4th ICC Latin American Cereals Conference

LACC IGW

"NIXTAMALIZATION"

as an alternative for beans (*Phaseolus vulgaris* L.) processing

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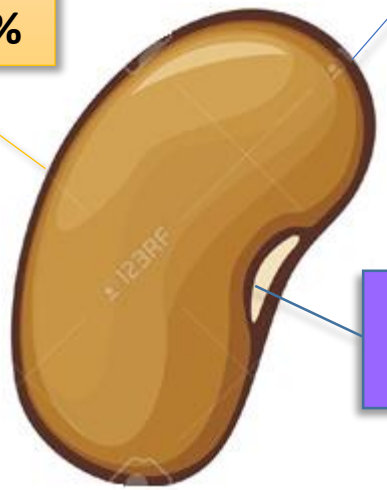
Beans *nixtamalization*…

COMMON BEAN (*Phaseolus vulgaris* L.)

Protein
14.0-33.0 %

Carbohydrates
52.0-76.0 %



Dietary fiber:
14.0-19.0 %

Consumption per capita: Mexico

1981: 25 kg

2008 to present: 11 kg

Alternative way of consumption

FLOURS

breads, cakes, biscuits, cookies, doughnuts, tortillas, pasta, snacks, tamales, tostadas

Beans *nixtamalization*…

Whole

Dehulled

MILLING/SOAKING

Siddiq et al. (2010)

EXTRUSION

Abd El-Hady and Habiba (2003)

COOKING-DEHYDRATION/FREEZE-DRIED

Ramírez-Jiménez et al. (2014)

NIXTAMALIZATION-DRYING

Tellez-Tellez et al. (2005)

Classic

Wood ashes

González-Amaro et al. (2015)

Traditional

$Ca(OH)_2$

Santiago-Ramos et al. (2015)

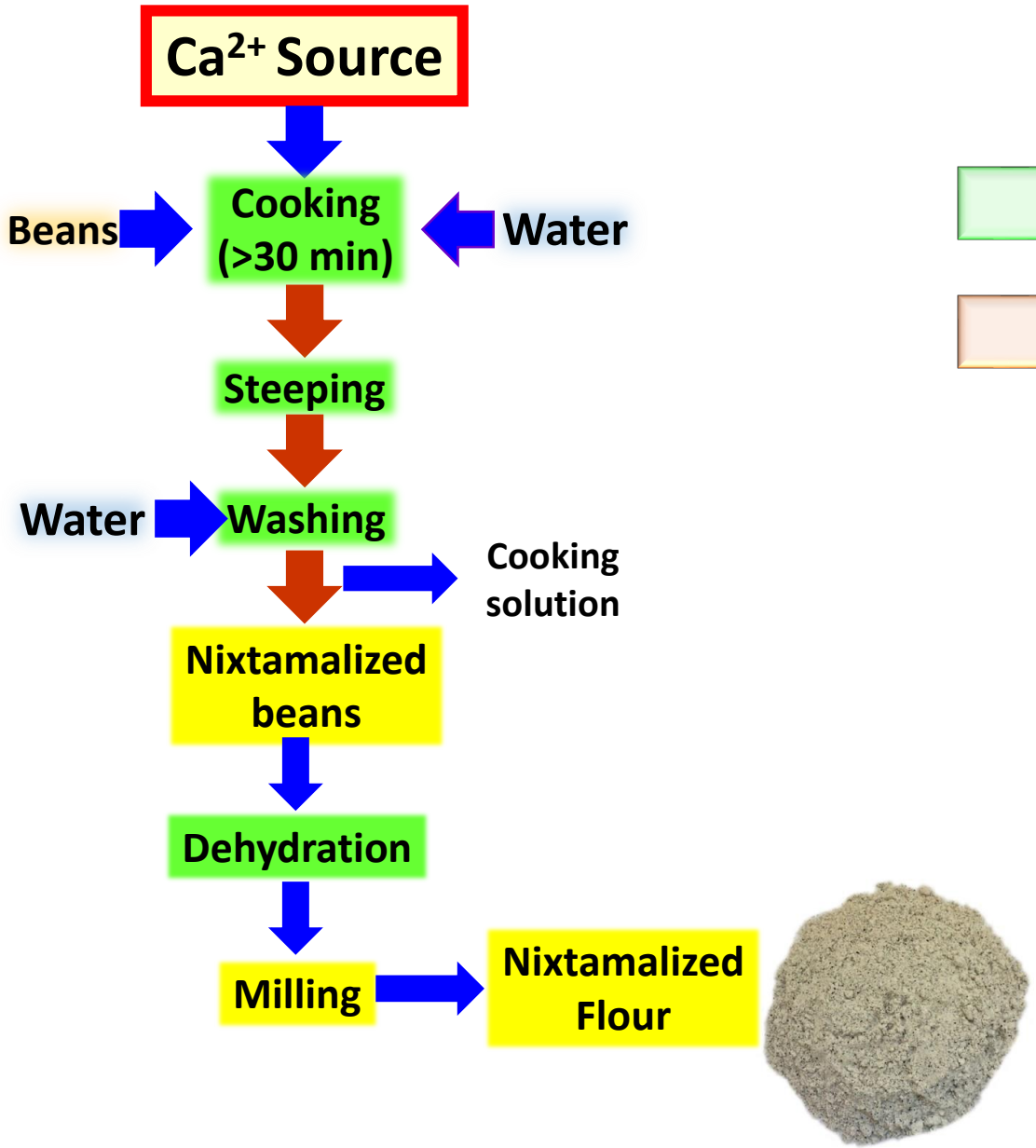
Ecological

$CaCO_3$, $CaCl_2$, $CaSO_4$ …

Figueroa-Cárdenas et al. (2011)

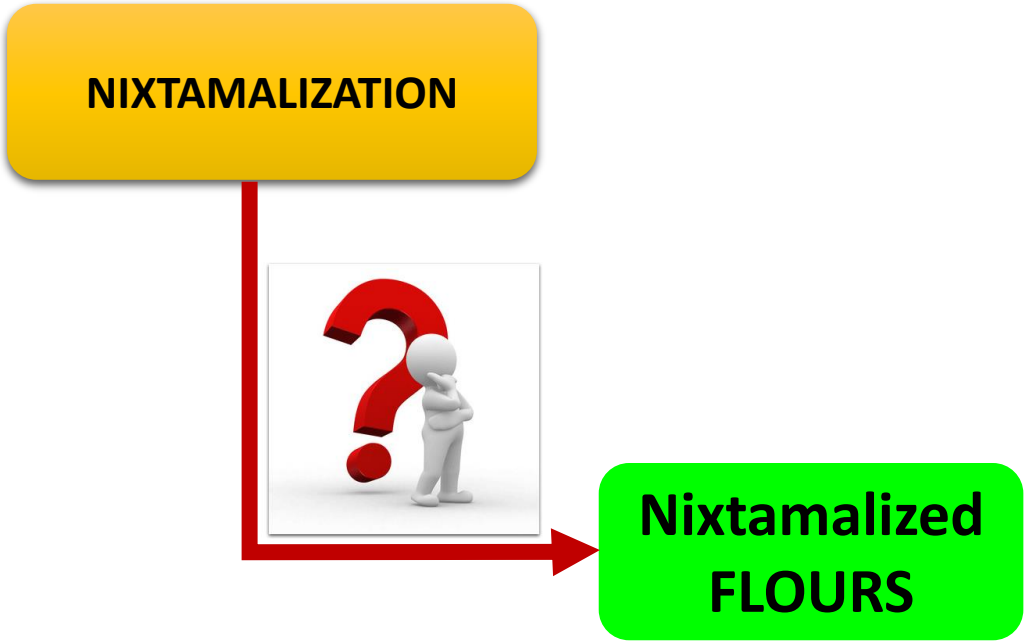
Beans *nixtamalization*…

NIXTAMALIZATION



Fortification with Ca and Fe

Reduction of antinutritional factors



Beans *nixtamalization*…

Black bean
var. 'Negro Querétaro'

Nixtamalization processes

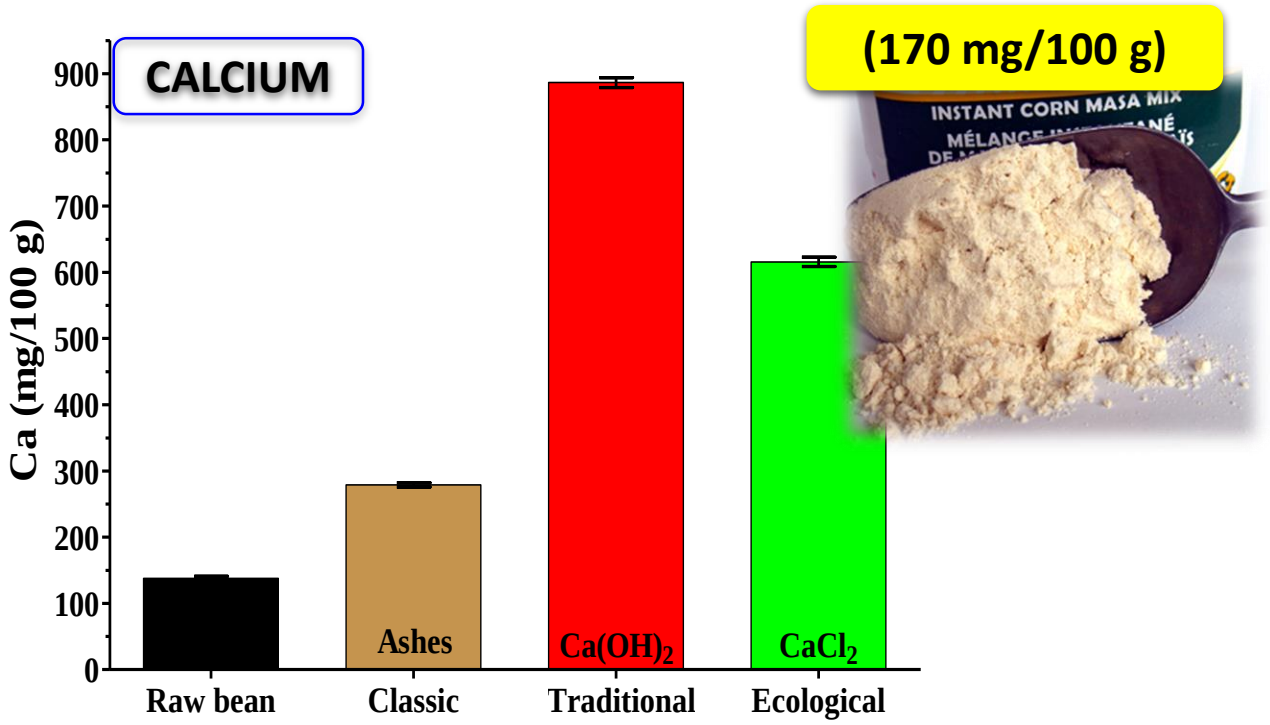
- Classic (CNP): Wood ashes (*Quercus spp.*)
- Traditional (TNP): $Ca(OH)_2$
- Ecological (ENP): $CaCl_2$
- Control: Only water

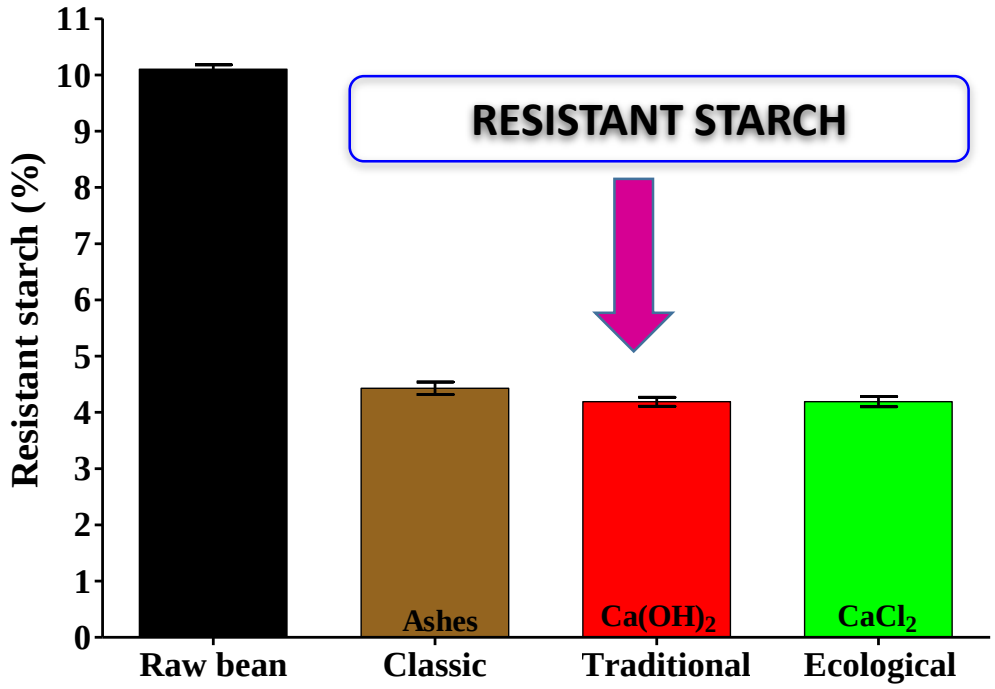
Chemical composition
Thermal properties (DSC)
X-ray diffraction
FT-IR

Beans *nixtamalization*…

Table 1
Chemical components of flours from raw and cooked beans.

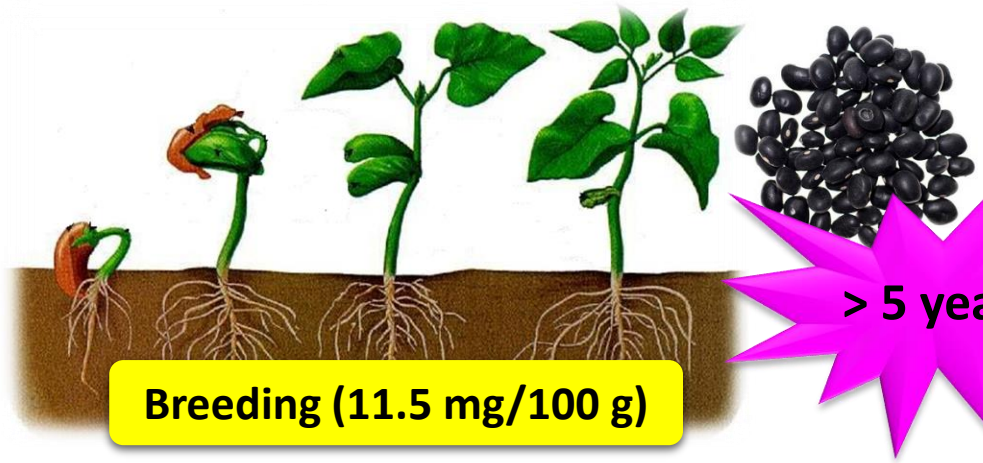
Flour	Crude protein (%)	Crude fat (%)	Ash (%)	Total carbohydrates (%)
Raw bean	23.04 ± 0.25ab	2.75 ± 0.06a	3.88 ± 0.10b	70.33 ± 0.29b
Control	22.85 ± 0.11ab	2.81 ± 0.02a	2.94 ± 0.07d	71.39 ± 0.15ab
CNP	23.59 ± 0.05a	2.51 ± 0.03b	3.41 ± 0.06c	70.47 ± 0.05b
TNP	23.25 ± 0.31ab	2.17 ± 0.03c	4.38 ± 0.06a	70.20 ± 0.34b
ENP	22.26 ± 0.47b	2.49 ± 0.06b	3.34 ± 0.06c	71.90 ± 0.59a





Control: only water / Classic (CNP): Wood ashes / Traditional (TNP): $Ca(OH)_2$ / Ecological (ENP): $CaCl_2$

Beans *nixtamalization*…

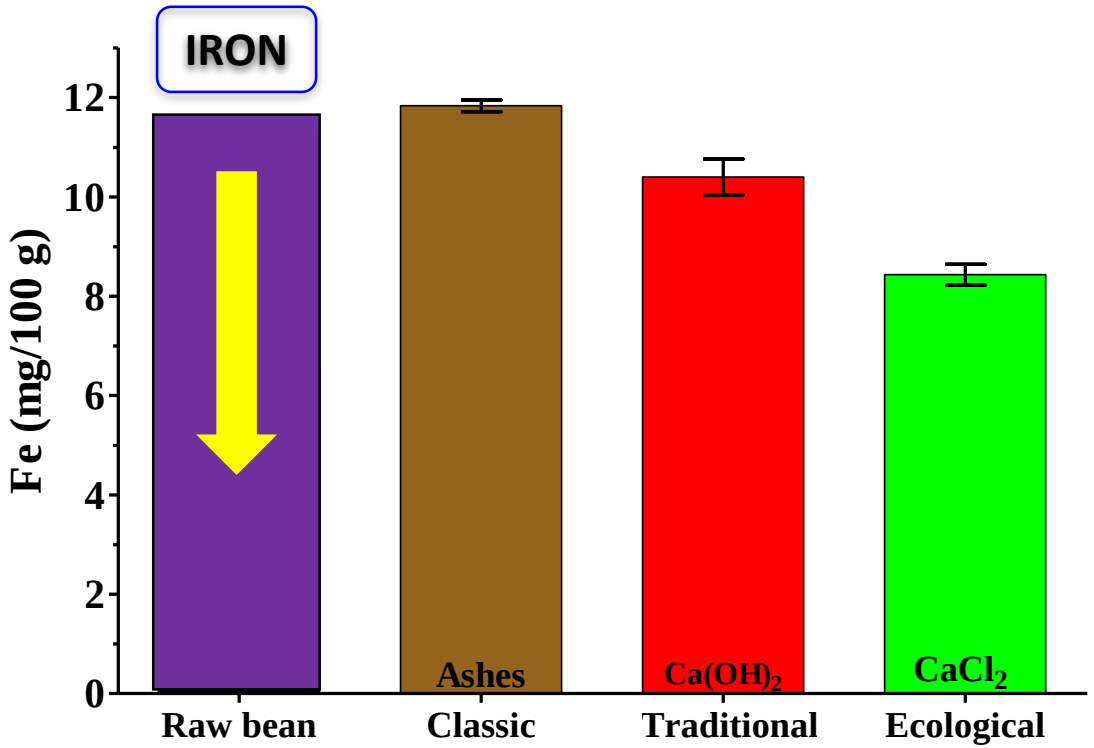


Breeding (11.5 mg/100 g)

> 5 years

Breeding improvement limitations:

- Expensive
- Depends on end use
- Presence of phytic acid



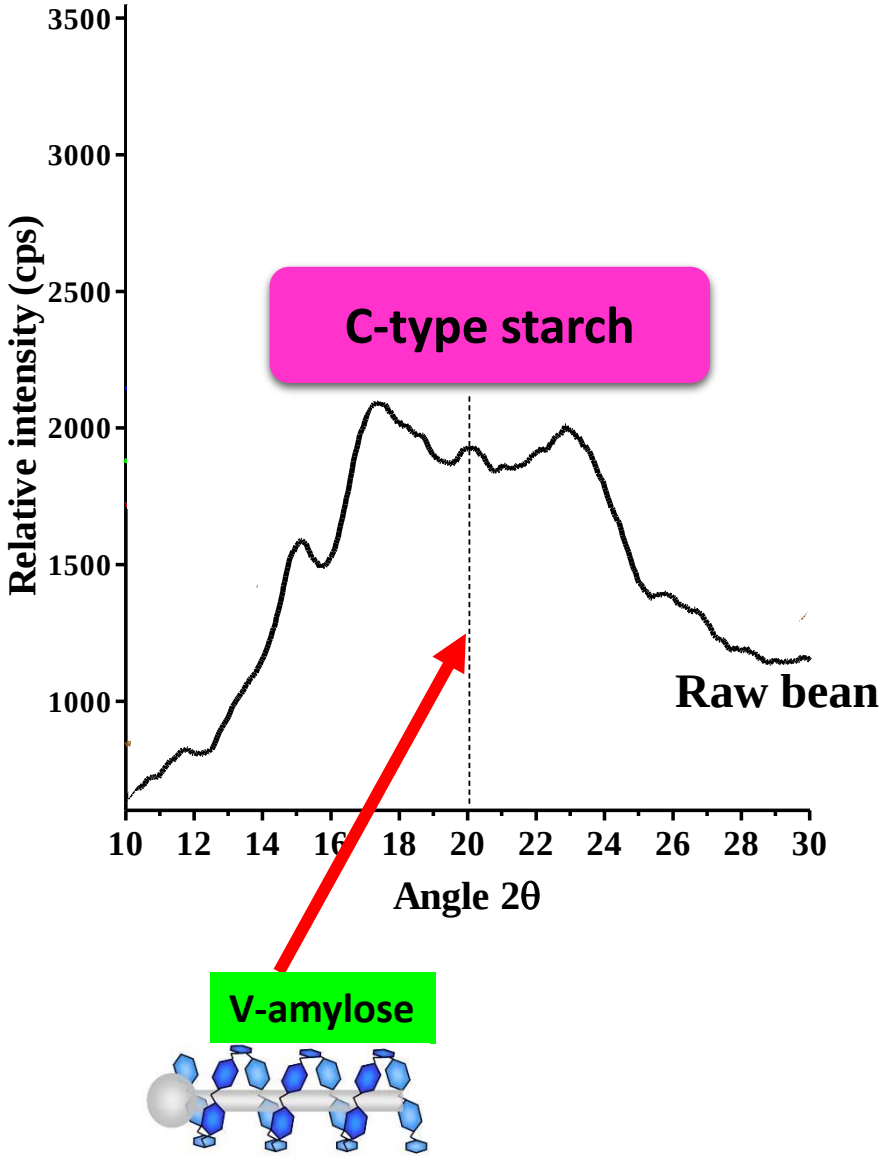
Direct fortification limitations:

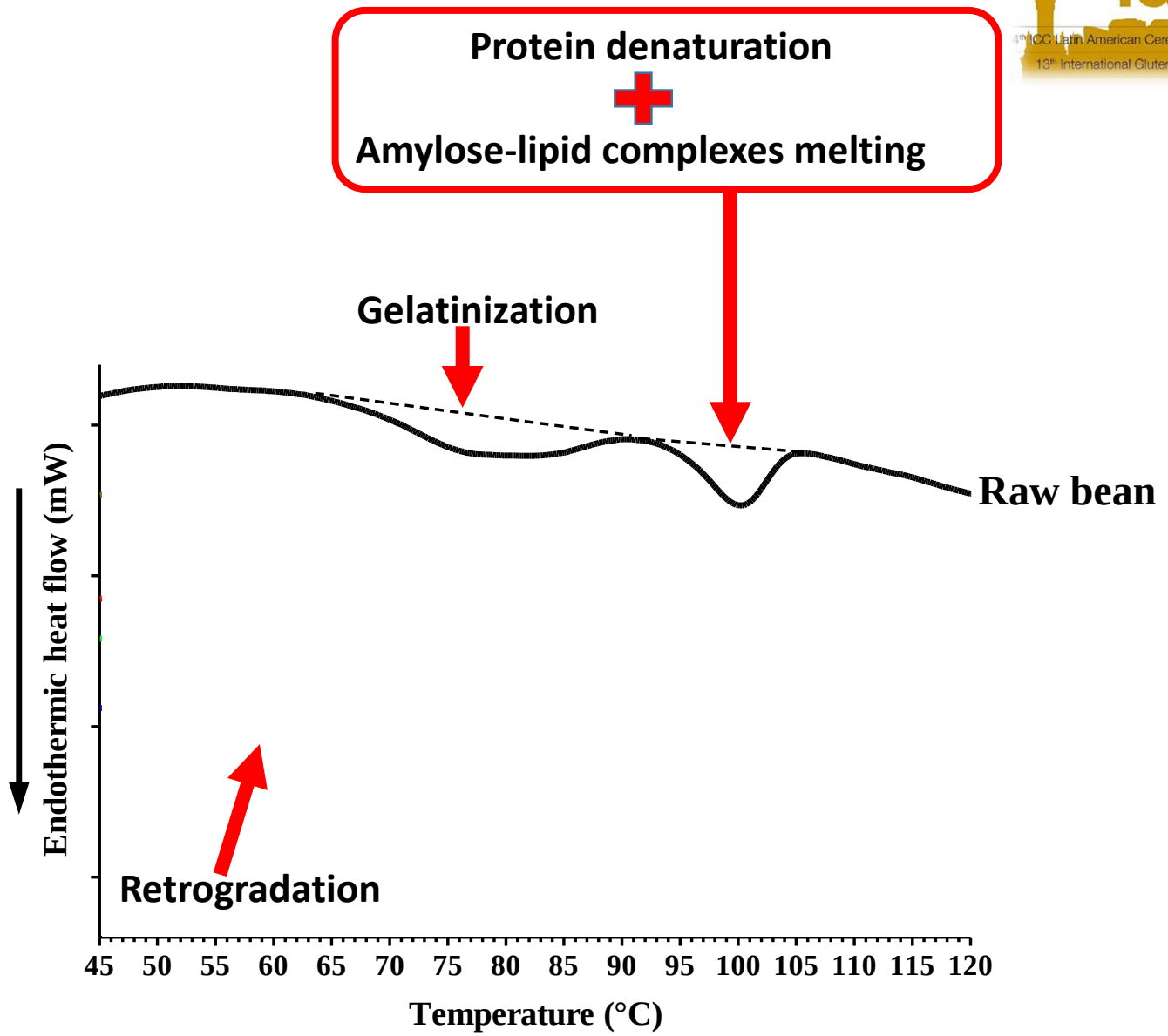
- Expensive
- Can alter sensory properties

Classic nixtamalization:

- Inexpensive
- Low income countries

Beans *nixtamalization*…





Control: only water / Classic (CNP): Wood ashes / Traditional (TNP): $Ca(OH)_2$ / Ecological (ENP): $CaCl_2$

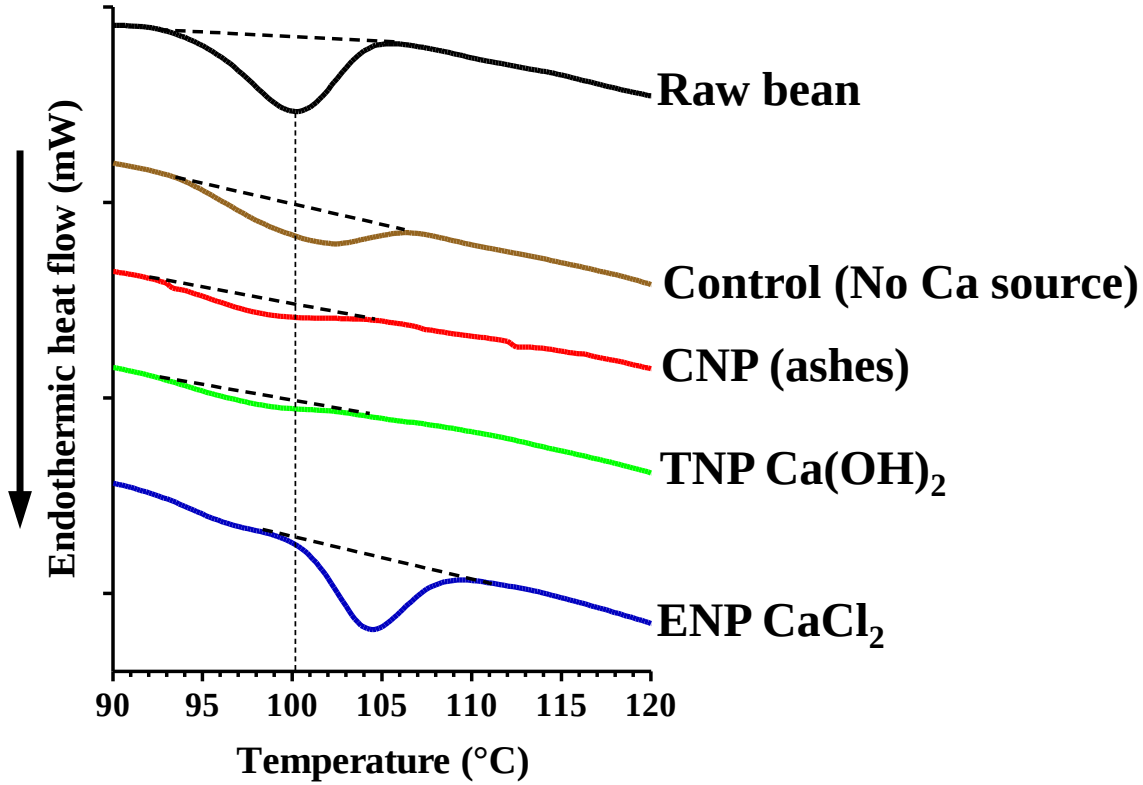
Beans *nixtamalization…*

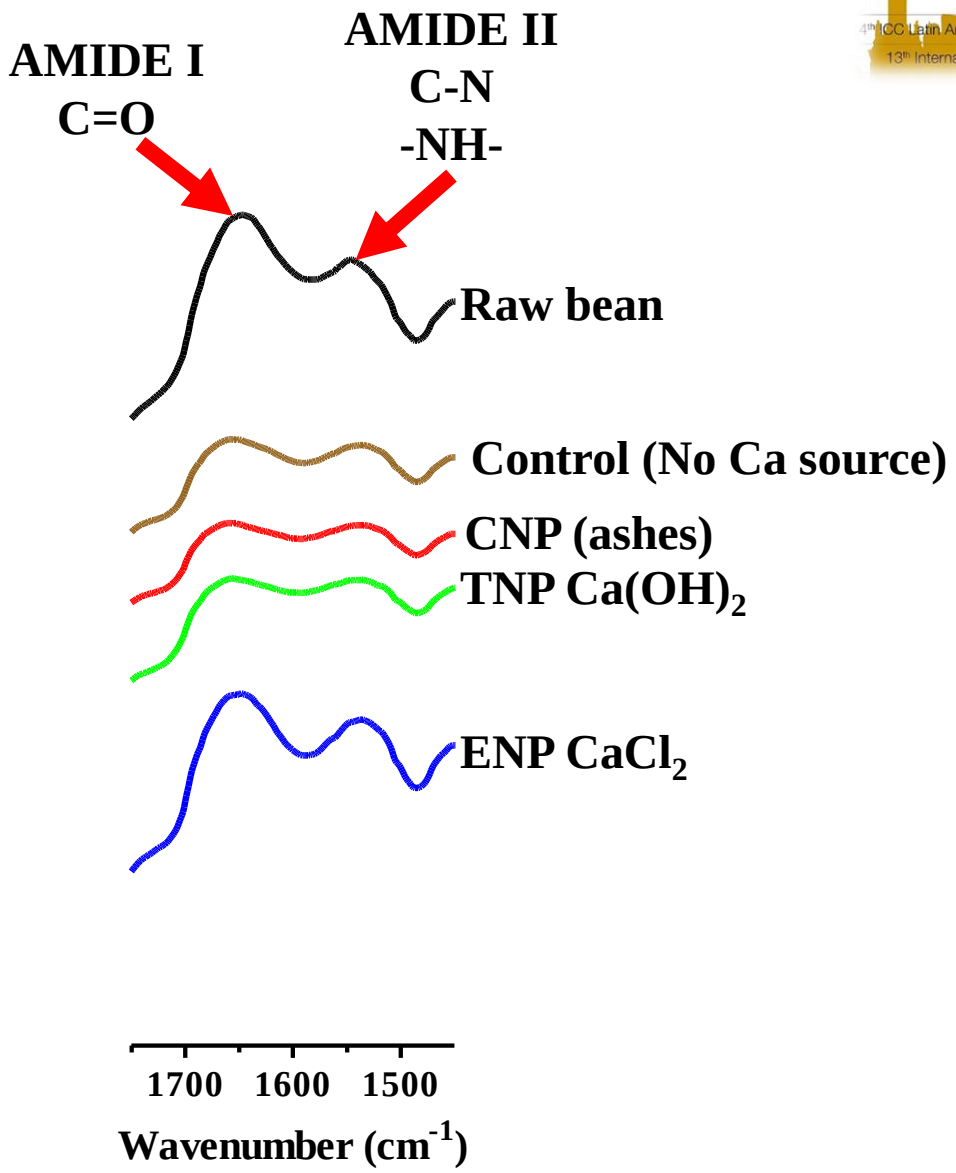
Protein denaturation

Protein denaturation

+

Amylose-lipid complexes melting





Amylose-lipid complexes lixiviation

Final remarks

1. Nixtamalization is a suitable process for Ca and Fe fortification of bean flours.
2. Nixtamalized bean flours are good source of protein, fiber, minerals and resitant starch.
3. Starch and protein digestibility of flours?
4. Evaluation of flours in food products?

Beans *nixtamalization*…

Final remarks

NIXTAMALIZATION

Softening and hydrolysis of pericarp (corn, wheat), seed coat (bean)

Fortification/enrichment/incorporation of Ca and Fe

Increase of niacin availability

Improvement of amino acid profile

Reduccion of the antinutritional factors

Production of functional ingredients (flours)

Gómez and López (2012)

González and Hernández (2012)

Zizumbo and García (2016)

Chuck-Hernández (2016)

Vázquez-Carrillo et al (2012)

Hernández (2013)

Jelves Mella et al (2017)

Zizumbo and García (2016)

Gaytán-Martínez et al (2017)

Chuck-Hernández (2016)

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