

ASSESSING THE PROCESSES OF KITOZA: A TRADITIONAL MALAGASY MEAT PRODUCT





- **AFTER project/European Union**
- **AFTER = African Food Tradition REvisited by Research**
- **AIMS AT improving the quality and safety of african traditional food**



F T E R

COORDINATOR **CIRAD - France**

France (Actia, Adiv, CVG, Inra, Racines)
Italy (Spes)
Portugal (ESB)

EUROPE UK (NRI)

Benin (UAC)
Cameroon (Ensai)
Egypt (FAAU, NRC)
Ghana (FRI)
Madagascar (UT)
Senegal (Ucad et Aafex)

AFRICA South Africa (CSIR)

- **Kitoza: the only meat product**
- **Traditional meat product of Madagascar**
- **Previously prepared for kings and nobles**
- **Made from beef or pork strips 20 to 50 cm long, 2 to 4 cm wide**
- **Salted and then sun-dried and/or smoked**
- **May be produced at household level**
- **Smoked kitoza in small scale shops**

Previous results:

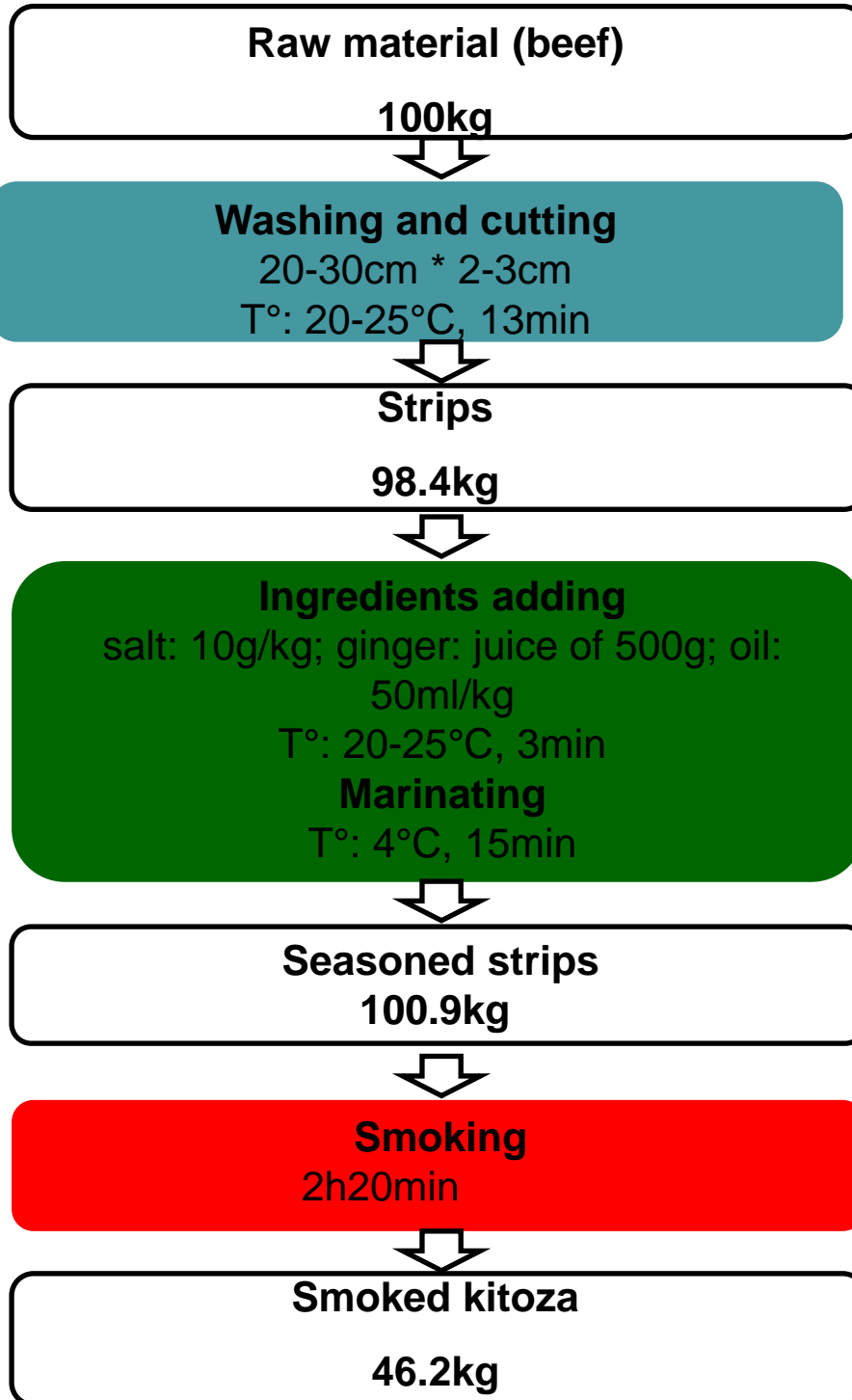
- **Survey in Antananarivo and sampling:
sun-dried and smoked beef or pork kitoza**
- **Physico-chemical and microbiological
analyses on end products**
- **Sensory analyses and consumer
acceptance studies (Poster)**

- 3 smoked products chosen: 2 beef and 1 pork

STEPS:

- Recording temperature and weight in sites**
- Establishing a synthetic traditional diagram**
- Sampling at critical unit operations**
- Assessing the impact of the process on product quality**

Producer A (beef 1)



SaltGain: 1.0kg/100kg

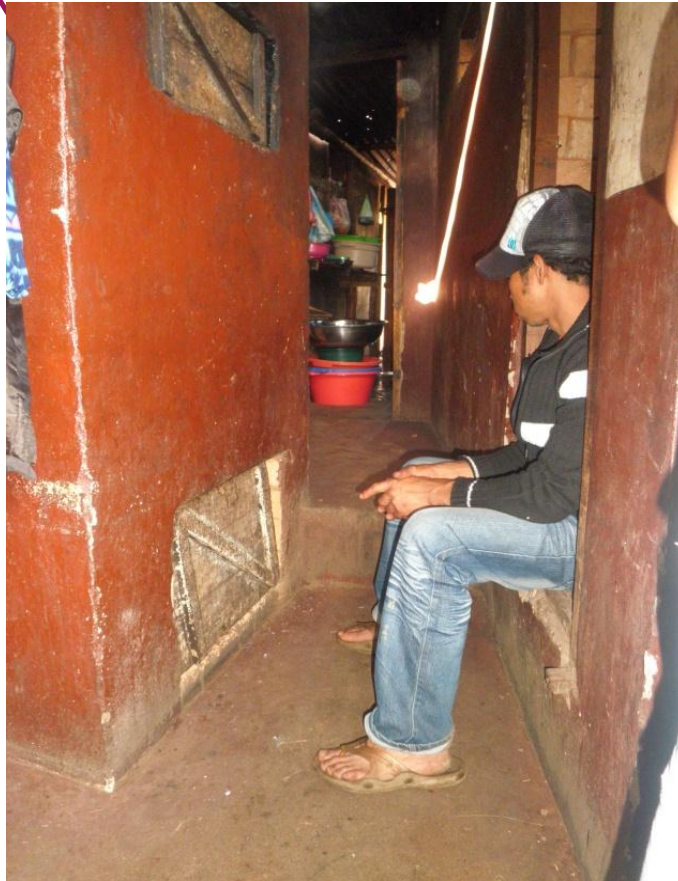
WaterLoss: 48kg/100kg

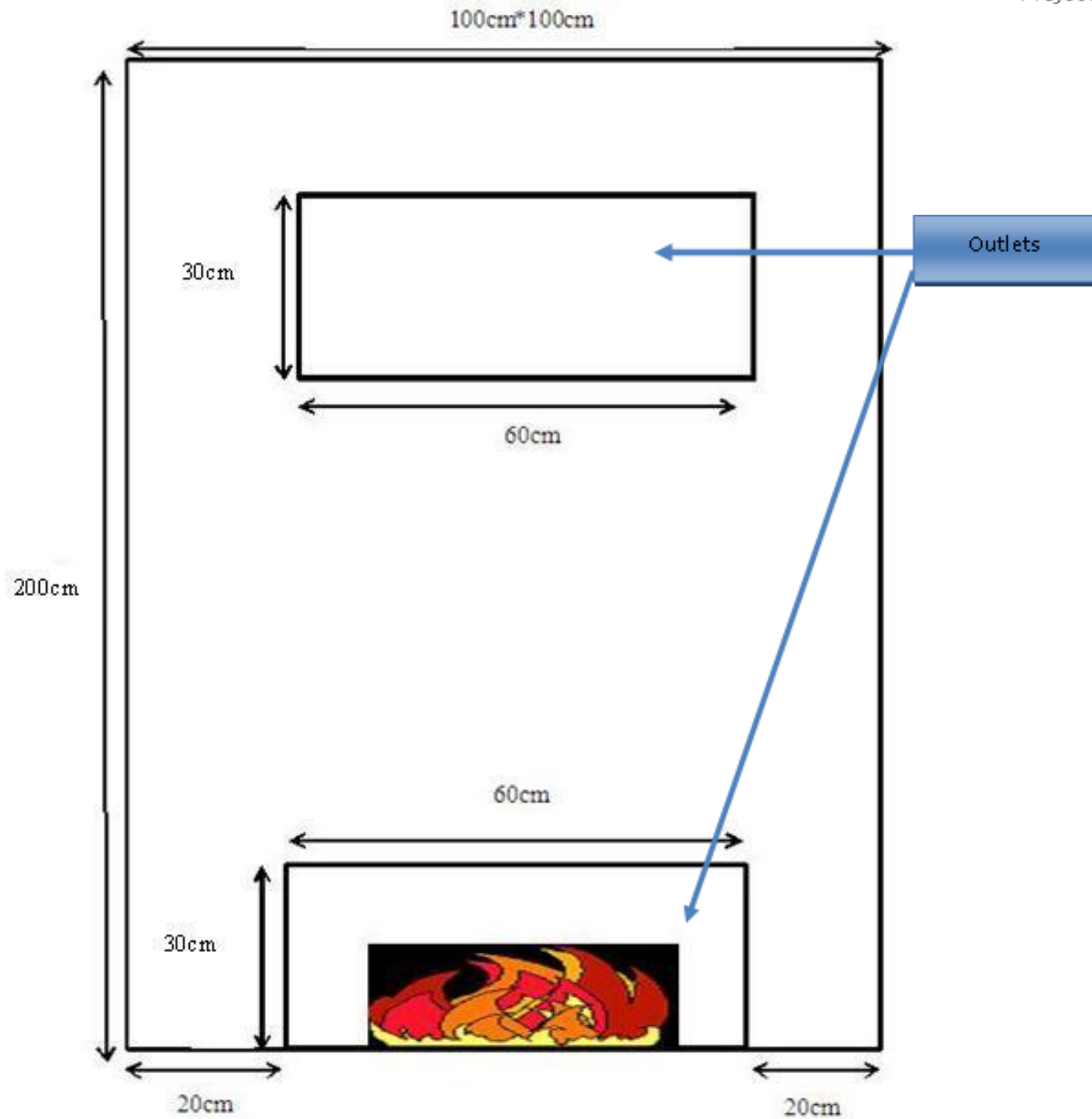


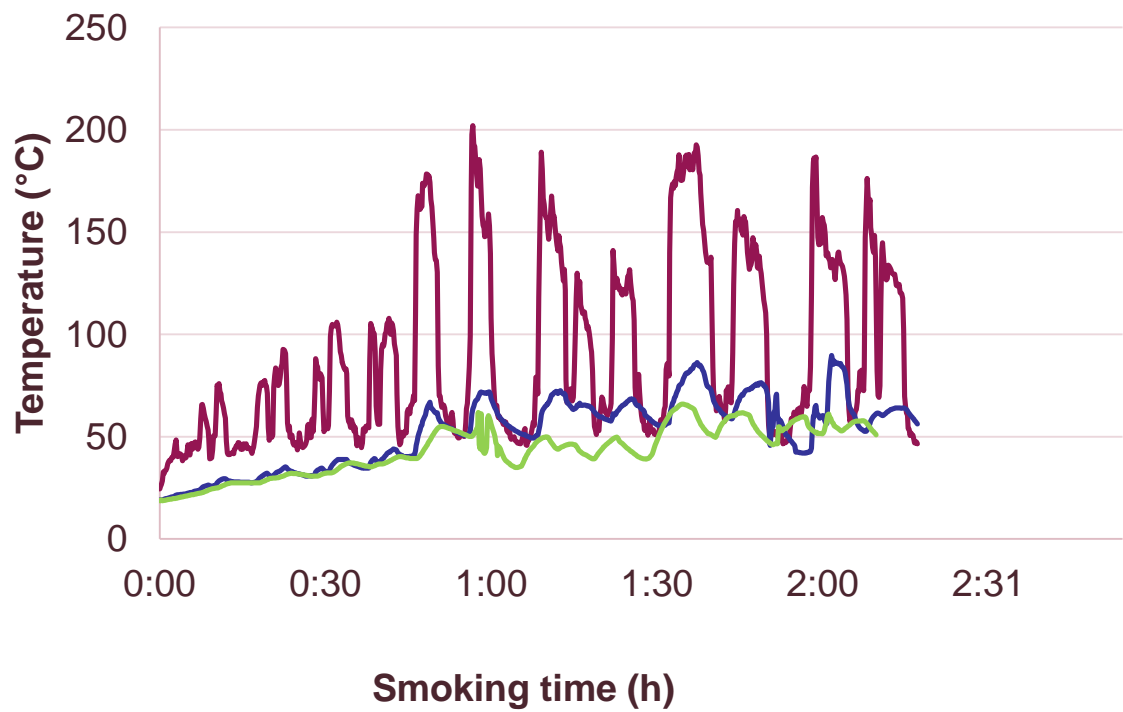
A F T E R

African food tradition revisited by research

*Project coordinator : Cirad
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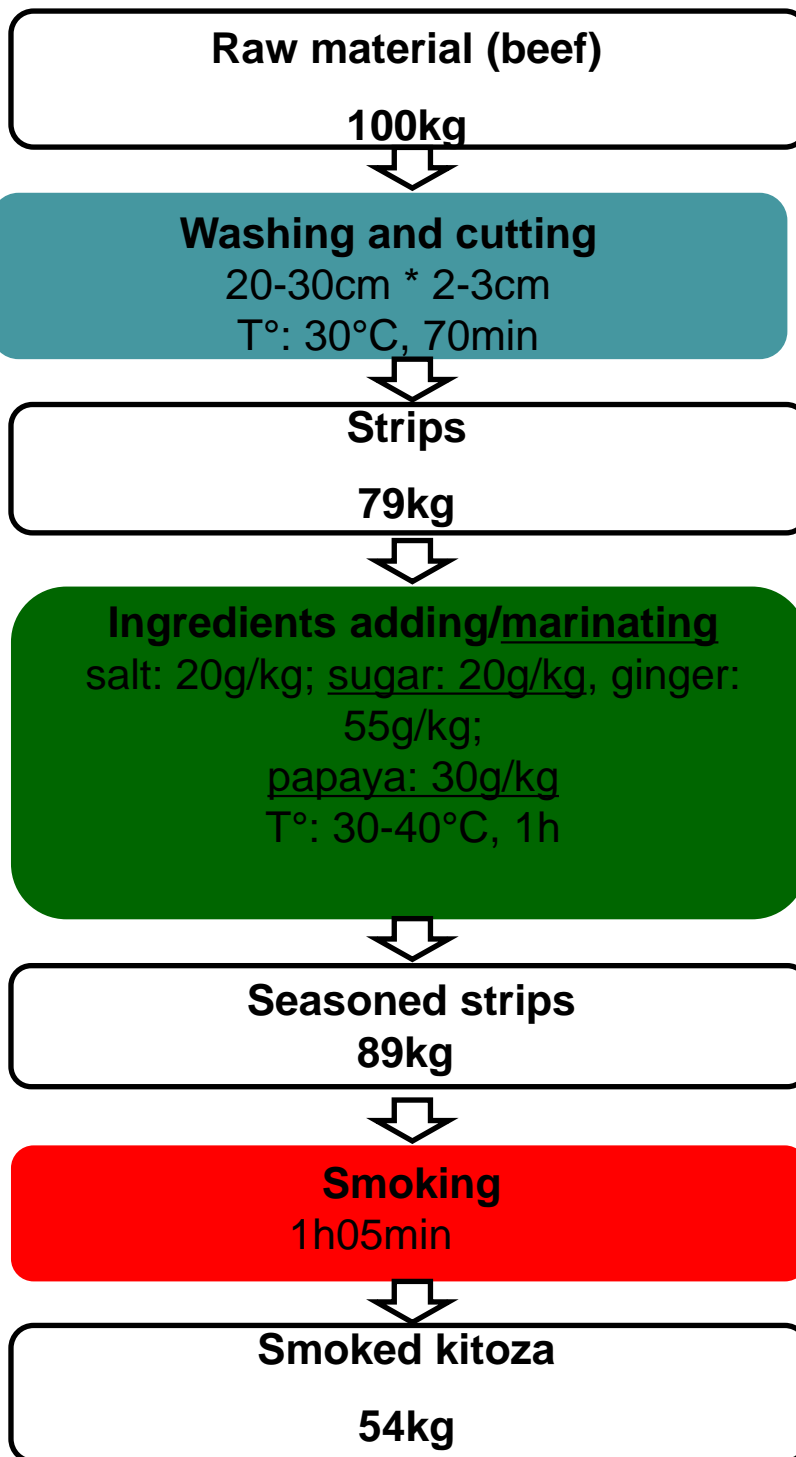




— Smoking unit — At the surface — Core temperature

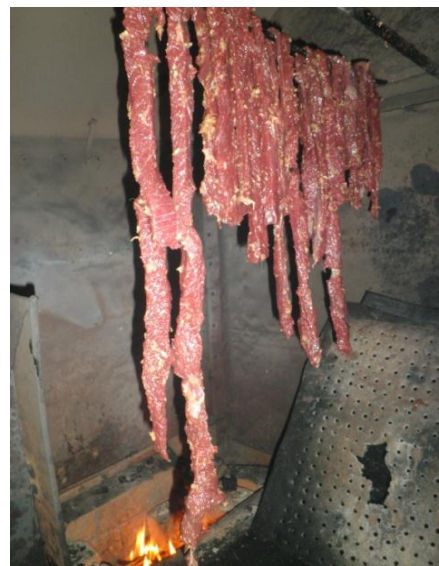
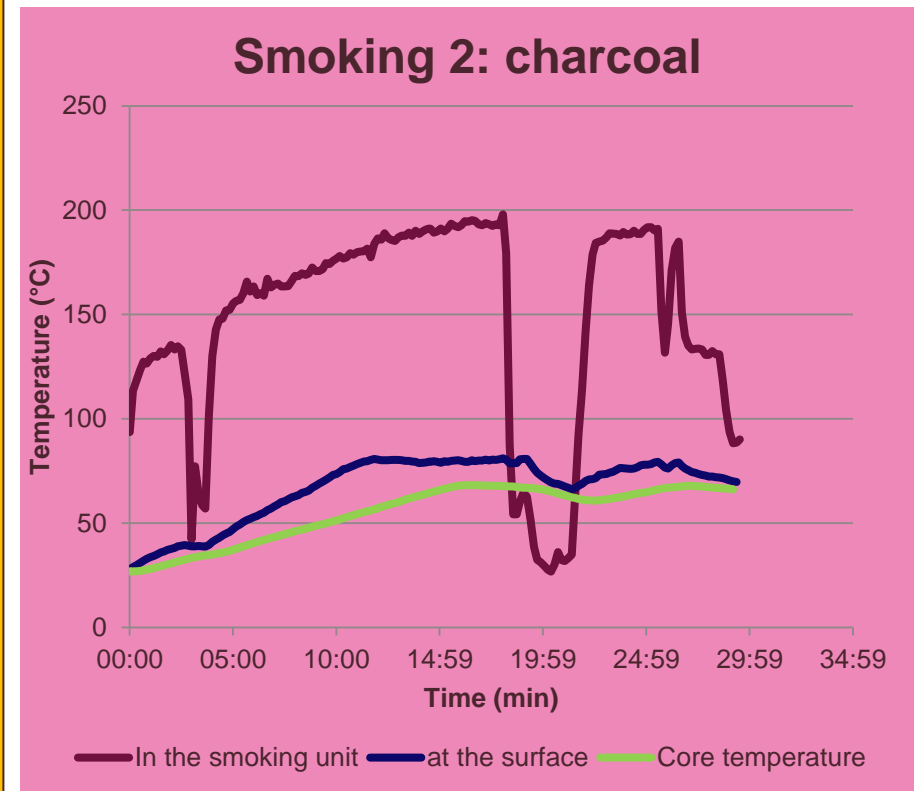
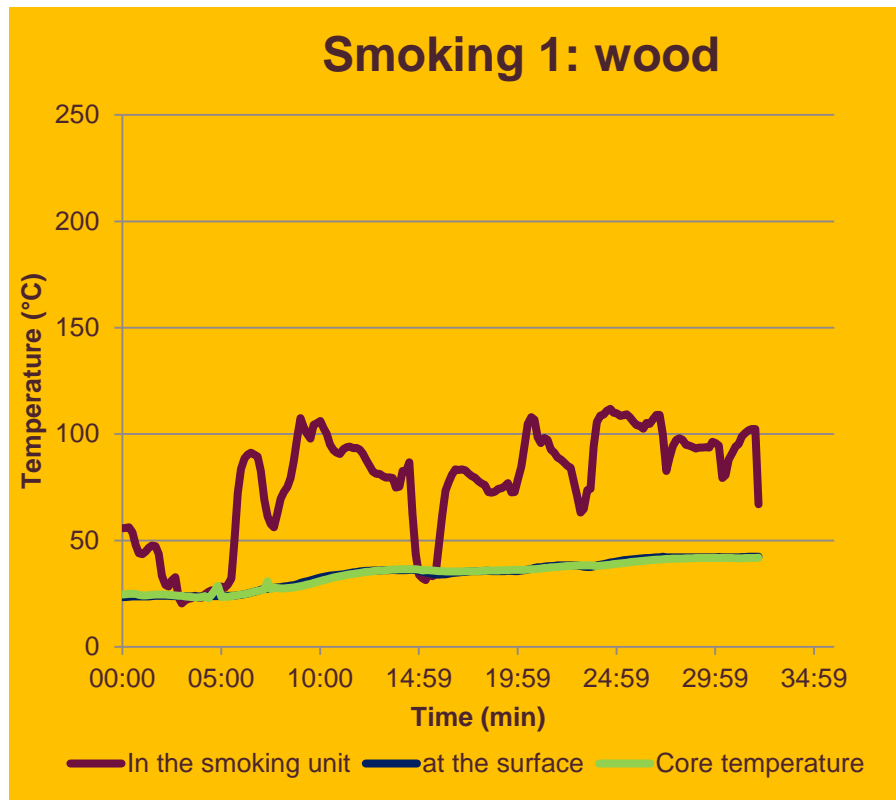
	Raw material	Strips	Seasoned strips	Smoked kitoza
Water wb (g/100g)	76.1±0.6 ^a	74.8±0.4 ^a	74.3±0.7 ^a	55.6±1.8 ^b
Salt wb (g/100g)	ND	ND	0.99±0.04 ^a	1.61±0.14 ^b
Aw	0.990±0.001 ^a	0.989±0.001 ^a	0.984±0.003 ^b	0.968±0.003 ^c
pH	5.59±0.16 ^{a,b}	5.40±0.01 ^c	5.54±0.06 ^{a,c}	5.72±0.02 ^b
Glucose wb (g/100g)	0.153±0.054 ^a	0.222±0.028 ^{a,b}	0.188±0.006 ^b	0.209±0.021 ^{a,b}
Phenols wb (mg/100g)	ND	ND	ND	2.10±0.25
B(a)P wb (µg/kg)	ND	ND	ND	6.92±1.18
TAMF (log cfu/g)	5.8±0.0 ^a	5.1±0.0 ^b	5.8±0.1 ^a	2.4±0.1 ^c
LAB (log cfu/g)	5.5±0.1 ^a	5.2±0.3 ^a	5.5±0.2 ^a	2.2±0.2 ^b
<i>E. coli</i> (log cfu/g)	1.3±0.6 ^a	<1 ^a	<1 ^a	<1 ^a
<i>Salmonella</i>	none/25g	none/25g	none/25g	none/25g

Producer B
(beef 2)



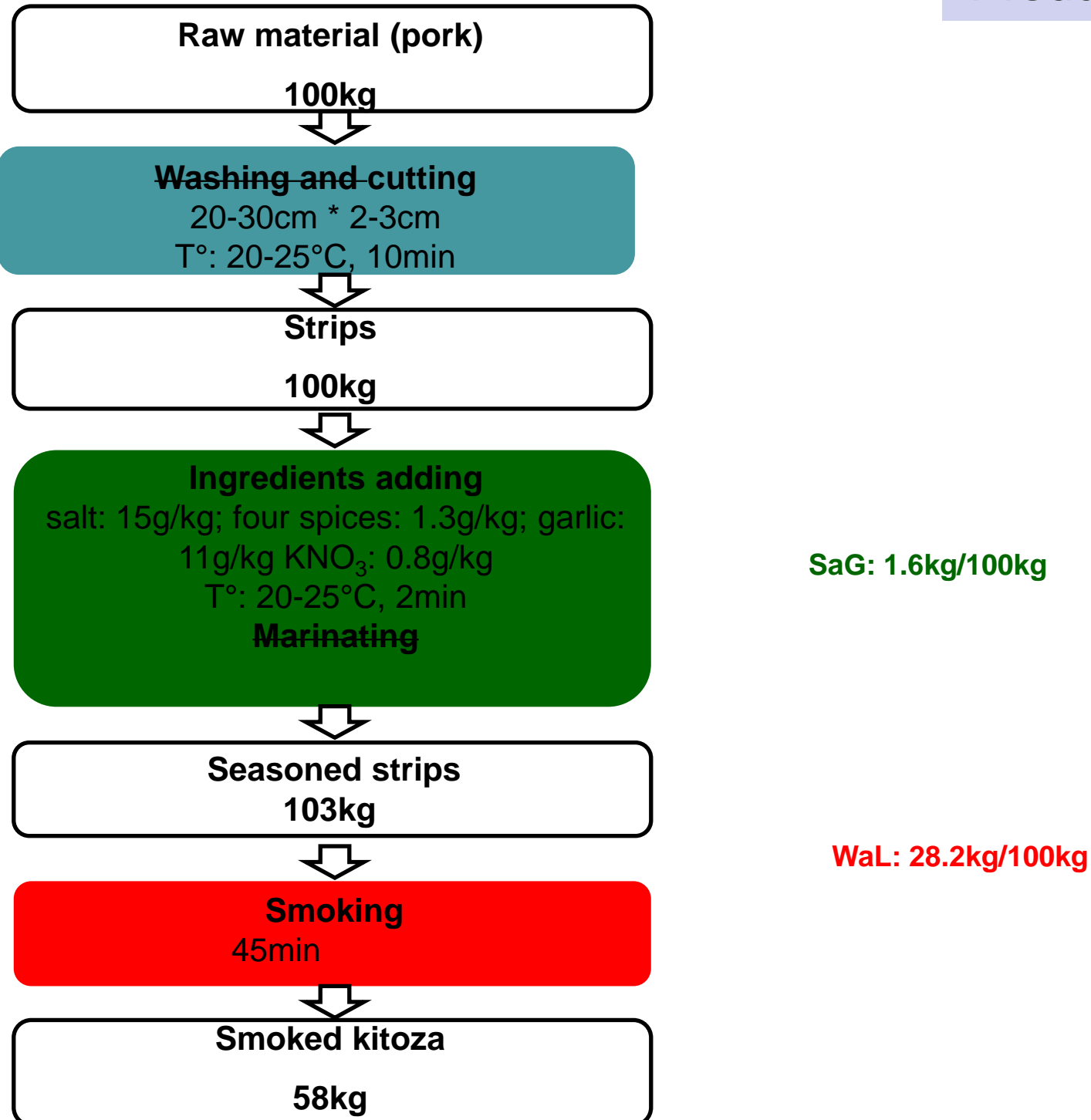
SaG: 1.7kg/100kg

WaL (kg/100kg):	15.6	25.8
PhG (g/100kg):	0.4	0.0
BaP (mg/100kg):	0.1	0.1

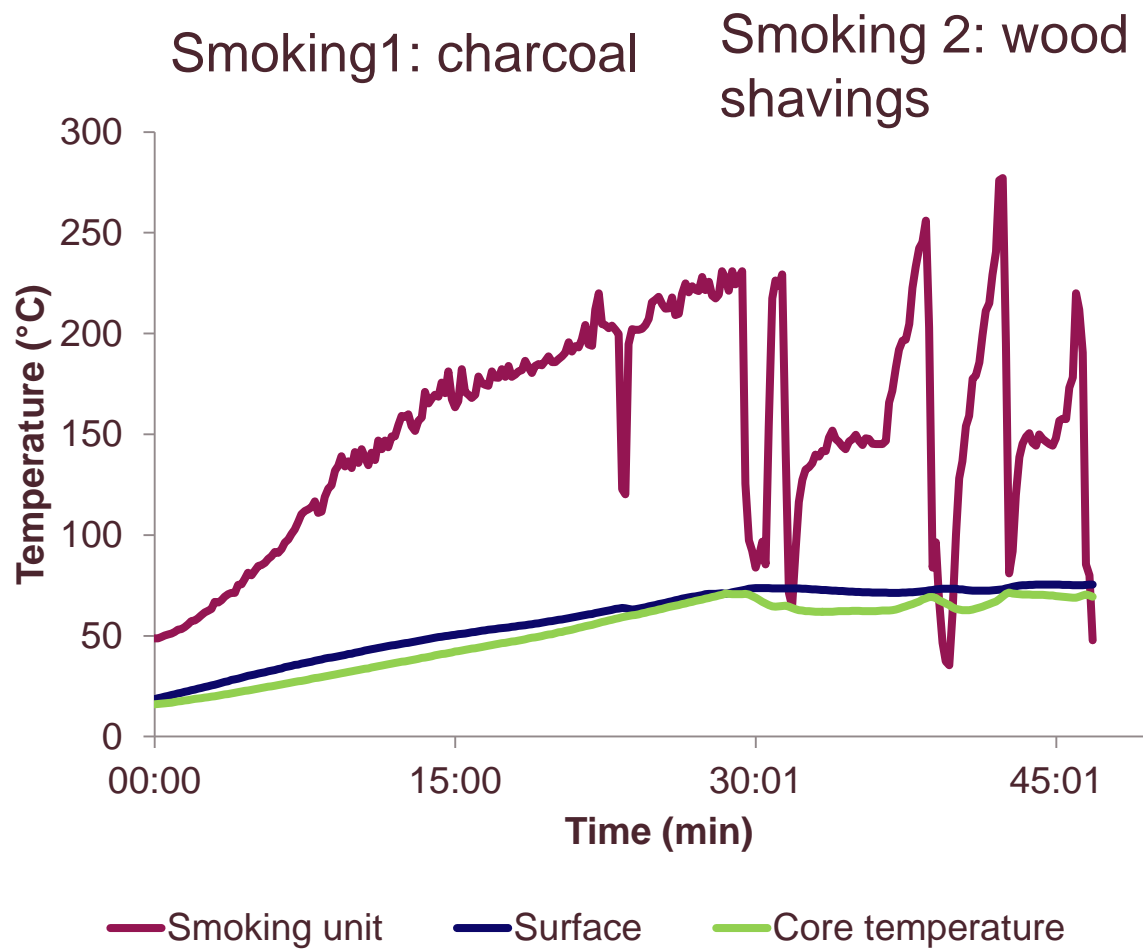


Producer B (beef 2)

	Raw material	Strips	Seasoned strips	Smoking 1	Smoking 2
Water wb (g/100g)	77.0±0.6 ^a	76.6±0.4 ^a	74.9±0.5 ^b	70.5±0.4 ^c	61.9±1.3 ^d
Salt wb (g/100g)	ND	ND	1.86±0.16 ^a	2.13±0.15 ^{a,b}	2.18±0.13 ^b
Aw	0.989±0.001 ^a	0.989±0.001 ^a	0.976±0.000 ^b	0.973±0.004 ^b	0.968±0.002 ^c
pH	5.74±0.16 ^{a,b}	5.80±0.16 ^{a,b}	5.81±0.03 ^{a,b}	5.64±0.02 ^a	5.87±0.07 ^b
D-Lactic acid wb (g/100g)	<0.014 ^a	<0.014 ^a	<0.014 ^a	<0.014 ^a	<0.014 ^a
Glucose wb (g/100g)	0.080±0.029 ^{a,b}	0.061±0.058 ^a	0.164±0.038 ^{b,c}	0.390±0.020 ^d	0.195±0.080 ^c
Phenols wb (mg/100g)	ND	ND	ND	0.44±0.04 ^a	0.40±0.04 ^a
B(a)P wb (µg/kg)	ND	ND	ND	1.70±0.07	2.06±0.21
TAMF (log cfu/g)	6.1±0.3 ^a	6.6±0.2 ^b	6.6±0.2 ^b	5.5±0.1 ^c	5.1±0.1 ^d
LAB (log cfu/g)	5.4±0.3 ^a	5.8±0.1 ^b	5.9±0.1 ^b	5.9±0.2 ^b	4.0±0.1 ^c
<i>E. coli</i> (log cfu/g)	3.7±0.8 ^a	2.8±0.1 ^b	2.9±0.3 ^b	2.9±0.2 ^b	<1 ^c
<i>Salmonella</i>	none/25g	none/25g	none/25g	none/25g	none/25g







	Raw material	Strips	Seasoned strips	Smoked kitoza
Water wb (g/100g)	73.5±0.3 ^a	69.8±1.5 ^b	63.5±0.6 ^c	62.8±0.3 ^c
Salt wb (g/100g)	ND	ND	1.57±0.12 ^a	1.54±0.07 ^a
Aw	0.990±0.001 ^a	0.989±0.001 ^a	0.981±0.001 ^b	0.977±0.001 ^c
pH	5.91±0.09 ^a	5.93±0.11 ^a	5.68±0.07 ^b	5.70±0.01 ^b
D-Lactic acid wb (g/100g)	0.017±0.005 ^{a,b}	<0.014 ^b	0.017 ^{a,b}	0.021±0.002 ^b
Glucose wb (g/100g)	0.069±0.019 ^a	0.081±0.012 ^a	0.136±0.019 ^b	0.169±0.003 ^c
Phenols wb (mg/100g)	ND	ND	ND	0.60±0.11
B(a)P wb(µg/kg)	ND	ND	ND	2.38±0.21
TAMF (log cfu/g)	7.3±0.3 ^a	7.2±0.4 ^a	5.1±0.3 ^b	3.8±0.3 ^c
LAB (log cfu/g)	6.5±0.3 ^a	6.2±0.7 ^a	5.3±0.2 ^b	3.0±0.1 ^c
<i>E. Coli</i> (log cfu/g)	1.7±0.2 ^a	1.2±0.2 ^b	1.0 ^b (n=1)	<1 ^b
<i>Salmonella</i>	none/25g	none/25g	none/25g	none/25g

Characteristics of end products

	Producer A	Producer B	Producer C
Smoking : combustibles time	wood 2h20min	wood/ charcoal 1h	charcoal/wood shavings 0h45
Water (g/100g wb) Salt (g/100g wb) Aw	55.6±1.8 1.61±0.14 0.968±0.003	61.9±1.3 2.18±0.13 0.968±0.002	62.8±0.3 1.54±0.07 0.977±0.001
Phenol B(a)P	2.10±0.25 6.92±1.18	0.40±0.04 2.06±0.21	0.60±0.11 2.38±0.21
pH	5.72±0.02	5.7±0.07	5.70±0.01 ^b
Pathogenic germs	<Detection Threshold after smoking		



POINTS OF THE PROCESSES TO BE IMPROVED

- **Good practices of hygien not respected:**
 - Tools not desinfected
 - No cold chain,...

- **B(a)P (PAH) content > 5 µg/kg for some end products**
($< 2 \mu\text{g}/\text{kg}$ for **B(A)P** in 2014 according to european regulations, EC 835/2011)

- **End products shelf life not guaranteed after 2 or 3 days**
 - pH \approx 5.8
 - $A_w \approx$ 0.93
 - No packaging
 - No microbiological stability for final products

Reengineering suggestions for local market development

- Improving the drying and smoking step
- Increasing the shelf life by:

Optimizing temperature and duration:

- water content and A_w reduced
- same water, salt and phenol contents for all products

Using charcoal and/or wood shavings:

- PAH content reduced

➤ **Testing the storage of reengineered products at :**

- room temperature
- 4°C
- 4°C under vacuum

by comparing:

- microbiological contents (TAMF, LAB, pathogenic flora)
- shelf life (DLC)

➤ **Sensory analyses**

AMONG AFTER PROJECT OBJECTIVES:

- Promoting kitoza to new consumers
- Prospecting new markets (european)
 - Madagascar is not included in the export positive list of meat products to the EU (Food Law EC 178/ 2002, EC 2073/2005 and POAO EC 853/2004)

Reengineering suggestions to comply with European market constraints



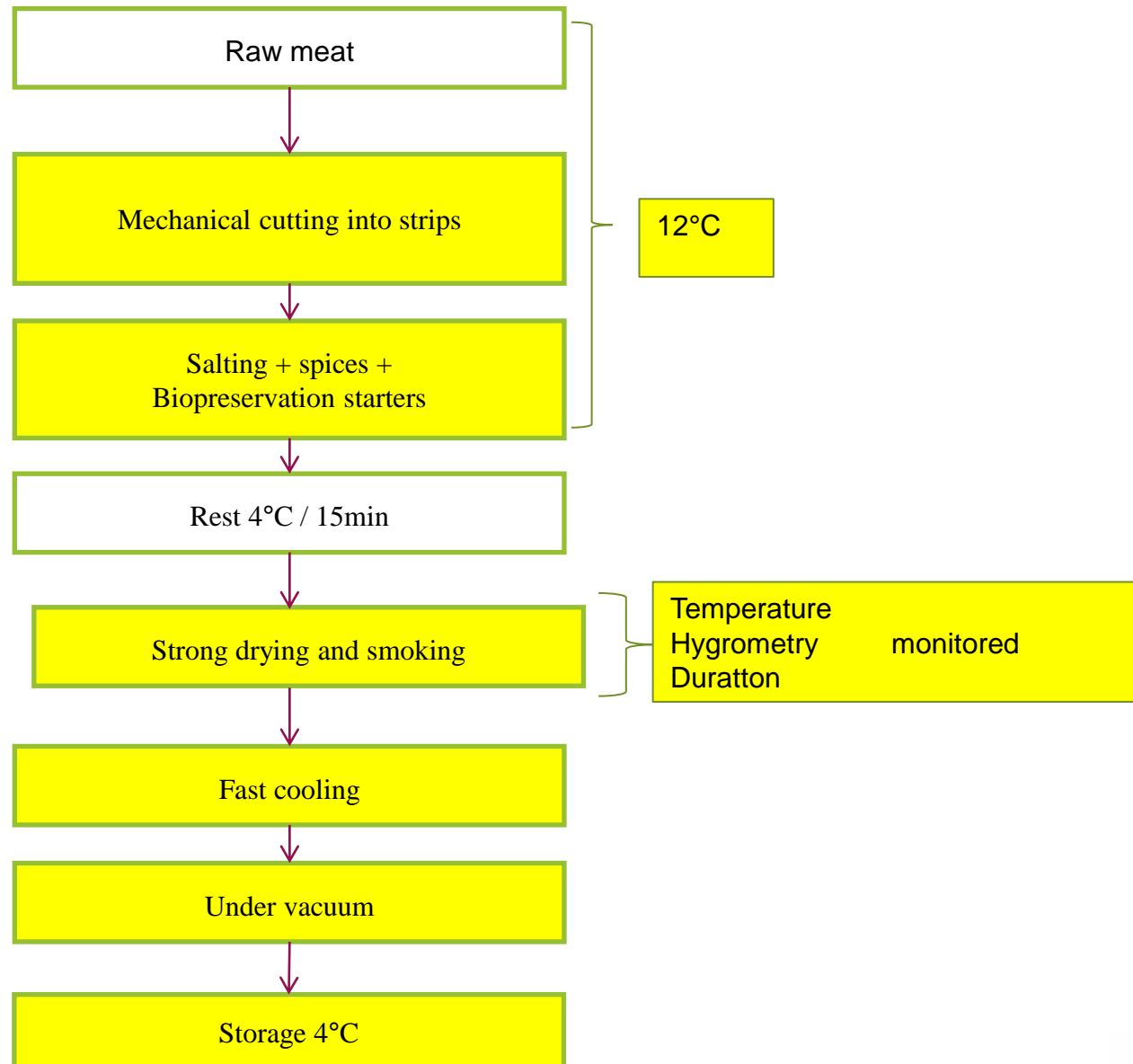
- **Production Kitoza (beef and pork) in Europe with a view to commercializing in european territory**
- **Use of air conditioned system to control the cold chain throughout the process**
- **Automating the smoking unit in order to control the drying-smoking and the PAH content**
- **Packaging the end products under vacuum or protective atmosphere to improve the shelf life**

-Studies on going:

- Adapting diagrams and manufacturing processes to the technical means available on the european territory
 - Determining suitable packaging for end products
 - Applying biopreservation starter (pork kitoza) with a view to increasing shelf life

- Sensory analyses to be done

Conclusion: Process flow diagram for EU reengineering





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ACKNOWLEDGMENTS







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Thanks to PRODUCERS



• **THANK YOU FOR
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