

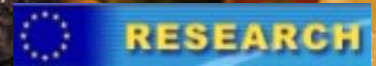


Promoting European **TRACEABILITY** Excellence & Research

# Genetically modified and non-GM supply chains Coexistence and Traceability The EC Integrated Project Co-Extra

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# European Food Safety Concerns

- According to Eurobarometer:
  - European public opinion globally against GMO
  - Lack of public confidence in food safety and government administration, and even scientists to some extent.
- Public **opinion** may change: at present consumers' attitudes are divided into:
  - +/-30% for GM food
  - +/-30% against GM food
  - +/-30% wait and see what are the benefits for the consumer
- Labeling is a strong European demand by the EU population (similar requests in third countries).



# European Food Quality requests

- Social evolution: growing markets' requests of
  - Organic “quality”
  - “Wild type” products instead of industrial
  - “quality signs” e.g. AOC, IGP...
- Concerns about Frauds (wine..)
- Growing part of consumers requesting better and “certified / traced” quality products
- Together with the lowest prices



# Traceability and Labeling: a growing European request

- To ensure the free choice to the consumer facing new products (GMO, irradiated food...)
- Quality and authentication of the products
- Necessary for compliance with EC Directives and Regulations on labeling of GM food
- Necessary for traceability of GM plants under the new EC Directives and Regulation on approvals of GM crops and imports



# GMOs under EU laws (part 1)

- **Regulation 258/97 Labeling of new foods and ingredients**
  - Not specific for GMO foods (see e.g. irradiated food)
- **General “Food Law” (Regulation 178/2002)**
  - Evaluate potential risks for food and feed (creation of European Food Safety Authority (EFSA) 2004)
  - General obligation of traceability
- **GMO Deliberate Release (Directive 2001/18 EC amending 90/220)**
  - Member states often delay the transposition of this Directive into national law implement this law i.e. delay planting of GMOs.
  - This may lead to loopholes whereby GMOs have been planted in France and are legal under EC Directives but not yet treated under French law: GMO crops location are thus not registered
- **Transboundary movements of GMOs (Regulation 1946/2003)**
  - Between Member States
  - Same quality requested between products for domestic or export markets (application of Cartagena protocol on Biosafety).



# GMOs under EU laws (part 2)

- **Approval & Labeling Regulation (1829/2003)**
    - Obligation to petitioners to furnish methods of detection of GMOs and control samples to the Central Reference Laboratory of the EC Joint Research Centre.
    - Labeling of processed GM-derived products is required even when the continued presence of GM material cannot be demonstrated.
  - **Traceability and Labeling Regulation (1830/2003)**
    - GMO specific traceability obligation in complement of 178/02
    - Labeling of feed and foods made from GMOs
    - Threshold 0.9% for authorized GMOs
    - 3 years intermediary period of threshold 0.5% for non-authorized GMOs that have nonetheless received a good EFSA evaluation.
- **Co-existence of GM & non-GM crops**
    - EC's General guidelines published
    - Recommendations on analysis and sampling (CEN standard)
    - Directive in preparation? EC or national system?
  - **Discussions on fortuitous GMO presence in seeds for planting**
    - EC proposals (0.3 – 0.7%) while some MS request 0.1%



# Some traceability related FP5 research programs



- Several programs on food safety and quality, detection methods...

- DNATrack: N. Marmioli

DNA-TRACK

- QPCRGMFOOD: 2000-2003 A. Holst-Jensen



- GMOCHIPS: 2001-2004 J. Remacle. Y. Bertheau

- ENTRANSFOOD Cluster: H. Kuyper



- Results

- provided first insights on GMO detection
- Evidenced issues on GMO detection
- Influenced the European regulation



# European Community Research programs: FP6

- Numerous programs on “food safety and quality” priority including traceability (SEAFOODplus, SAFE FOODS, TRACE, IFORS...)
- Present programs on “Co-existence and Traceability”
  - **SIGMEA** (FP6, STREP): 2004-2007 J. Sweet, A. Messéan
  - **Co-Extra** (FP6, IP): 2005-2009 Y. Bertheau
  - **Transcontainer** (FP6, STREP; biological conta



**Consumers driven**

**Stakeholders involvement, agreement with ENGL (SIGMEA, Co-Extra)**

**Fields and supply chains levels**

**Different aims, techniques and strategies, according to the evolution of the regulation, the EU's policy, the stakeholders' needs...**



# Co-Extra

**GM and non GM supply chains:  
their CO-EXistence and TRAcability**

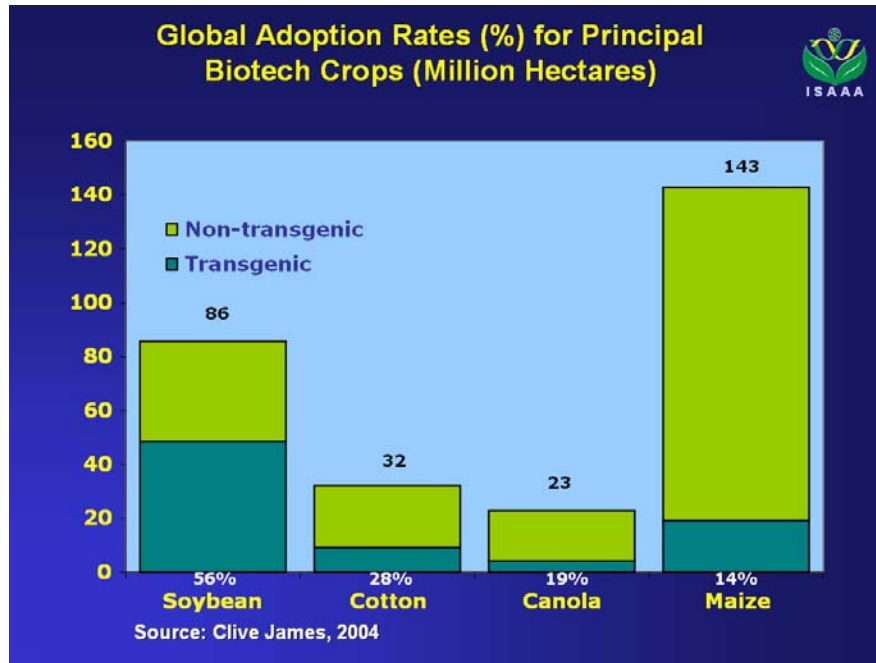
**53 partners**  
**(EU, BU, BR, AR, RU) + collab. USA**  
**18 countries      23 M€**  
**(IP, <http://www.coextra.eu/>)**



# Background : GMO productions

- Main currently concerned productions

- New' productions and supply chains



potato  
rice



tomato  
squash



papaya  
sugarbeet



- Food supply chains contaminations: Starlink, pig vaccine corn
- “Escaped” GMO: Tomato, Bt10, papaya, LLRICE601, chinese rice...

- Increasing GMO pressure
- Future GMO for industry, phytoremediation, pharmacy...



# Co-Extra objectives

Fill-in the gap between the set European legal framework and its practical implementation

## Areas

- Co-existence
- Traceability
- Implementation

## Aspects

- Technical
- Economic
- Legal

WP8: Dialogue and **communication**

WP1: Biological approaches for gene flow mitigation

WP4: Development of testing and sampling approaches

WP2: Supply chains analysis, description and modelling

WP5: Development and integration of analytical traceability tools

WP3: **Economic** costs and benefits of traceability and co-existence

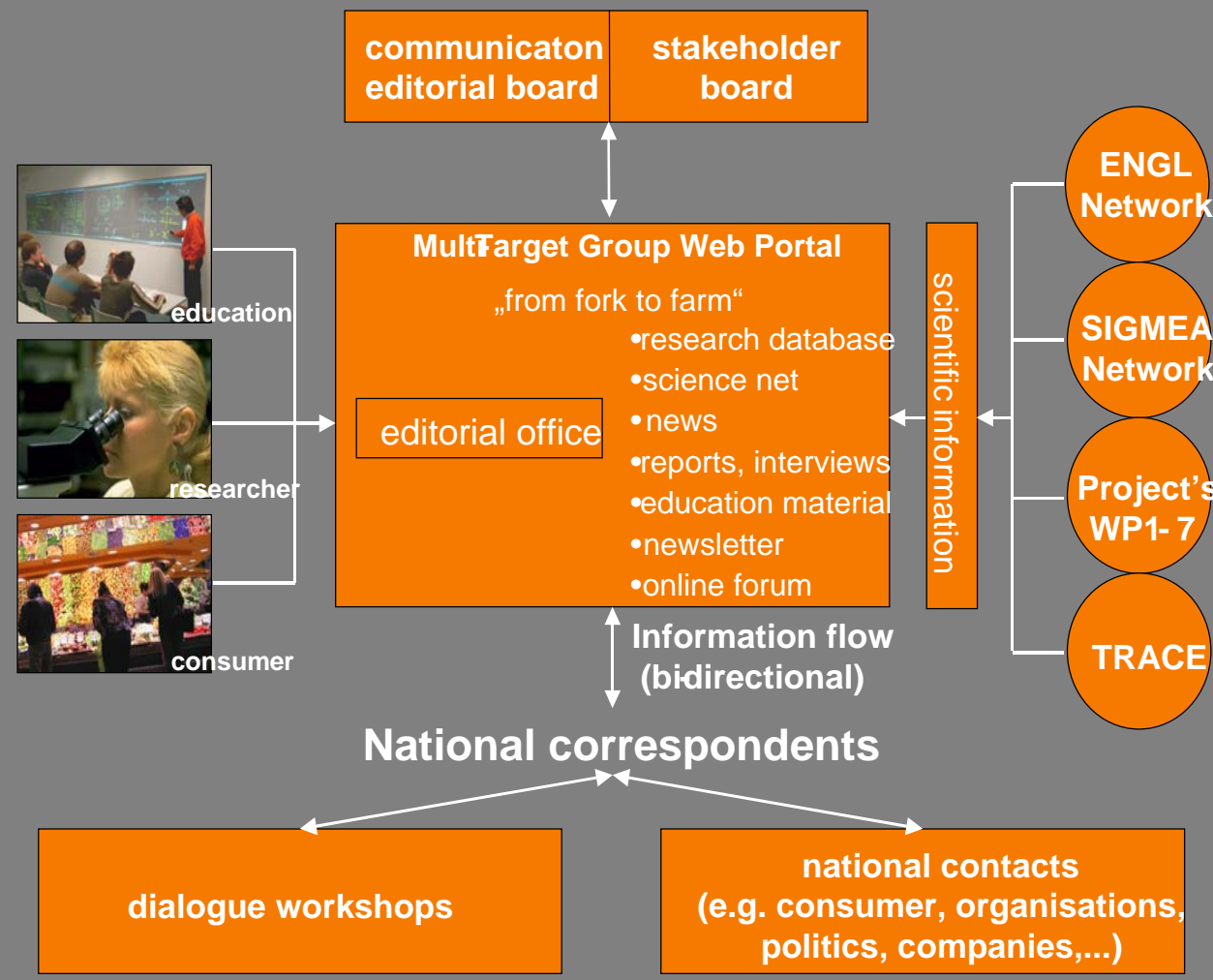
WP6: Technical challenges of GMO detection

WP7: **Integration** with respect to legal, scientific, social and **traceability** issues



# Inputs and outcomes

- Focus groups of stakeholders (surveys of practices, requests...)
- National relays for results dissemination (Web sites, press releases...)
- User-friendly decision-support tools



Acceptability studies, effect of use of reliable detection methods on European consumers' confidence...

# Analytical methods

- Sampling plans according to consumers' and producers' risks, nature of the lots...
- Detection methods (next slide)
- Costs and benefits (e.g. hidden as an example for other supply chains)
- Decision support systems



# Detection methods

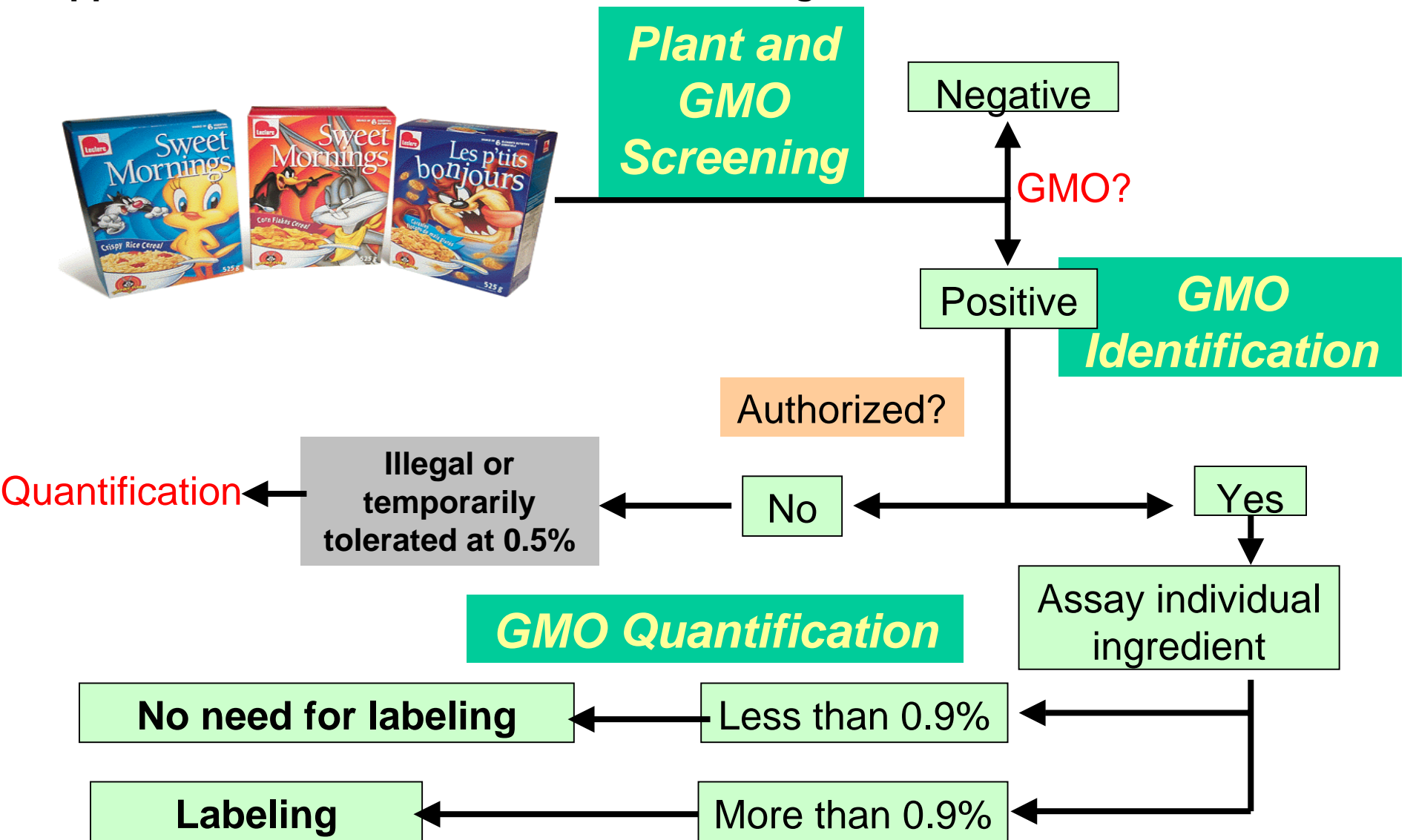
- On site detections, screening methods applicable for matrix approach...
- DNA extraction from some matrices
- Performance improvements: LOD, LOQ, accuracy...
- Challenges: unknown GMO, stacked genes, validations of new kinds of detection methods (e.g. PCR + micro-arrays)
- Costs and duration (multiplex, alternatives to PCR, different chemistries...)
- Validation and standardization of resulting techniques

Flexibility requested to comply with forthcoming regulation  
e.g. regulatory thresholds for seeds



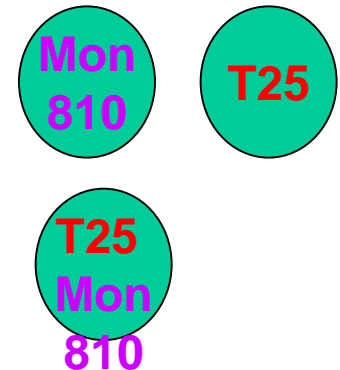
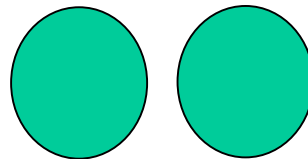
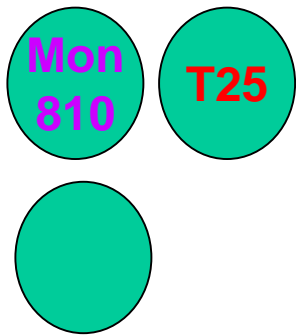
# Usual Detection Scheme

applicable to numerous matrices according different thresholds (seeds...)



# Some Unresolved Issues

- **Detection of Unknown GMOs (quantitative differential PCR)**
- **Detecting stacked genes (genetic crossing of 2 GMOs)**



How to differentiate these 3 test samples?

# Conclusion

- GMO detection: first application of PCR to whole supply chain, first standards on PCR based detection
- Numerous issues in GMO detection area are similar to those faced by other detection fields
- Beside some “ideal” situations (quantification of approved GMOs), there are still numerous decisions to take in uncertain environments (e.g. probability of presence of unknown GMOs)
- DSS (Decision Support Systems) should be generalized to take harmonized appropriate decisions (lab and CA)



# Thank you for your attention...



**I am required by law to tell you that everything you ordered today may be harmful to your health.**

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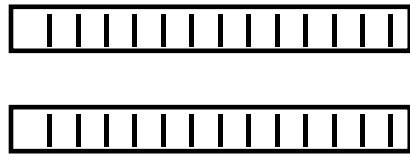
# Components of Identity Preservation Systems

IP systems trace the plant and plant products throughout the entire auditing process of the planting production, harvesting, handling, and marketing cycles.

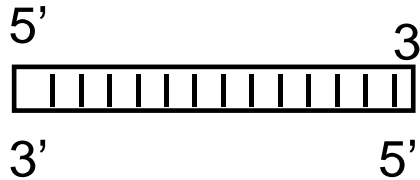
- 1) Seed purity tests
- 2) Previous filed/crop history (previous crops, weeds)
- 3) Field isolation (borders, barriers, planting and flowering times)
- 4) Planting (records of history of cleaning equipment, field inspections)
- 5) Harvesting (pre-harvest inspection records, equipment cleaning records)
- 6) On-farm storage (cleaning, product segregation)
- 7) Transport (all bins, truck, conveyers, elevators cleaned and recorded)
- 8) Wholesalers and retailers records
- 9) Export records and proper labelling



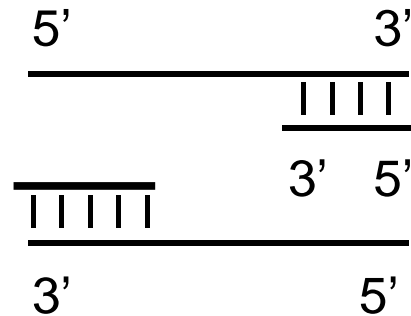
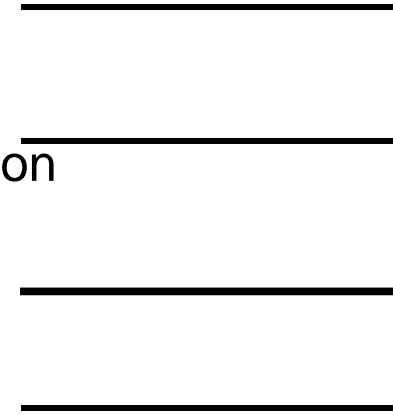
# The Polymerase Chain Reaction (PCR)



ds DNA



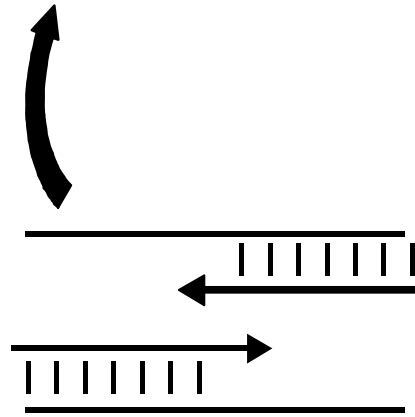
Denaturation  
(90-94 °C)



Primer  
hybridization)  
(35-72 °C)



after n cycles :  $(1+\epsilon)^n$  molecules  
with  $0 < \epsilon < 1$  to optimize



Elongation  
(Polymerization)  
By a DNA polymerase  
(72 °C)