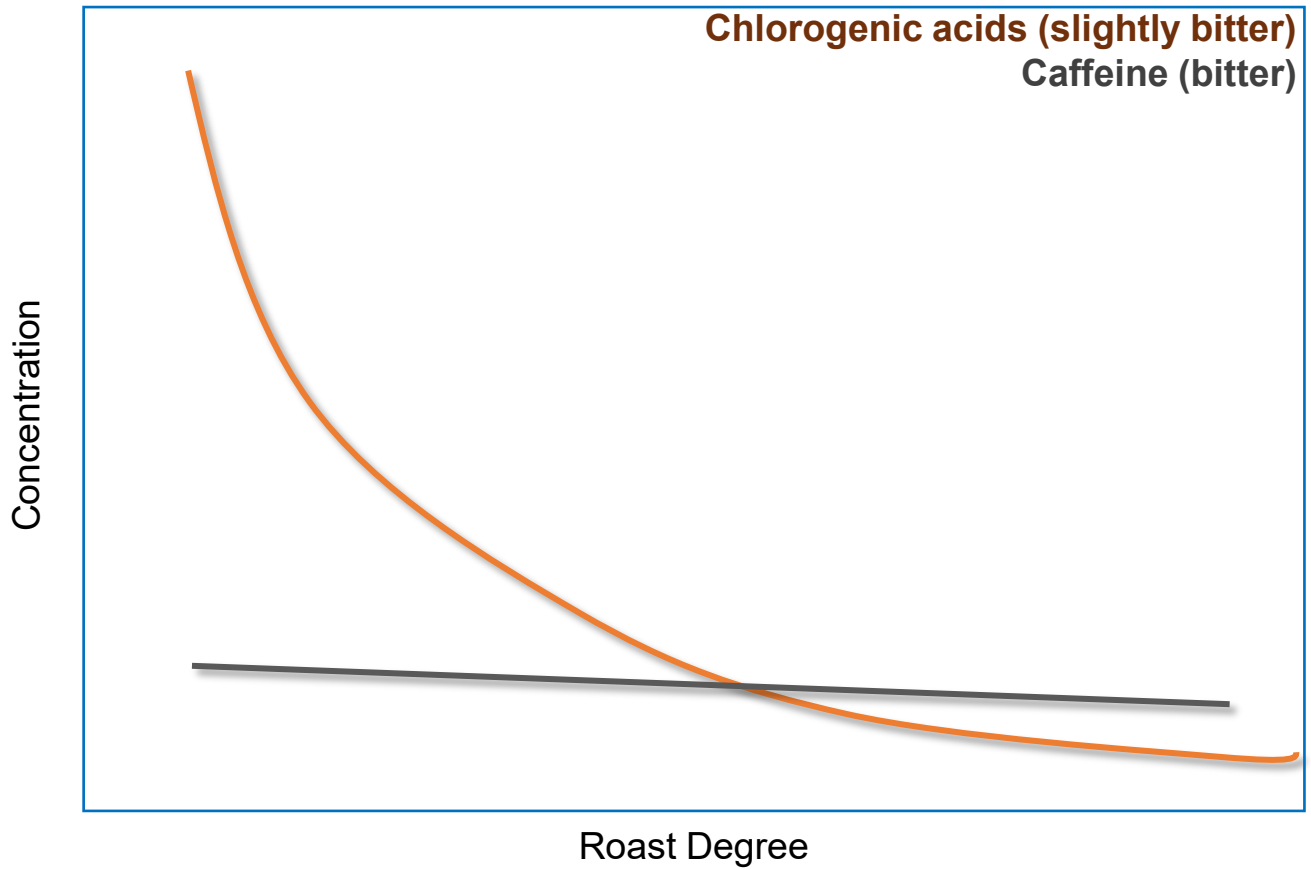
More studies needed to understand processing and roasting impact of acetic acid on sensory.



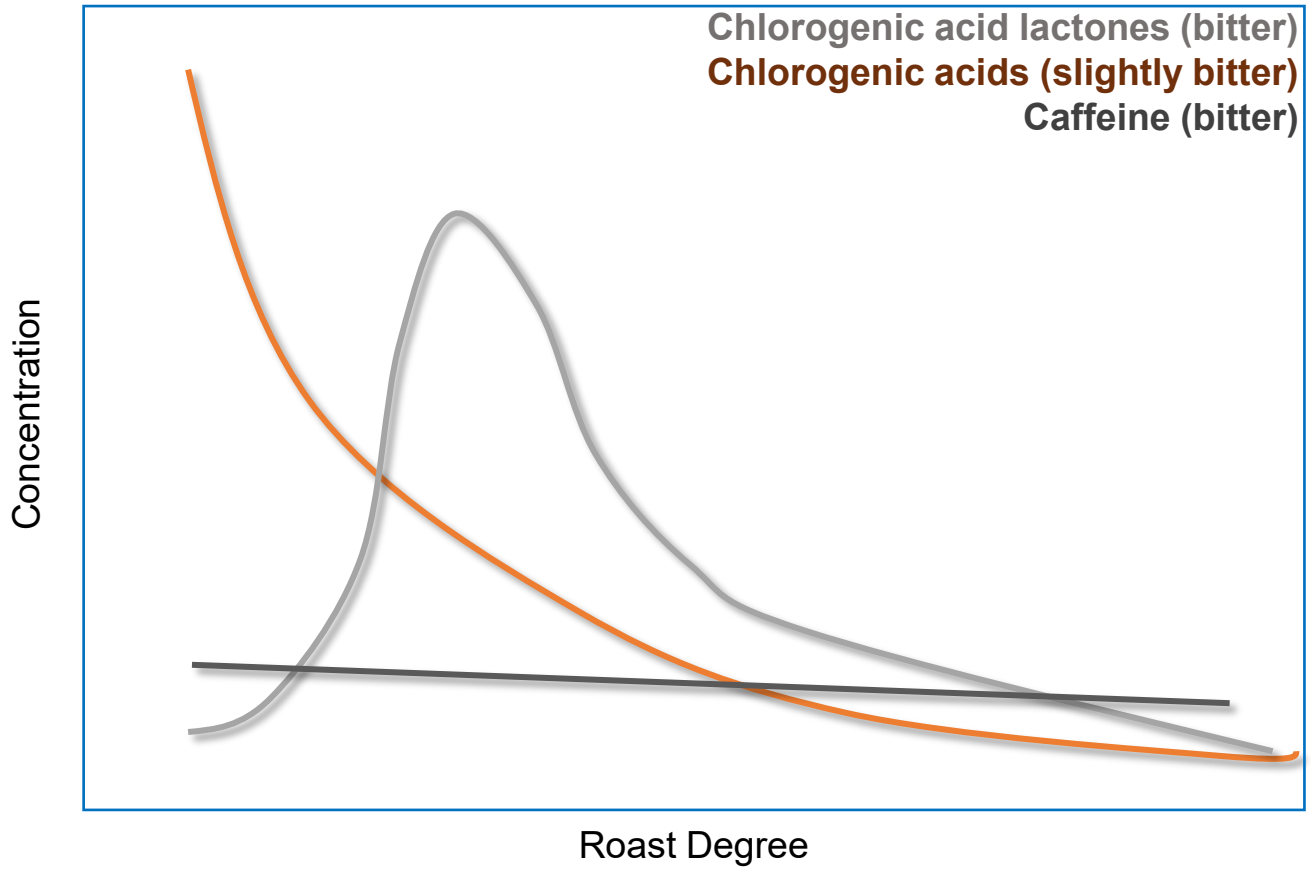
Roasting time and bitterness



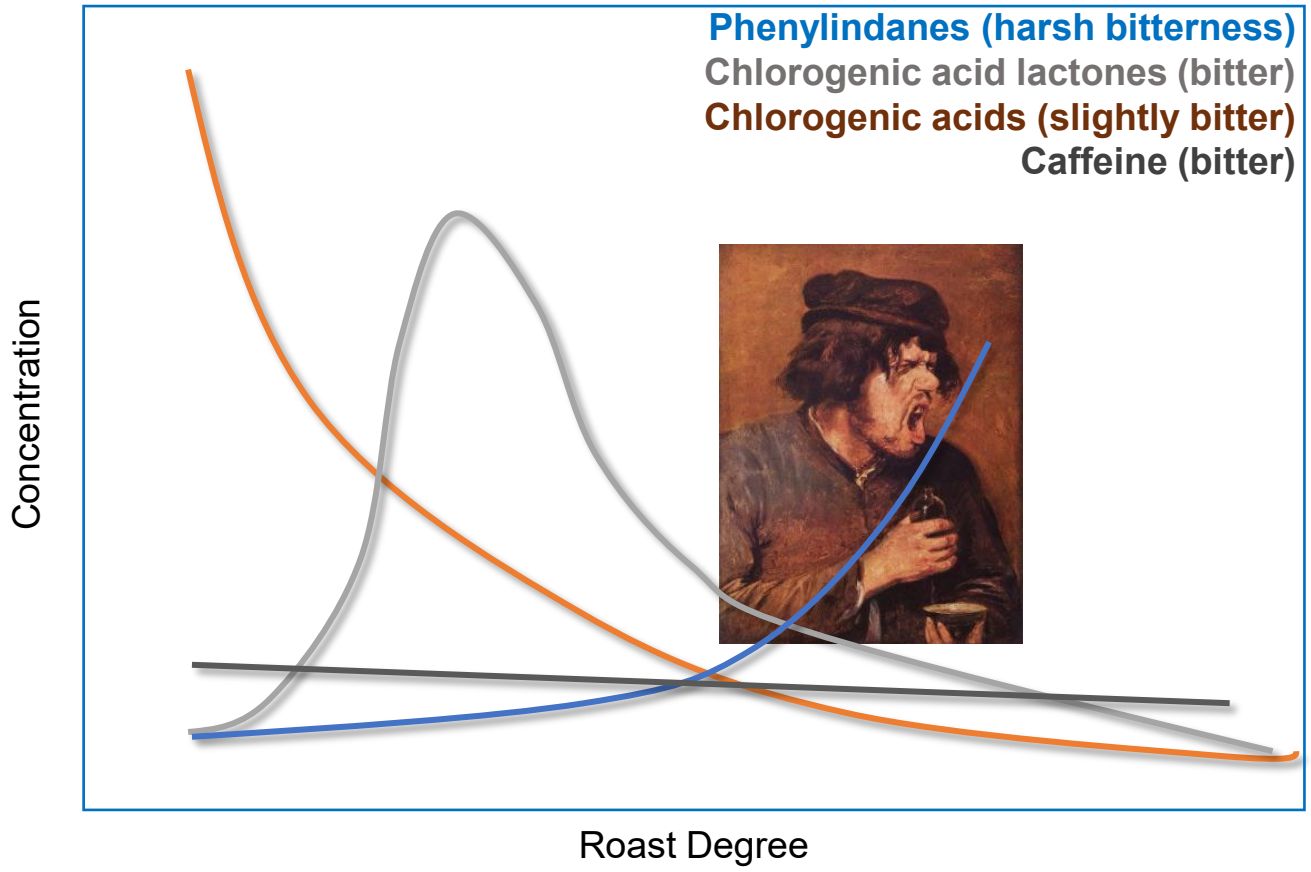
Roasting time and bitterness



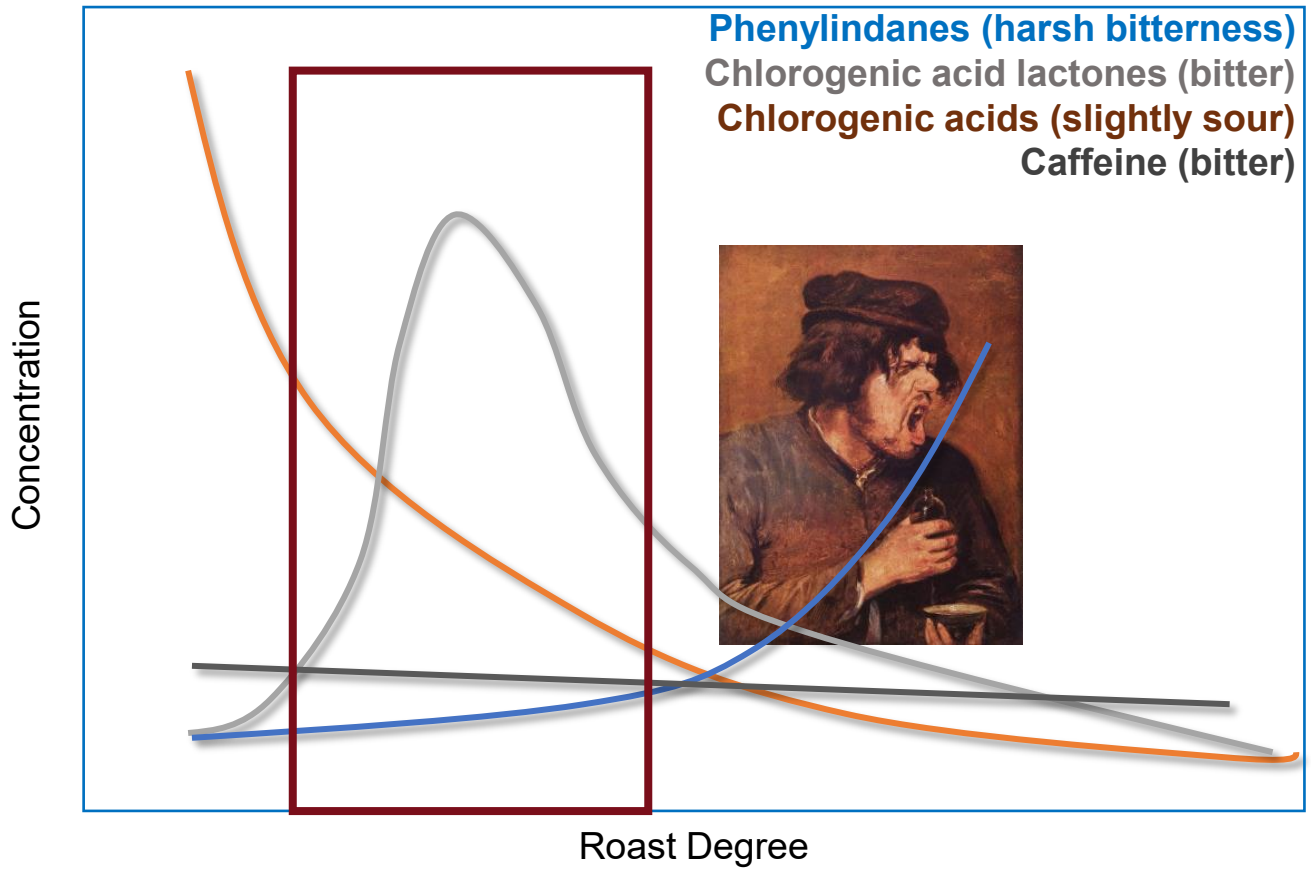
Roasting time and bitterness



Roasting time and bitterness



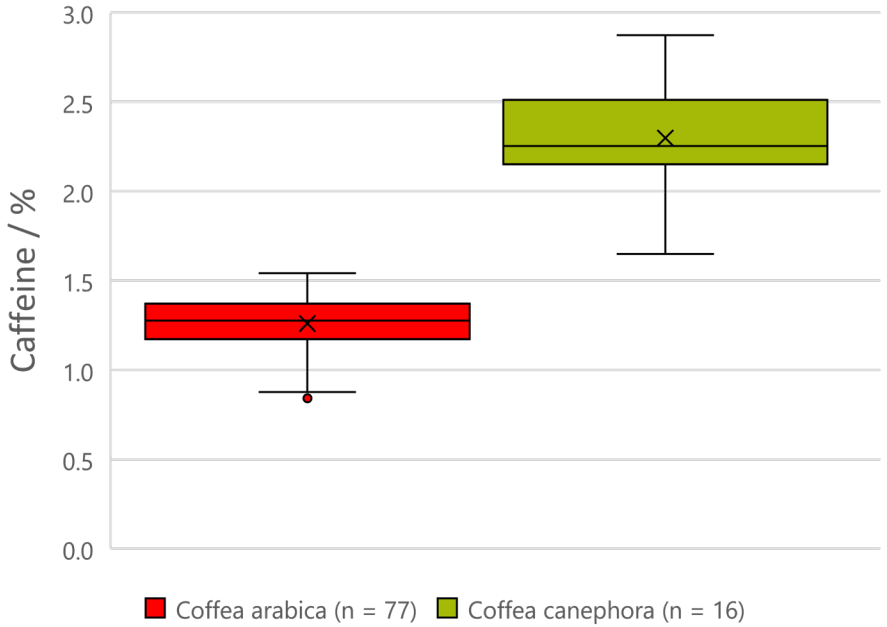
Roasting time and bitterness

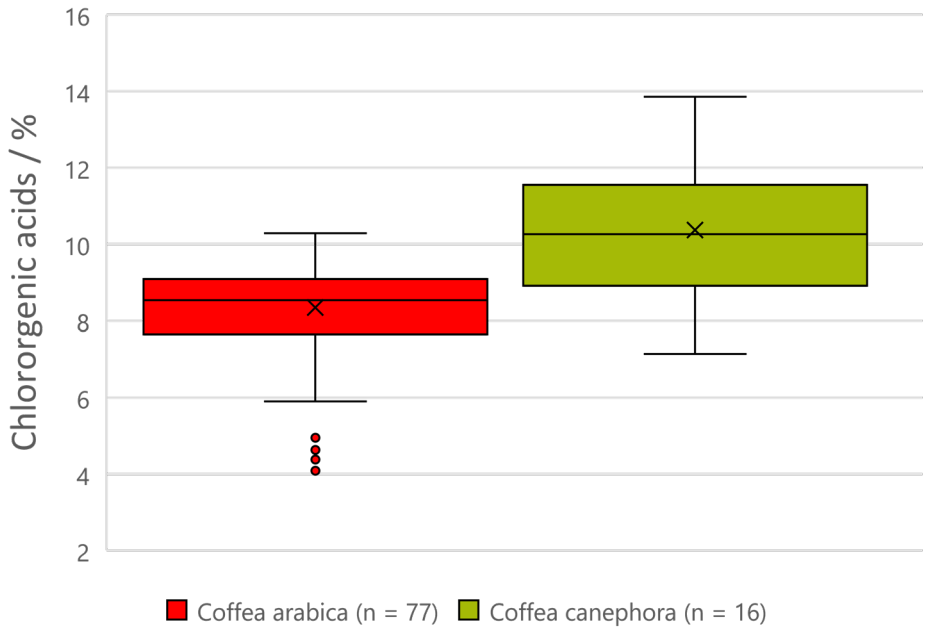


Canephora with more caffeine and chlorogenic acids

Higher potential of bitter taste in coffees

On average 2 x more caffeine and 25 % more chlorogenic acids in Canephora green coffee.





Aroma and flavour

Arabica: Sweeter, more complex roast aroma (Furan derivatives, aldehydes and ketones)

Canephora: Earthy notes in darkest Canephora (pyrazines, other N-containing compounds)

BUT: Fermentation derived flavours are adding fruitiness to Canephora

Taste

Arabica: higher potential acidity (more citric, malic acids in green), appreciation of lower roast impact

Canephora: low acidity, higher potential of bitterness (chlorogenic acids lactones, caffeine).

THANK YOU FOR YOUR ATTENTION ANY QUESTIONS?

Thanks to InterAmerican for providing the Canephora coffee for the study as well as the coffees for today's cupping

Thanks to Algrano for providing the Arabica that was used in the study

Prof. Dr. Chahan Yeretzian

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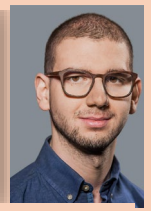

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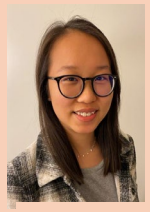

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Sustainability along the whole value chain

Mastering coffee flavor and quality