Modelling needs for field crops sector

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March, the 24th 2017 - Lisbon – FOOD MC
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>2000</td>
<td>Lisbon strategy launched</td>
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<td>2005</td>
<td>French competitiveness clusters launched (3% of EU GDP in R&amp;D)</td>
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<td>2009</td>
<td>Phase 2 for clusters: « projects factory »</td>
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<td>2013</td>
<td>Phase 3 for clusters: « products factory »</td>
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<td>2018</td>
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French competitiveness clusters: their missions

Anticipate
Scientific, patent, technical, marketing survey

Collaborative project germination
Technical animation Networking

Sustain and assist projects
Funding management Project management

Private funding Internationalisation
SME assistance Competencies needs

RESEARCH – TRAINING - INDUSTRIES
Céréales Vallée Cluster
Challenges of the French agricultural production

1st agricultural power

18%  France
13%  Allemagne
14%  Pologne
10%  Royaume-Uni
7%  Roumanie
5%  Italie
2%  Espagne
7%  Autres

Breakdown of agricultural production - EU 28 (value)

1st grain producer

22%  France
16%  Allemagne
10%  Pologne
7%  Roumanie
5%  Italie
6%  Espagne
7%  Autres

Cereal production by country – EU 28 (volume)

Source: Eurostat 2016
Challenges of the French agricultural production

9,2 billion euros of trade surplus for agriculture

= 76 rafale planes
Challenges of the French agricultural production

70% of French farm production processed by the Agro-food industries
Challenges of the French agricultural production

New opportunities, future-oriented

20% of annual growth for the bio-sourced plastics market

28000 direct jobs in France in vegetal-based chemistry
Céréales Vallée, at the heart of worldwide challenges

Innovating to produce

More

Better

New things

To cope with supply shortages

In line with the economic, social and environmental requirements of sustainability

to produce foods with nutritional design in adequacy with targeted populations

Innovate new applications of renewable carbon
A cluster who enlarges its topic for a whole, sustainable and competitive approach of cereal systems

**Economic issue**
- To insure agriculture production resilience
- To take a chance on new markets opportunity
- To mutualise R&D

**Environmental issue**
- To propose alternative inputs solutions
- To diversify protein intakes and limit environmental impact of animal productions

**Societal issue**
- To fix on territory the high added value activities
- To create strong link between sectors
- To favour attractiveness for agricultural, food and feed jobs
10 years of innovation in cereals
Bringing together the whole field crop value-chain

From seed to consumer
10 years dedicated to catalyse innovation in cereal sector

- **309** Certified projects
- **556** partners in projects
- **95** partners out of France
- **524 M€** projects
- **76%** R&D
- **15%** Training
- **5%** International
- **4%** Industrial
- **39%** Public funds
- **61%** Private funds
Optimizing and increasing cereal production
Territorial Innovation Lab (LIT) for field crop in Auvergne – Living Lab

Excellence area
For Field crop Pioneer in Europe
- Welcoming space for projects blow-up
- Open and participative innovation
- Co creation with and for farmers
- Involvement of every concerning person in area
- Concept, Design, Diffuse innovating solutions
- Agroécology inspiration

Agricultural equipment
OAD
New sectors
Training tools
Sensors
Organisationnal innovation
Farming practices
Robot
New Products
New varieties
Biocontrol products
Scientific Knowledge
Project examples

- **MOPAD - Micro-Organisms for a Sustainable Agriculture**
  - To develop biocontrol approaches using micro-organisms or micro-organism extracts to control fusarium in bread wheat
  - micro-organisms found in soils (bacteria, fungi, oomycetes) and microbial and micro-algae
  - seed protection, pre-sowing and post-sowing spray treatments in fields

- **PARRASOL – For a renewable and higher rewarding farming through soil**
  - To Produce more, respecting environment, consuming less fuel and inputs, to enhance economic reward, to answer to arable areas decrease, world population increase and quality requirements
  - **Innovative tires** with better traction, lower compaction, added with soil sensors => tools for decision support
  - Math models for soil compaction and plant genetic phenotype
Modelisation needs in agriculture

- **Genetic data management**
  - To detect literature relevant information by numeric automatic systems
  - Combine genetic reading and relevant genomic analysis

- **Precision farming**
  - sensors, signal treatment
  - smart inputs and treatments,
  - climate change management

- **Grain quality management**
  - Grain filling scheme within plant growing
  - To anticipate grain quality for better transformation
Promoting transformation of cereals into high-quality animal feed and products
Project example

**STIMULUS** – Parietal degradation during Maize feed breeding in France – Study of Histological and biochemical parameters

- Breeding since 70’s: higher and stronger maize plant, more efficient against fall
- Different parietal structure and nutritional score for milk cattle
- NIRs Measurements
- Prediction model of nutritionnal value of feed from histological and biochemical analysis, and further more from genetic profil of maize

=> Better and quicker breeding
Modeling needs

- Nutritional value of feed
  - from biochemical analysis
  - From grain, through processes

- Image analysis to predict appetite
Satisfying basic for needs while balancing nutrition and qualities of use

- Optimisation of processing
- Meeting quantitative needs
- Health security
- Waste and consumables reduction
- Organoleptic qualities
- Nutritional intake
**Project examples**

- **NOMAC – New resources to control the digestion of cereal products**
  - Low energy cereal product to prevent obesity
  - Predict the in vivo energy intake depending on their structure
  - Gastric emptying and digestion kinetics can be adjusted thanks to natural diversity
  - Starch structure viscosity gastric emptying and glycemic index

- **GRANoFLAKES – to develop innovative solutions in maize sector for cornflakes**
  - Identify the best maize variety for cornflakes processes
  - Modelize components behaviour through extrusion to lead to an optimized cornflakes considering taste, structure and nutrition
  - Predict behaviour of cornflakes in milk (cold and warm)
  - Predict grain composition and structure through different varieties growing
Example: Structure of a maize grain
Quantification of germ, floury and vitrous parts by analysing grain section

Facilitate quality breeding
Modelling needs

- To improve product self-conservation
  - Modellise and predict lipid oxydation process
  - Modellise water and salt transfers

- Process flexibility and optimisation, higher rate, waste limitation
  - Cooking: heat transfert, « new » cooking process (microwaves ans ohmic)
  - Sourdough behaviour, fermentation step optimisation
  - Predicting dough behaviour in process from biochemical/rheological analysis
  - Oil extraction rate within nutritional preservation

- Quality prediction
  - Storage, drying of grain
  - Fail, braking, dust, weight loss

- Nutritional quality prediction from formulation
  - Specially for artisanal transformation, collective food cooking
Giving value to a renewable resource

- Recovering cereals constituents
- Process development environment-friendly
- Ensuring a circular economy
- Development of chemical intermediate from plant sources
Project examples

- **ECO-C-REAL – To optimize eco-extraction from bran with natural solvants**
  - Bran contains active molecules specially wanted by cosmetic, pharmacy or nutrition industries
  - Terpens are strong natural solvents (from wood or agriproducts) that can replace hexan
Modelling needs

- To optimize extraction rate

- To anticipate green chemistry processes
  - Fermentation, Bioconversion…

- Biomaterials
  - Technical behaviour
  - Permeability
How to work with Céréales Vallée’s members?
How to work with Céréales Vallée?

- Collaborative projects
- Business partnership
- PhD co-management
- Preliminary tests…

⇒ Cereales Vallee will bring you to qualified french industrial partners from cereales and fields crop sectors

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Cluster’s team

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