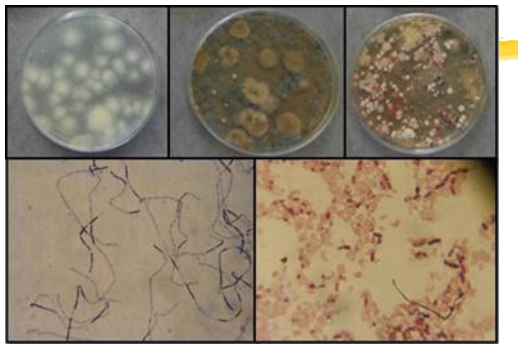

Reducing postharvest losses: Building on the CIRAD Experience

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Presentation

1 - Background and new issue of post harvest losses (PHL)

2 –CIRAD strategic approach, skills and activities related to PHL

Presentation

1 - Background and new issue of post harvest losses (PHL)

What is Post Harvest Losses (PHL) ?

- Food loss : modification or spoilage of quantity, quality, edibility.

  - Internal losses: physical losses :
    - Quantity: the product is diminished by weight
    - Quality : sales might be lost or only be made in a lower value market
  - External losses* : that fall on both the value chain participants and the rest of society.

** Rick Hodges, Ben Bennett, NRI, World Bank Review: Post-harvest Loss Reduction for Cereal Grain Staples in sub-Saharan Africa*

Food losses and wastage are considered throughout the value chain

Technical activities

- harvest, drying, threshing, cleaning, storage,
- Food processing / agro industry

Commercial activities

- Transport, Distribution, marketing

Wastage

- Cooking, Consumption

Complexity of postharvest systems

1 - A variety of technical causes

- Endogenous factors: natural changes to a living foodstuff
- Exogenous factors:
  - physical factors: humidity, temperature, etc.
  - biological factors: moulds, insects, rodents, etc.

Complexity of postharvest systems

2 - A variety of crops

- Conservable crops: cereals…
- Perishable crops: root and tubers, fruit, vegetables (onions)… greater levels of losses

Complexity of postharvest systems

3 - A variety of climatic conditions

- **Wet tropical zones:** drying problems, risks of development of mould, mycotoxins, etc. : high risks of losses
- **Dry tropical zones:** major problems, besides wintering, are primarily those caused by pest attacks: insects, rodents, etc.

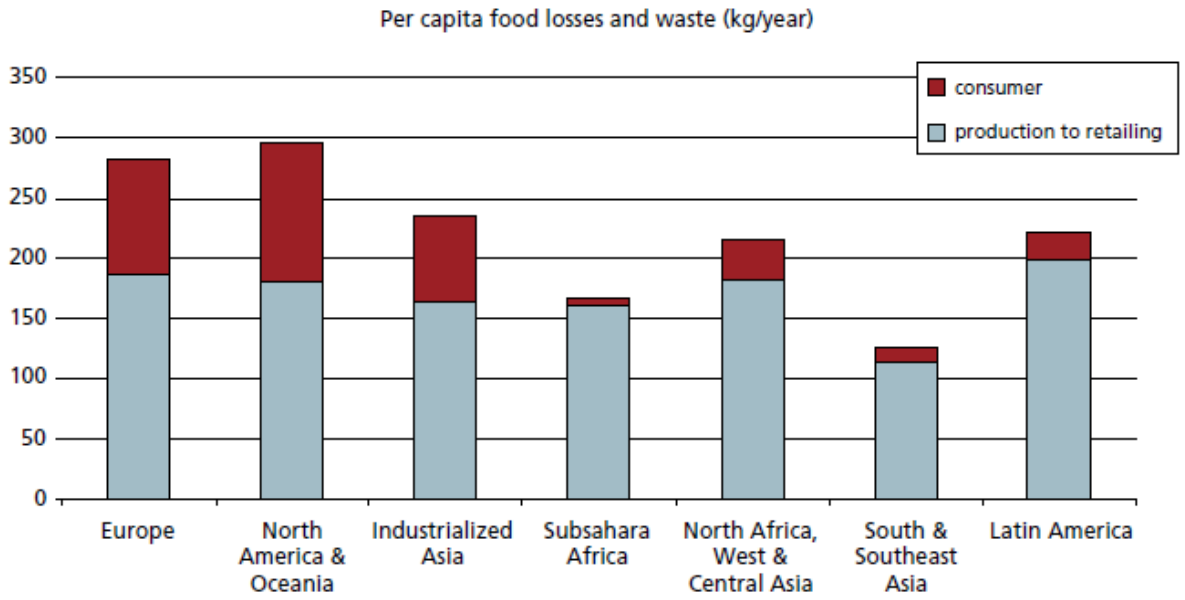
PHL hard to assess: complexity of postharvest systems in different industries and countries. **But** the challenge is to know and recognize the losses and waste to reduce and valuing them.

Organizing datas on PHL

Initiatives:

- Aphlis (JRC, NRI): www.phlosses.net / cereals South and East Africa
- INPhO (FAO, CIRAD, GTZ) , www.fao.org/inpho , cereal & cassava, technical information

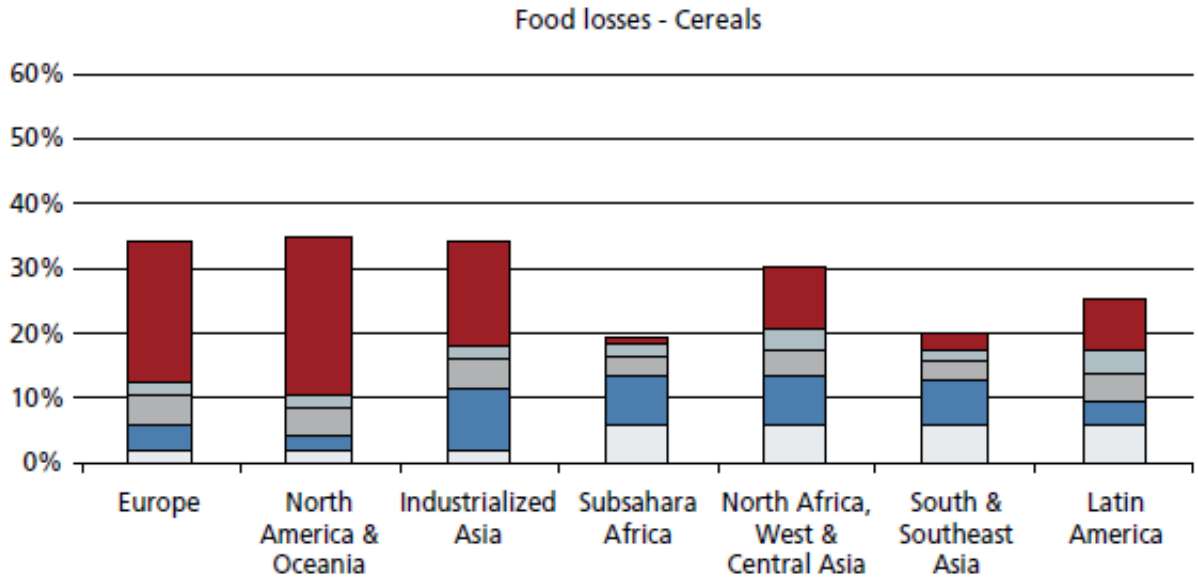
Global food losses

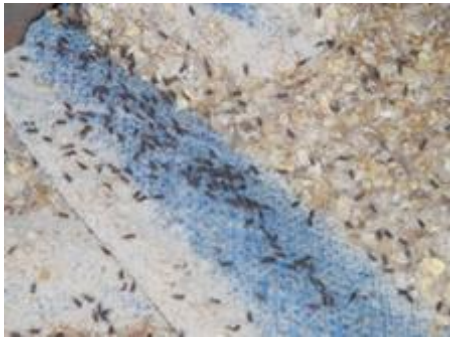


- Per capita food losses (kg/year.): Europe 280 / Sub Sahara 170
- Per capita food waste by consumer (kg/year.): : Europe 95 / Sub Sahara 6

Global Food Losses and Food Waste – Int Cong. SAVE FOOD!; Interpack 2011; Düsseldor.

Food losses and waste of the edible parts of cereal produced for human consumption

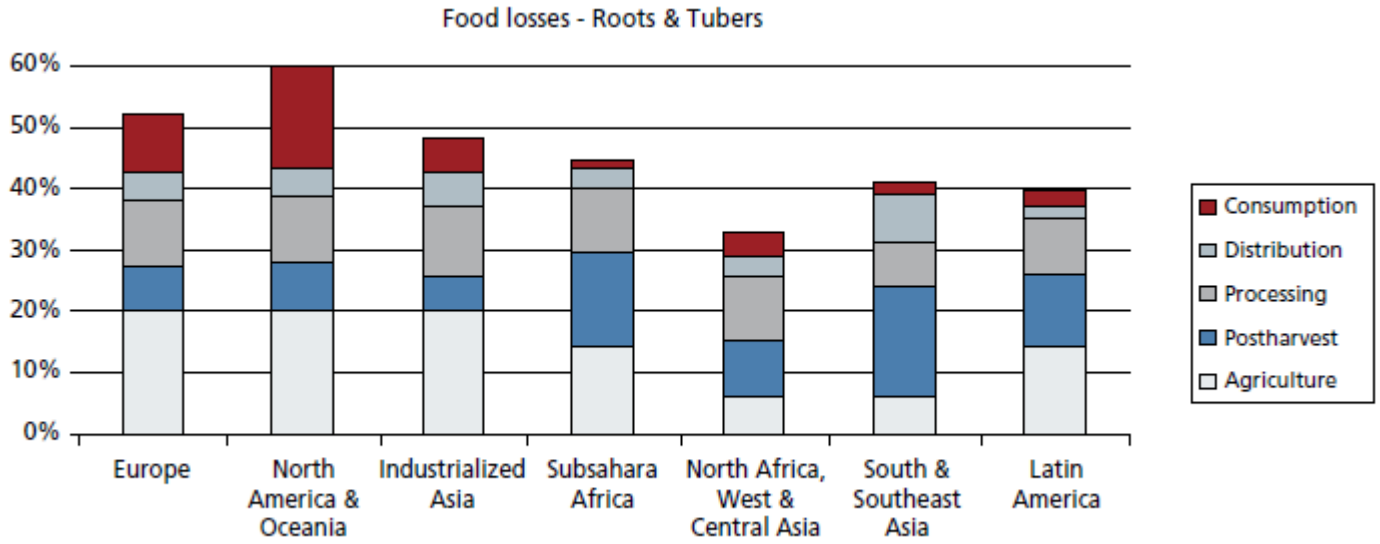




- Wheat dominant crop supply in high income region / losses in consumer phase: 40 to 50% of total cereal food waste
- Rice dominant crop in low income region. High food losses at agricultural production, post harvest handling and storage stages.

Global Food Losses and Food Waste – Int Cong. SAVE FOOD!; Interpack 2011; Düsseldor.

Food losses and waste of the edible parts of root and tuber crops produced for human consumption



- Potato dominant crop supply in medium- and high-income region. Agricultural losses link to grading and quality standards set by retailers. Losses in consumer phase high.
- Cassava dominant crop supply in SA, SSA and LA. High PHL. Fresh roots and tuber high perissable in humid climate.

Similar datas for oilseed, Fruit and vegetable, meat, fish and seafood, milk and diary.

A changing context: Evolution of policies aimed at limiting PHLs

- FAO 1970/ 1990:
  - improving storage at village level
  - disseminating insect management methods
- FAO study and report conclusions (1994):

1 – "It seems that **traditional techniques** developed over generations by farmers have proven their worth. Today they are still predominant, since they are well mastered by and firmly anchored in the culture of each ethnic group. Nonetheless **socio-economic and ecological changes** are transforming the production and marketing conditions for staple products (grains and tubers). **The postharvest system must adapt to this new context of perpetual change**."

2 – "It means taking on a different mentality in the face of the socio-economic changes, i.e. seek to adapt to the market, take into account the **new environmental constraints**, and uphold the **quality of production**."

A changing context: New dietary habits

New dietary habits causes:

- increasing urbanization
- tend to eat out
- seeking pre-processed products (not longer only staple food)
- satisfy the health rules
- evolution of the agro-industries

Boisson *Akpan* (© D. Pallet - Cirad)

A changing context: new major players

Working with small or micro-enterprises.

- New opportunities for work and revenue to both rural and urban populations.
- The technologies used at this level are generally rudimentary, with inefficient use of energy.

Need for new equipment and processes

- These small enterprises are often managed by women with great know-how

A changing context: new major players

Engaging women in PHL reduction

The central role of women in the food industries must be taken into account in proposals to reduce PHL.

A twofold objective:

a) consolidate revenue sources from food products

b) lighten and simplify women's workload in the often laborious processing and conservation operations (de-husking, cleaning, winnowing, etc.).


Kishk balls (© Habiba H. Wassef - NRC)

A changing context: food security

A clear link between PHL reduction and food security

Promoting and improving the processing and conservation (losses reduction) of food products, at all levels of operation, must be one of the essential components of the food security strategic plans.

- ensure regular availability
- provide jobs and revenue i.e. ability to access food
- promote diversification and nutritional quality of diets
- meet the food preferences of diverse populations

For FAO: "*Food security exists when all people, at all times, have physical, social and economic access to sufficient safe and* ***nutritious*** *food that meets their* ***dietary needs*** *and* ***food preferences*** *for an active and healthy life.*"

PHL prospects

- These various changes in the context of postharvest losses
- Unexpected impact study: solution provided at one stage (new variety, new equipment) have impacts – often unexpected ones – at other stages.
- Fundamental to understand the various 'quality traits': technological, sensorial, nutritional and sanitary.
- Taking into account consumer preference
- Taking into account energy and environment

Recommandations

- Consider the problem as a whole.
- The solutions for reducing postharvest losses may be classified on two levels:
  - specific technical innovations and solutions with a direct action on reducing losses
  - measures contributing to creating a favourable framework for reducing losses.
- The challenge of innovations: their long-term adoption by the population
- Implement a multidisciplinary approach: biologists, entomologists, physiologists, food scientists and food engineers, in conjunction with the industry players.

Presentation

2 –CIRAD strategic approach, skills and activities related to PHL - contribution for future works

A research team and an integrated approach for food quality

The aim of the research unit is to develop an integrated approach for the manufacture and preservation of high quality food in Southern countries.

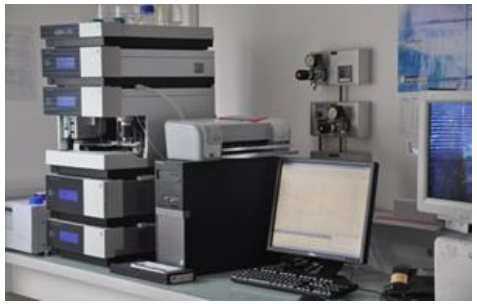
We study food quality, in all its facets: safety, nutritional, organoleptic, functional

An integrated approach for food quality

Characterisation of food biodiversity

Chemistry, biochemistry, sensorial analyses

Food safety management in food chain



Microbiology, biochemistry, molecular biology

Food processing maintaining quality

Process engineering
Physico-chemistry

PHL reduction CIRAD strategic approach

To gain an insight into the relationship between losses and food security.

- **Working assumption:**

Our hypothesis is that in the staple food chain the introduction of tested appropriated technologies near production areas must reduce postharvest losses and increase the food security of populations living in these areas.

PHL reduction CIRAD strategic approach

Postharvest operation.

- We consider under postharvest the operations of storage, stabilization (such as drying),
- Also the first food processing steps (such de-husking, parboiling, grating, etc.) which can be done near the production area.
- These operations make it possible (i) to stabilize the foodstuffs and thus to facilitate their conservation; and (ii) to bring local added value and thus to increase the food security of the populations.

PHL reduction CIRAD strategic approach

Scope of work

Our scope of work should take into account the following criteria:

(i). We consider the short food chains for local markets, in which the products are intended for the local and regional markets.

(ii). We are interested in the stabilization and processing operations which take place near farms, e.g.: storage, drying, etc.

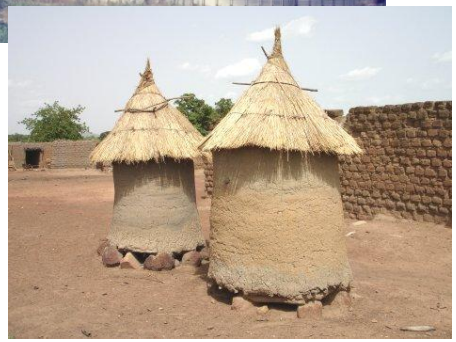
(iii). We are interested in the processing operations which take place near consumer areas where products gain added value, e.g.: parboiling, fermentation etc.

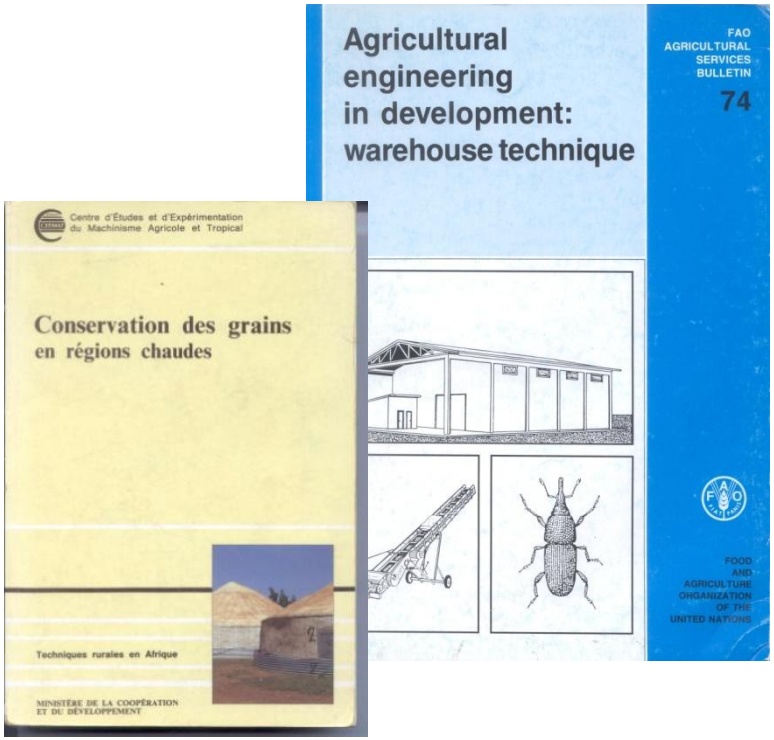
Technologie post-récolte des grains

Dans le passé (Années 80)

Activités essentiellement orientées "stockage"

Recherche appliquée, expertises, formation en stockage des grains (sacs et vrac)





Exemples:

- Etudes sur le stockage des grains dans différents pays d'Afrique de l'Ouest et d'Amérique du Sud (Nicaragua, Equateur..) pour le Ministère de la Coopération ou la FAO.
- Stage de Formation sur techniques de stockage
- Publication de différents ouvrages

Technologie post-récolte des grains

Durant les années 1990

Analyse et évaluation des systèmes post-récolte traditionnels ou modernes - Activités orientées sur les aspects "procédés de transformation"

Développement de petites unités de transformation (minirizeries, décortiqueurs mil-sorgho …)

Poursuite des études

« Stockage »

- transferts de chaleur dans stocks sacs (Chine)
- transferts de chaleur dans grains en vrac en cellules métalliques (Cameroun)

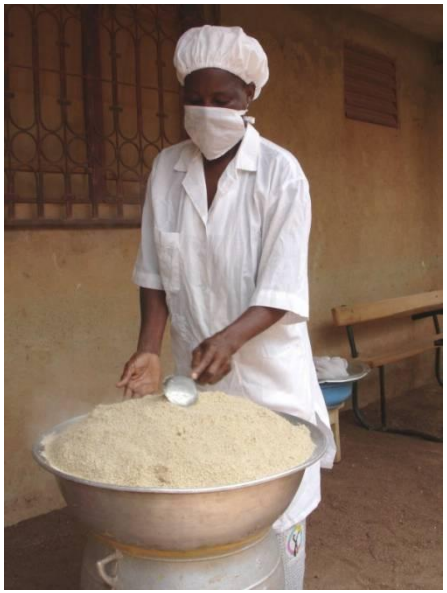
Recent projects:
Improving the quality of processed products

Diagnostic et amélioration des procédés artisanaux et semi-industriel

- Filière riz: Haïti, Brésil, Guinée, Mali, Indonésie…

- Filière céréales sèches (dégermage maïs, décorticage mil-sorgho..): Burkina…

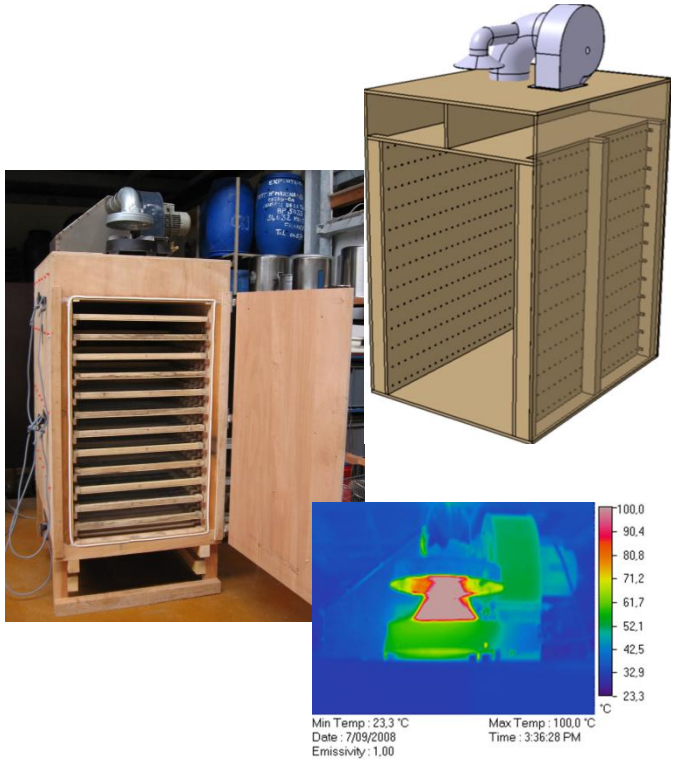
- Filière fonio
- Projet CFC : Amélioration des technologies post-récolte (1999-2005)
- Projet européen INCO Fonio : Amélioration qualité (2006 – 2008)
- Projet Union Africaine AvalFonio (2013 – 2015)



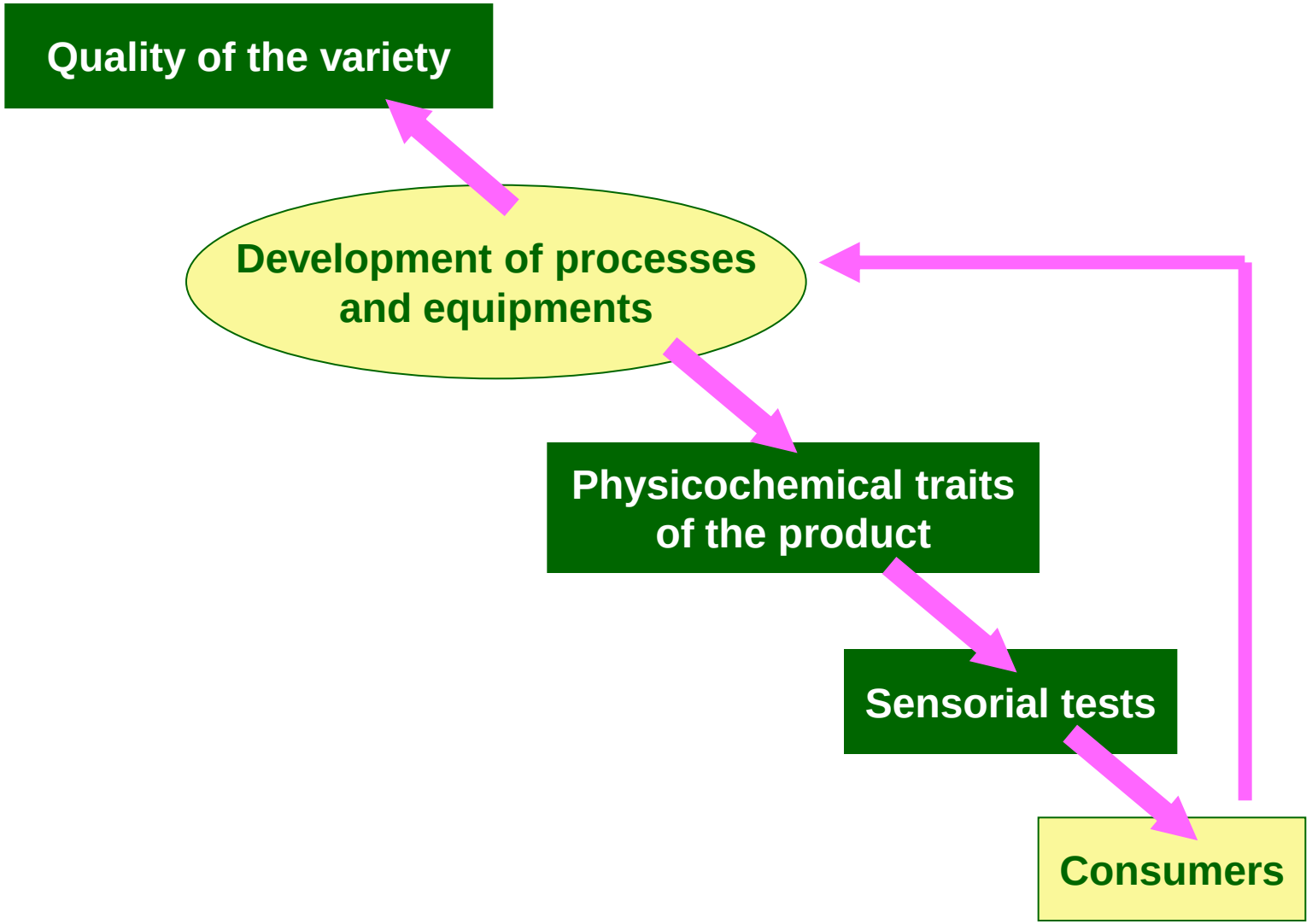
Design and reengineering of processes and equipments

Equipment design, control and optimization.

A product-process environment approach involving quality, energy and management of associated by-products.



Equipment design : Descending approach



Design and set up of cleaner and sever

- **Conception réalisation de matériels de nettoyage des céréales**
  - Cribles rotatifs
  - Canal de vannage

Nettoyeur rotatif
150-300 kg/h

Canal de vannage
150 - 450 kg/h

Design and set up of husker

- Conception réalisation de décortiqueurs à fonio (100 – 150 kg/h)

Décortiqueur à fonio GMBF
(version électrique)

Essais du décortiqueur GMBF au Mali
(version thermique)

Design and set up of couscous dryers

Séchoir Serre solaire

Séchoir « Flux traversant »

Sensory profile and consumer acceptance

- **Identification of quality criteria of the varieties and the products through surveys: individual interviews, focus groups**
- **Sensory testing of the products**

  . Choice of local processors and products with a large range of sensory properties

  . Constitution of a panel with local consumers and gender equity

  . Generation of descriptors that describe the product regarding visual aspect, odor, taste and texture

  . Training the panelists (20-25)

  . Scoring the products in triplicate during several sessions

  . Statistical analysis of sensory data

Sensory testing of bissap in Senegal

Sensory testing of smoked Kitoza in Madagascar

Sensory testing of Kenkey in England

Sensory profile and consumer acceptance

- **Consumer testing**
  . Choice of the 4-5 sensory contrasting products
  . Establishment of the questionnaire during focus groups
  . Conducting consumer testing with at least 100 consumers to evaluate the acceptability of the products and consumer preferences
  . Statistical analysis of consumer data
- **Physicochemical analysis** of the raw material and products
- **Relation** between sensory properties, consumer acceptance and physicochemical traits of the products

Consumer testing of Gowé in France

Consumer testing of Akpan in France

Consumer testing of Jaabi in Cameroun

AVAL FONIO : Amélioration de l'après récolte et valorisation du fonio en Afrique

Objectifs spécifiques

- Approfondir les connaissances sur les systèmes post-récolte du fonio

- Améliorer et diffuser des techniques post-récolte (récolte, battage, nettoyage)

- Améliorer la qualité du fonio commercialisé par la mise au point et le transfert de techniques de transformation et de stabilisation

- Améliorer la connaissance des processus d'innovation dans les petites agro-industries et contribuer au renforcement des dispositifs d'accompagnement

Union européenne

Union africaine

AVAL FONIO

Coordination

Cirad (UMR QualiSud) - France

Partenaires

1: IRAG / Guinée

2: IER / Mali

3: IRSAT / Burkina Faso

4: ESP-UCAD / Sénégal

Associés

1: CNTA / Burundi

2: SupAgro / France