

Granulated Cassava: Gari/Tapioca in Cameroon

Key Findings from RTBfoods in Period 2

Franklin K. NGOUALEM, ENSAI, Cameroon

Other Contributing Scientists (listed on last slides of the presentation)

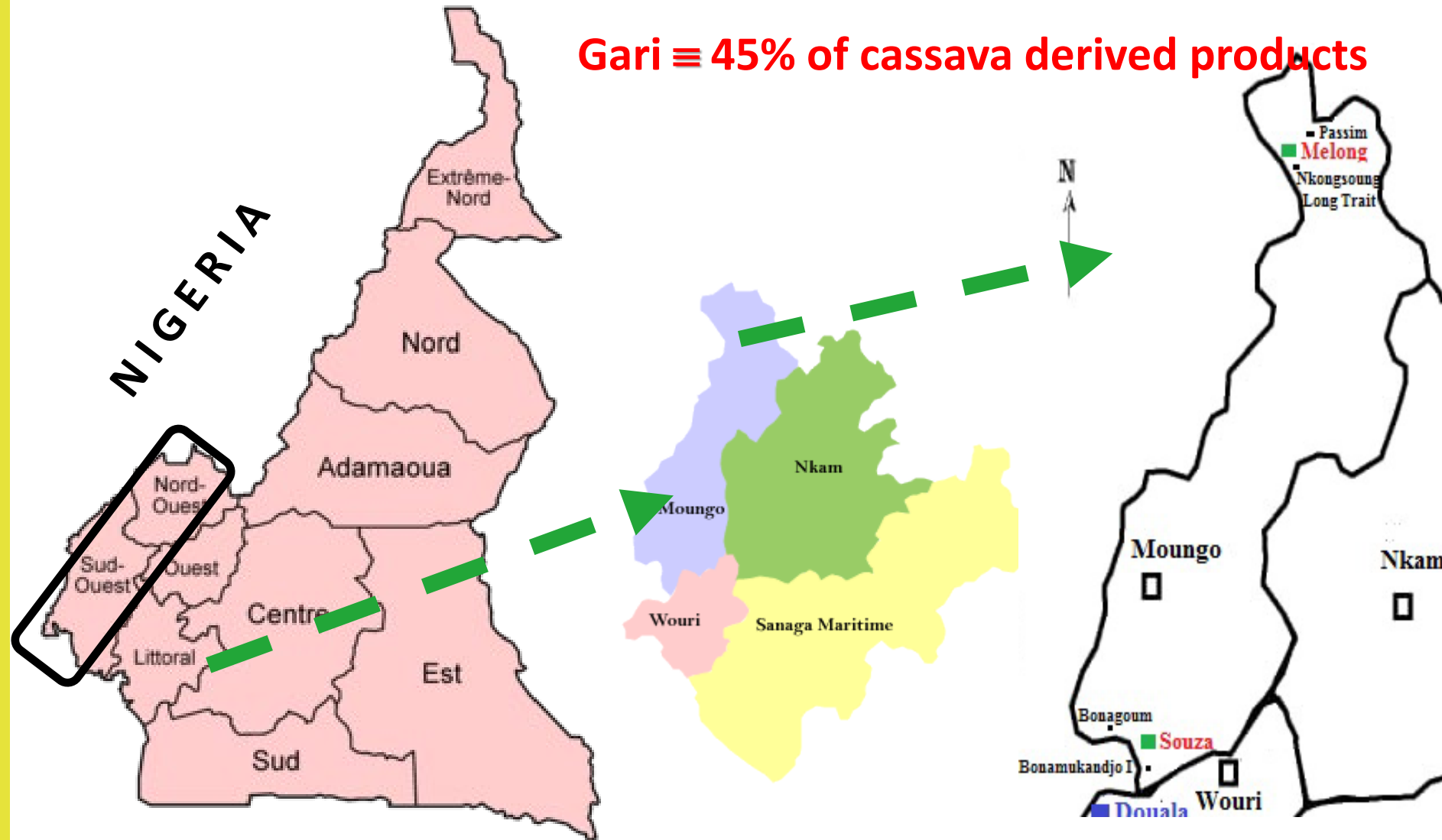
RTBfoods 2nd Annual Meeting, Kampala, Uganda, 3-7 Feb. 2020

Countries of Activity Implementation

● WP1-Act.3 Surveys

CAMEROON

Gari ≡ 45% of cassava derived products

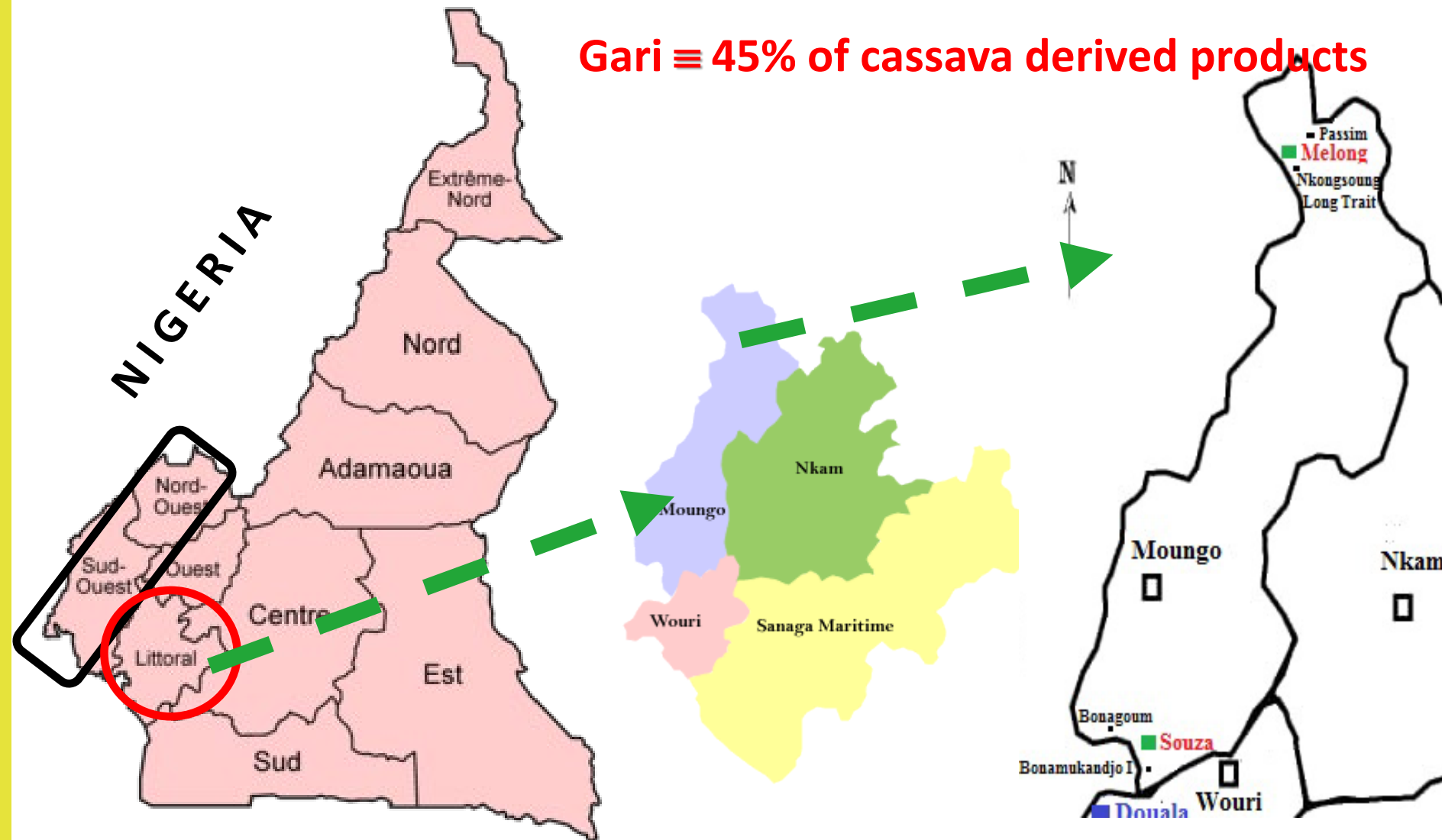


Countries of Activity Implementation

● WP1-Act.3 Surveys

CAMEROON

Gari ≡ 45% of cassava derived products



Institutes & Main Scientists Involved

- **ENSAI** – Cameroon:
 - R. Ndjouenkeu,
 - F. Ngoualem
- **IITA** – Nigeria & Cameroon:
 - N. Takam
 - B. Teeken
- **CIRAD-France**:
 - G. Fliedel



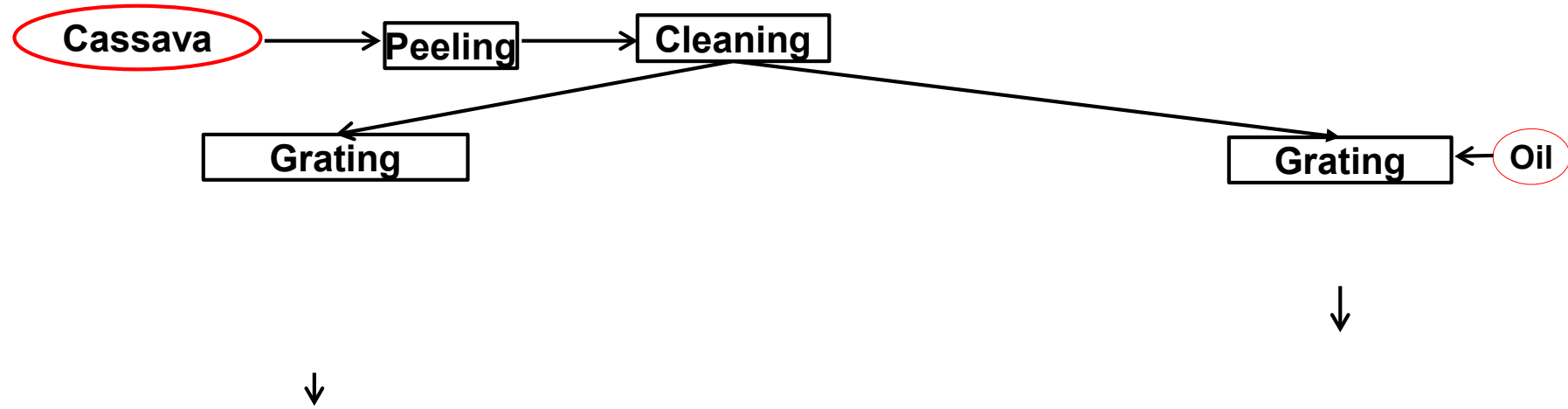
WP1



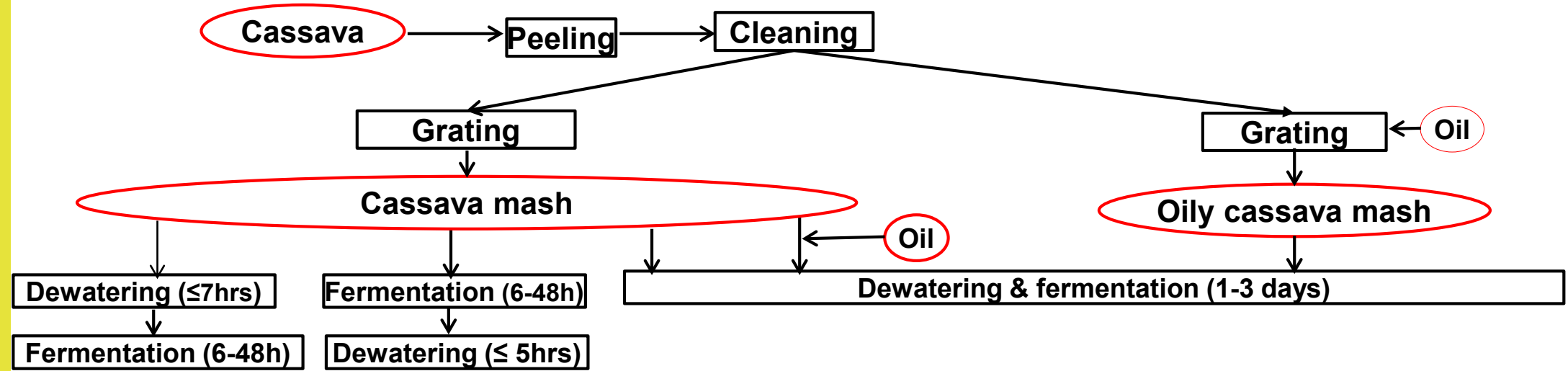
Process Description



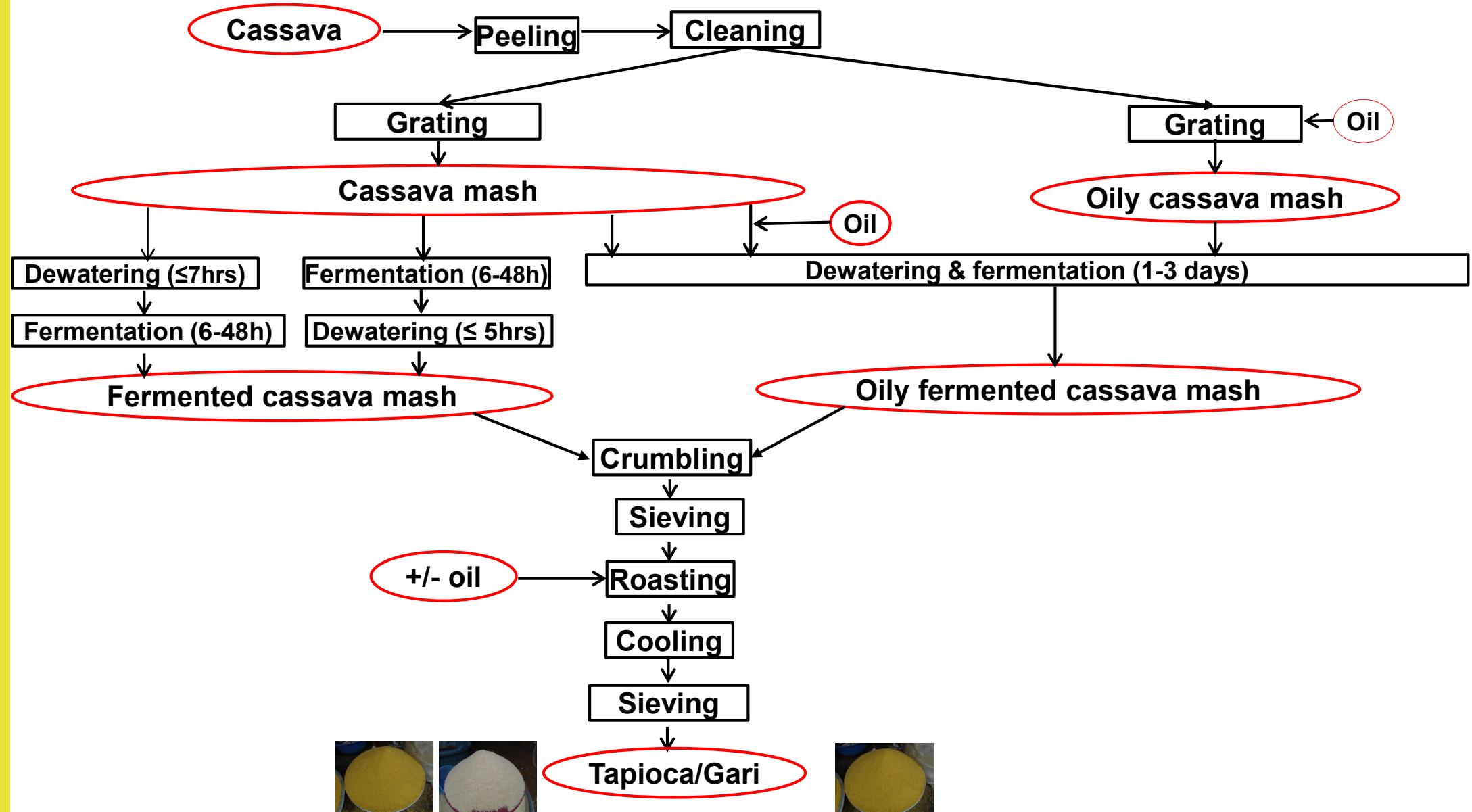
Process Description



Process Description



Process Description



Processing determinants of Gari quality



Grating

Quality of the grater



Diameter of cassava mash

Processing determinants of Gari quality



Grating

Quality of the grater



Diameter of cassava mash

Addition of oil

During grating

Before fermentation and dewatering

During roasting

Processing determinants of Gari quality



Grating

Quality of the grater



Diameter of cassava mash

Addition of oil

During grating

Before fermentation and dewatering

During roasting

Dewatering and/or fermentation

Order of these steps

Combination of these steps

Processing determinants of Gari quality

Grating

Quality of the grater



Diameter of cassava mash

Addition of oil

During grating

Before fermentation and dewatering

During roasting

Dewatering and/or fermentation

Order of these steps

Combination of these steps

Potential effect on
Gari/Tapioca quality?

Farmers' preferences for cassava varieties

Locality	Women	Men
Bonagoum	<ol style="list-style-type: none"> 1. Manioc Agriculture or manioc Agriculture blanc or Bosedi 2. Manioc naturel or Satè or Kondrè blanc 3. Manioc rouge mangeable or manioc rouge du village 4. Manioc Sénégalais or Big big Lass 	<ol style="list-style-type: none"> 1. Manioc Agriculture or manioc Agriculture blanc or Bosedi 2. Manioc rouge or manioc rouge mangeable 3. Manioc naturel or Satè or Kondrè blanc 4. Manioc Sénégalais or Big big Lass
Bonamukandjo I	<ol style="list-style-type: none"> 1. Manioc naturel or Satè or Kondrè blanc 2. Manioc Agriculture or manioc Agriculture blanc or Bosedi 3. Manioc rouge mangeable or manioc rouge du village 	<ol style="list-style-type: none"> 1. Manioc Agriculture or manioc Agriculture blanc or Bosedi 2. Manioc rouge or manioc rouge mangeable 3. Manioc naturel or Satè or Kondrè blanc
Passim	<ol style="list-style-type: none"> 1. Madjock 2. Manioc rouge or manioc rouge Sénégalais or Sénégalais Vert 3. Nyaban or Manioc blanc sauvage 4. Manioc Sénégalais 	<ol style="list-style-type: none"> 1. Madjock 2. Manioc rouge or manioc rouge Sénégalais or Sénégalais Vert 3. Nyaban or Manioc blanc sauvage
Nkongsoung Long Trait	<ol style="list-style-type: none"> 1. Manioc rouge 2. Manioc blanc or Nylon or manioc blanc ancien bouture or manioc blanc à tiges noires 3. Manioc blanc tiges blanches or manioc Sénégalais 	<ol style="list-style-type: none"> 1. Manioc blanc or manioc agriculture or Agriculture blanche 2. Manioc rouge 3. Manioc blanc or Nylon or manioc blanc ancien bouture

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Farmers' preferences for cassava varieties

Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red



White

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red



White

White colour of the flesh

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red



White

White colour of the flesh



Yellow

Yellow colour of the flesh

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red



White

White colour of the flesh



Yellow

Yellow colour of the flesh

Length of vegetative cycle:

Short: edible at 8 months

Long: edible at 12 months

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red



White

White colour of the flesh



Yellow

Yellow colour of the flesh

Length of vegetative cycle:

Short: edible at 8 months

Long: edible at 12 months

Long

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red



White

White colour of the flesh



Yellow

Yellow colour of the flesh

Length of vegetative cycle:

Short: edible at 8 months

Long: edible at 12 months

Long

Short / Long

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red



White



Yellow

Yellow colour of the flesh

White colour of the flesh

Length of vegetative cycle:

Short: edible at 8 months

Long: edible at 12 months

Long

Short / Long

Long

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red



White



Yellow

Yellow colour of the flesh

White colour of the flesh

Length of vegetative cycle:

Short: edible at 8 months

Long: edible at 12 months

Long

Short / Long

Long

Taste :

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red



White



Yellow

Yellow colour of the flesh

White colour of the flesh

Length of vegetative cycle:

Short: edible at 8 months

Long: edible at 12 months

Long

Short / Long

Long

Taste :

Sweet

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red



White



Yellow

Yellow colour of the flesh

White colour of the flesh

Length of vegetative cycle:

Short: edible at 8 months

Long: edible at 12 months

Long

Short / Long

Long

Taste :

Sweet

Bitter / Sweet

Farmers' preferences for cassava varieties



Main characteristics of farmed cassava varieties

Colour of the second peel and of pulp



Red



White



Yellow

Yellow colour of the flesh

White colour of the flesh

Length of vegetative cycle:

Short: edible at 8 months

Long: edible at 12 months

Long

Short / Long

Long

Taste :

Sweet

Bitter / Sweet

Sweet

Farmers' preferences for cassava varieties



		White 2 nd peel		Red 2 nd peel
		Short vegetative cycle	Long vegetative cycle	
Preference	Rank	1 or 2 (town & rural area)	2 or 1 (town)/3 (rural area)	3(town)/1 or 2 (rural area)
	Women	<ul style="list-style-type: none"> • Food security (home consumption) • Quick processing (financial independence) • Avoidance of process constraints 		
		Need of cassava all over the year		
	Rank	1	3	2
	Men	Quick selling (rapid need of money from farmed cassava)		

Main characteristics of farmed cassava varieties

Main characteristics of farmed cassava varieties

Short vegetative cycle

- Good production yield in non-fertile soils
- Easy to peel
- High water content of roots
- Low fibre content of roots
- Non-storability of roots in soil beyond maturity
- Sweet

Main characteristics of farmed cassava varieties

Short vegetative cycle

- Good production yield in non-fertile soils
- Easy to peel
- High water content of roots
- Low fibre content of roots
- Non-storability of roots in soil beyond maturity
- Sweet

Long vegetative cycle

- Low production yield in non-fertile soils
- Difficult to peel
- Low water content of roots
- High fibre content of roots
- Storability of roots in soil beyond maturity

High Quality Characteristics of Cassava roots



Women

1. White colour of the pulp
2. Low fibres content
3. Low water content
4. Farmed at most at maturity
5. High density
6. Big (size & length)
7. Roots which are easy to peel
8. **White second peel**
9. Sweet
10. Resistance to diseases

High Quality Characteristics of Cassava roots



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1. White colour of the pulp
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10. Resistance to diseases

Men

1. White colour of the pulp
2. Low fibres content
3. Farmed at most at maturity
4. Low water content
5. High density
6. Big (size & length)
7. Sweet

Low Quality Characteristics of Cassava roots



Women

- 1. High fibres content of roots**
- 2. Roots harvested over maturity**
- 3. Non-white colour of the pulp**
- 4. Rot around the root center (low density)**
- 5. High water content**
- 6. Roots heated by fire while in soil**
- 7. Roots which are easy to peel**
- 8. Low resistance to disease;**

Use long time after harvesting;

Long time between peeling & grating;

Red colour of the second peel

Low Quality Characteristics of Cassava roots



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- 2. Roots harvested over maturity**
- 3. Non-white colour of the pulp**
- 4. Rot around the root center (low density)**
- 5. Roots heated by fire while in soil**
- 6. High water content**
- 7. Roots harvested too early**

Summary of ideal cassava root characteristics



Summary of ideal cassava root characteristics

Short vegetative cycle

Low fibres content of roots

Roots which are easy to peel

Good production yield in non-fertile soils

Sweet

Farmed at most at maturity

Low water content of roots

Storability of roots in soil beyond maturity



Ideal cassava plant

- Resistance to diseases
- Size: Big & long
- White colour of the pulp
- Tail plant (when farmed with coffee or/and cocoa)

Summary of ideal cassava root characteristics

Short vegetative cycle

High water content of roots

Low fibres content of roots

Non-storability of roots in soil beyond maturity (low density & non-white colour of the pulp)

Roots which are easy to peel

Good production yield in non-fertile soils

Sweet

Farmed at most at maturity

Long vegetative cycle

Low water content of roots

High fibres content of roots

Storability of roots in soil beyond maturity

Roots which are difficult to peel

Low production yield in non-fertile soils



Ideal cassava plant

- Resistance to diseases
- Size: Big & long
- White colour of the pulp
- Tail plant (when farmed with coffee or/and cocoa)

Quality Characteristics of cassava during Processing



Men

Women

Quality Characteristics of cassava during Processing



Peeling

Men

Women

Quality Characteristics of cassava during Processing



↓
Peeling

Men

- White colour of roots
- Low fibres content
- Low water content
- **Roots which are difficult to peel**

Women

Quality Characteristics of cassava during Processing



Peeling

Men

- White colour of roots
- Low fibres content
- Low water content
- Roots which are difficult to peel

Women

- White colour of roots
- Low fibres content
- Low water content
- Roots which are easy to peel



Quality Characteristics of cassava during Processing



↓
Peeling

↓
Grating

Men

- White colour of roots
- Low fibres content
- Low water content
- **Roots which are difficult to peel**

Women

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Quality Characteristics of cassava during Processing



↓
Peeling

↓
Grating

Men

- White colour of roots
- Low fibres content
- Low water content
- **Roots which are difficult to peel**

- White colour of cassava mash

Women

- White colour of roots
- Low fibres content
- Low water content
- **Roots which are easy to peel**

Quality Characteristics of cassava during Processing



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Peeling

↓
Grating

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- Low water content
- **Roots which are easy to peel**

- White colour of cassava mash
- Low water content of cassava mash

Quality Characteristics of cassava during Processing



Peeling

Grating

Dewatering & fermentation

Men

- White colour of roots
- Low fibres content
- Low water content
- **Roots which are difficult to peel**

- White colour of cassava mash

Women

- White colour of roots
- Low fibres content
- Low water content
- **Roots which are easy to peel**

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- Low water content of cassava mash

Quality Characteristics of cassava during Processing



Peeling

Grating

Dewatering & fermentation

Men

- White colour of roots
- Low fibres content
- Low water content
- **Roots which are difficult to peel**

- White colour of cassava mash

- White colour of cassava mash
- Low water content of cassava mash
- **Presence of foam on paste bag during fermentation**

Women

- White colour of roots
- Low fibres content
- Low water content
- **Roots which are easy to peel**

- White colour of cassava mash
- Low water content of cassava mash

Quality Characteristics of cassava during Processing



Peeling

Grating

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Quality Characteristics of cassava during Processing



Peeling

Grating

Dewatering & fermentation

Sieving

Men

- White colour of roots
- Low fibres content
- Low water content
- **Roots which are difficult to peel**

- White colour of cassava mash

- White colour of cassava mash
- Low water content of cassava mash
- **Presence of foam on paste bag during fermentation**

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- **Roots which are easy to peel**

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Quality Characteristics of cassava during Processing



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Quality Characteristics of cassava during Processing



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Grating

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- White colour of cassava mash
- **Granules with middle size**

Quality Characteristics of cassava during Processing



Peeling

Grating

Dewatering & fermentation

Sieving

Roasting

Sieving



Men

- White colour of roots
- Low fibres content
- Low water content
- **Roots which are difficult to peel**

- White colour of cassava mash

- White colour of cassava mash
- Low water content of cassava mash
- **Presence of foam on paste bag during fermentation**

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- White colour of cassava mash
- **Granules with middle size**

High quality characteristics of Gari/Tapioca



High quality characteristics of Gari/Tapioca



Women

1. Low water content
2. Little bit sweet taste
3. Important shininess
4. Low quantity of oil
5. Little bit acidic taste
6. Uniformly shaped granules of middle size
7. Small quantity of visible fibres
8. No rancid oil odour/flavour
9. Complete cooking
10. Little bit resistant on chewing;
No sand
11. Higher density
12. Homogeneous colour
13. Important quantity of oil used

High quality characteristics of Gari/Tapioca



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Small quantity of visible fibres
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Good water absorption ability
11. No mouldy odour and/or flavour

High quality characteristics of Gari/Tapioca



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Traders

- Low water content
- Little bit sweet taste
- Important shininess

Men

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2. Little bit sweet taste
3. Important shininess
4. Uniformly shaped granules of middle size
5. No sand
6. No rancid oil odour/flavour
7. Little bit acidic taste
8. Homogeneous colour;
Small quantity of visible fibres
9. Low quantity of oil
10. Little bit resistance while chewing;
Good water absorption ability
11. No mouldy odour and/or flavour

Low quality characteristics of Gari/Tapioca



Women

1. Low shininess
2. High residual humidity
3. High sourness
4. High quantity of oil
5. Small size of granules;
Non-homogeneity of the colour;
Rancid oil odour/flavour
6. Incomplete cooking
7. Very sweet taste
8. Big size of granules;
No resistance to chewing

Low quality characteristics of Gari/Tapioca



Women

1. Low shininess
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4. High quantity of oil
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Non-homogeneity of the colour;
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No resistance to chewing

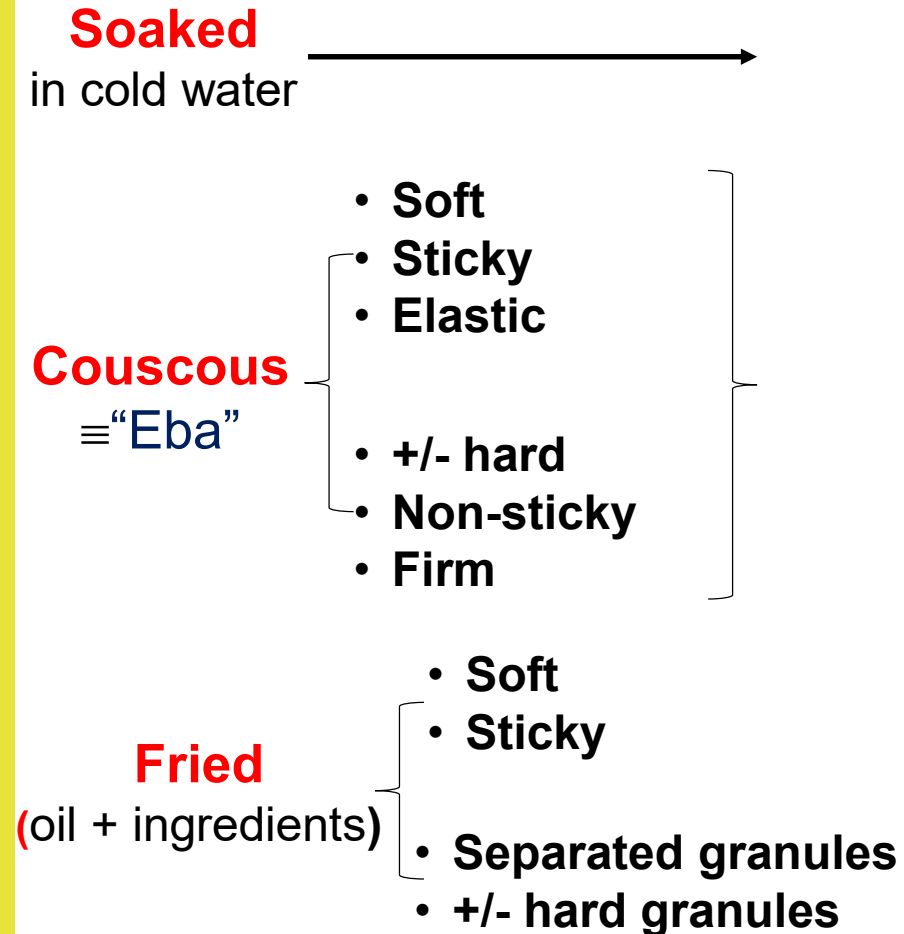
Men

1. Low shininess
2. High residual humidity
3. Non-homogeneity of the colour
4. High quantity of oil;
Small size of granules;
high sourness
5. Rancid oil flavour/odour;
Big size of granules
6. No/low resistance to chewing
7. Mouldy odour/flavour

Characteristics of Gari/Tapioca consumption forms



Characteristics of Gari/Tapioca consumption forms



Characteristics of Gari/Tapioca consumption forms



Functional requirements of gari used

Soaked
in cold water

Couscous
≡ "Eba"

Fried
(oil + ingredients)

- Soft
- Sticky
- Elastic

- +/- hard
- Non-sticky
- Firm

- Soft
- Sticky

- Separated granules
- +/- hard granules

- Resistance to disintegration
- Good water Absorption Capacity
- +/- resistance to chewing
- Total adhesion of oil on granules

- Water Absorption ability

High quality Gari/Tapioca
(middle size granules)

High quality gari*tapioca
(small/middle size granules)

High quality Gari/Tapioca
(middle size granules)

Gender Roles in Gari/Tapioca value chain



Gender Roles in Gari/Tapioca value chain



Cassava production

Family scale, mainly by women, for processing and home consumption.

Gender Roles in Gari/Tapioca value chain



Cassava production

Family scale, mainly by **women**, for processing and home consumption.

Men farm cassava mainly for trading.

Gender Roles in Gari/Tapioca value chain



Cassava production



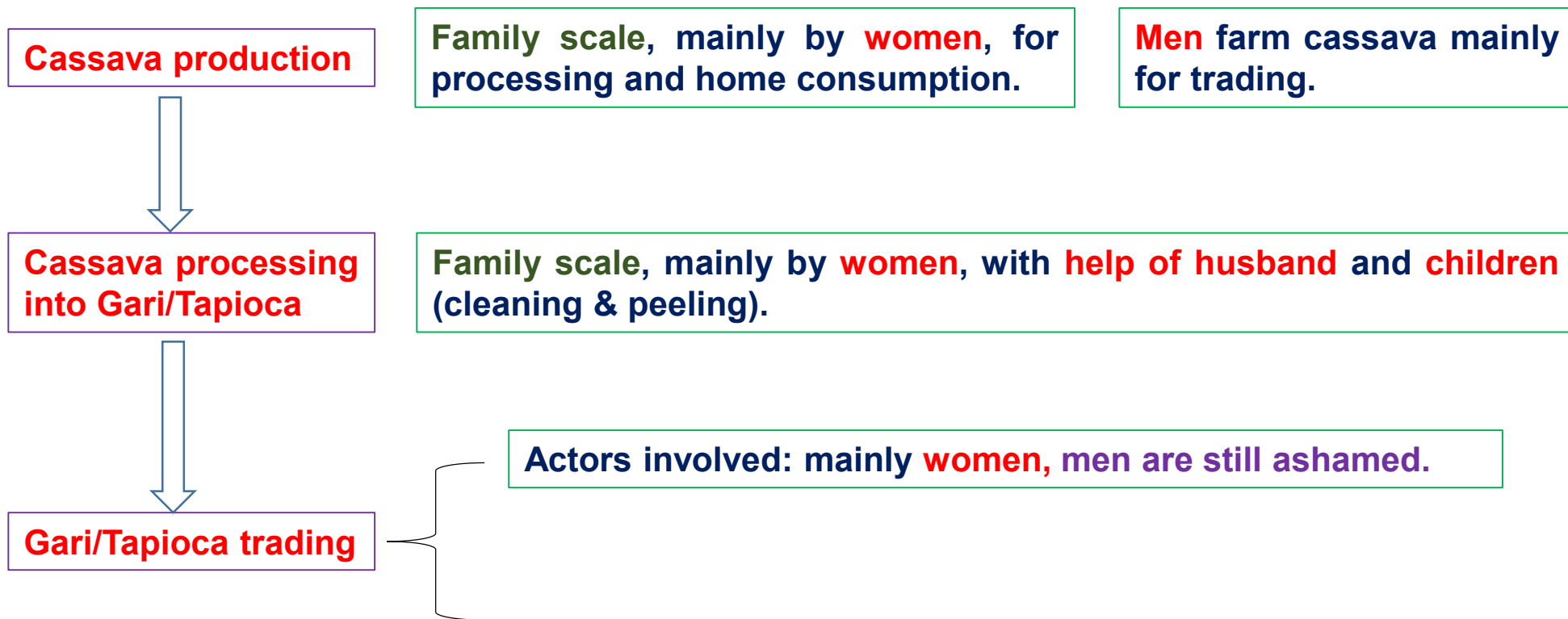
**Cassava processing
into Gari/Tapioca**

Family scale, mainly by **women**, for processing and home consumption.

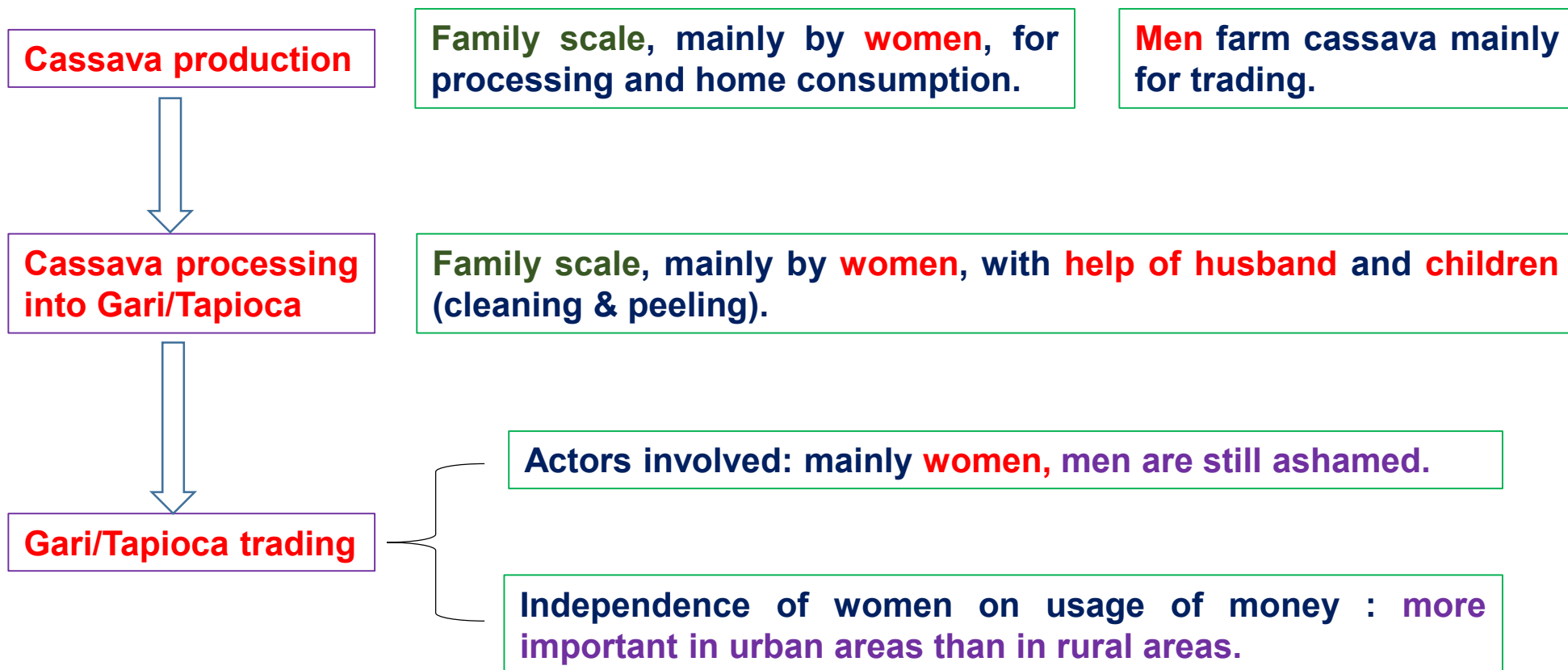
Men farm cassava mainly for trading.

Family scale, mainly by **women**, with **help of husband** and **children** (cleaning & peeling).

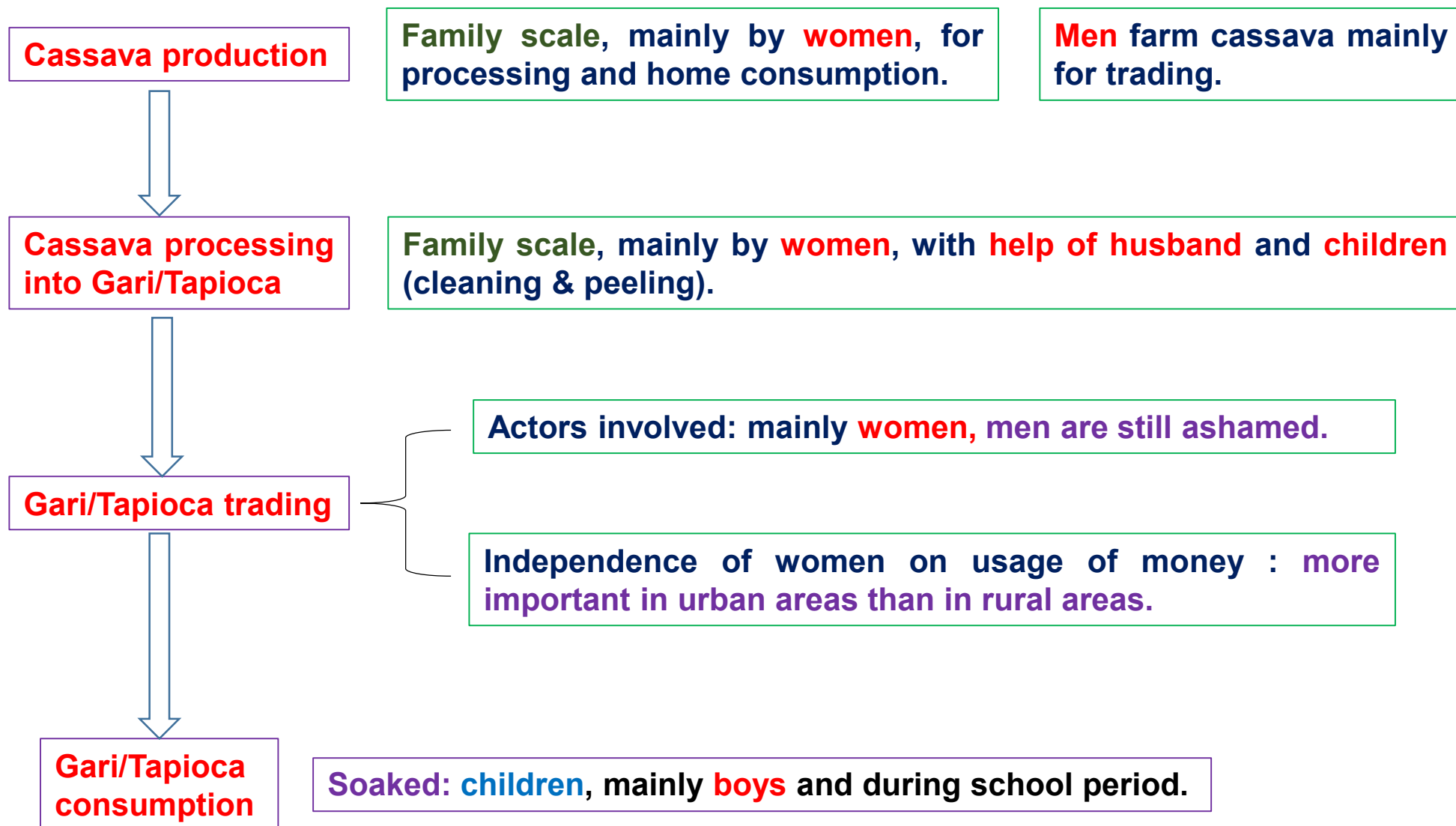
Gender Roles in Gari/Tapioca value chain



Gender Roles in Gari/Tapioca value chain



Gender Roles in Gari/Tapioca value chain



Conclusion on Perspectives



Conclusion on Perspectives



Ideal cassava

- Good production yield in poor-fertile soils
- Tail plant (when farmed with coffee and/or cocoa)
- Resistant to diseases
- Storability of roots in soil beyond maturity
- Big & long roots
- Easy to peel
- Low fibres content
- Low water content
- Sweet taste

Conclusion on Perspectives

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High quality Gari/Tapioca

• Appearance

- Shininess
- Uniform granules of middle size
- Homogeneous colour
- Low quantity of oil used
- Small quantity of visible fibres
- Higher density
- No visible white grain

Conclusion on Perspectives

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- **Dryness:** very low residual humidity

Conclusion on Perspectives

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• Dryness: very low residual humidity

• Flavour

- No rancid oil odour/flavour
- No mouldy odour/flavour

Conclusion on Perspectives

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• Water absorption ability

Conclusion on Perspectives

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- Higher density
- No visible white grain

• Dryness: very low residual humidity

• Flavour

- No rancid oil odour/flavour
- No mouldy odour/flavour

• Water absorption ability

• Taste & texture in mouth

- Little bit sweet
- +/- resistance to chewing

Conclusion on Perspectives



4 processes for Gari/Tapioca production

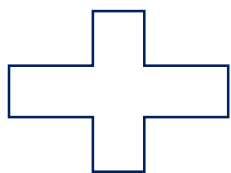
4 processes for Gari/Tapioca production



Mastering of processing steps (Activity 4)

2 or 3 local cassava varieties

4 processes for Gari/Tapioca production



2 or 3 local cassava varieties

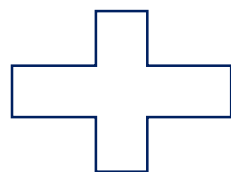
Mastering of processing steps (Activity 4)

White second peel with short vegetation cycle

White second peel with Long vegetation cycle

Red second peel with long vegetation cycle

4 processes for Gari/Tapioca production



2 or 3 local cassava varieties



8 or 12 samples of Gari/Tapioca

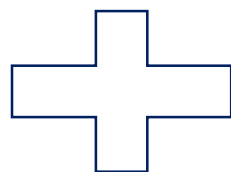
Mastering of processing steps (Activity 4)

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4 processes for Gari/Tapioca production



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Mastering of processing steps (Activity 4)

White second peel with short vegetation cycle

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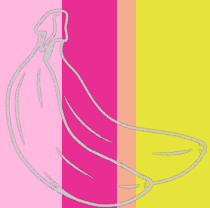
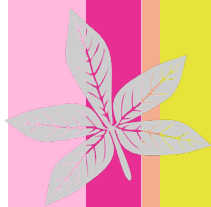
Red second peel with long vegetation cycle

8 or 12 samples of Gari/Tapioca

Determination of consumers' preferences (Activity 5)



THANKS FOR YOUR KIND ATTENTION



RTB foods

WP1 Collaborating Scientists



- Biatong Njeufa Esther
- Nguiadem Isabelle Linda