



cra-w

Walloon agricultural research centre

# ACTIVITY REPORT 2011/2012



Wallonie





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# ACTIVITY REPORT

## 2011/2012



Wallonie

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# Foreword

Research in the 2010-2012 three-year programme was centred on three main lines: improving the efficiency of labour and input, minimising adverse environmental impacts, and optimum utilisation of agricultural and horticultural products.

Experiments under controlled conditions at CRA-W's experimental site were accompanied by measurements and data analyses on working farms. The aim was to establish agricultural, economic and environmental management indicators in order to identify the most efficient production systems to make those farms more resilient to global climate, socioeconomic and other changes.

Data collected via observation networks were used to build decision support tools in such areas as tillage, fertilisation, cattle feed and plant protection product applications.

Exploitation of resistance genes and understanding of the biological cycles of both nutrients and bioaggressors, along with increasingly accurate determination of harmfulness thresholds, should enable input to be minimised in line with expected results and energy costs to be controlled.

However, only producing does not make a farm profitable; the products also have to be marketed at the best possible price, the quality of the products must be recognized and, if possible, the returns increased via buoyant downstream sectors following processing or extraction of valuable substances (various biobased compounds, substances with health benefits) with high added value.

Work in the last two years has focused on developing rapid, efficient methods for verifying the quality and origin of conventional and organic agricultural products (spectrometry, microscopy, chromatography and near and mid infrared mass spectrometry, molecular biology techniques like PCR and proteomics, etc.).

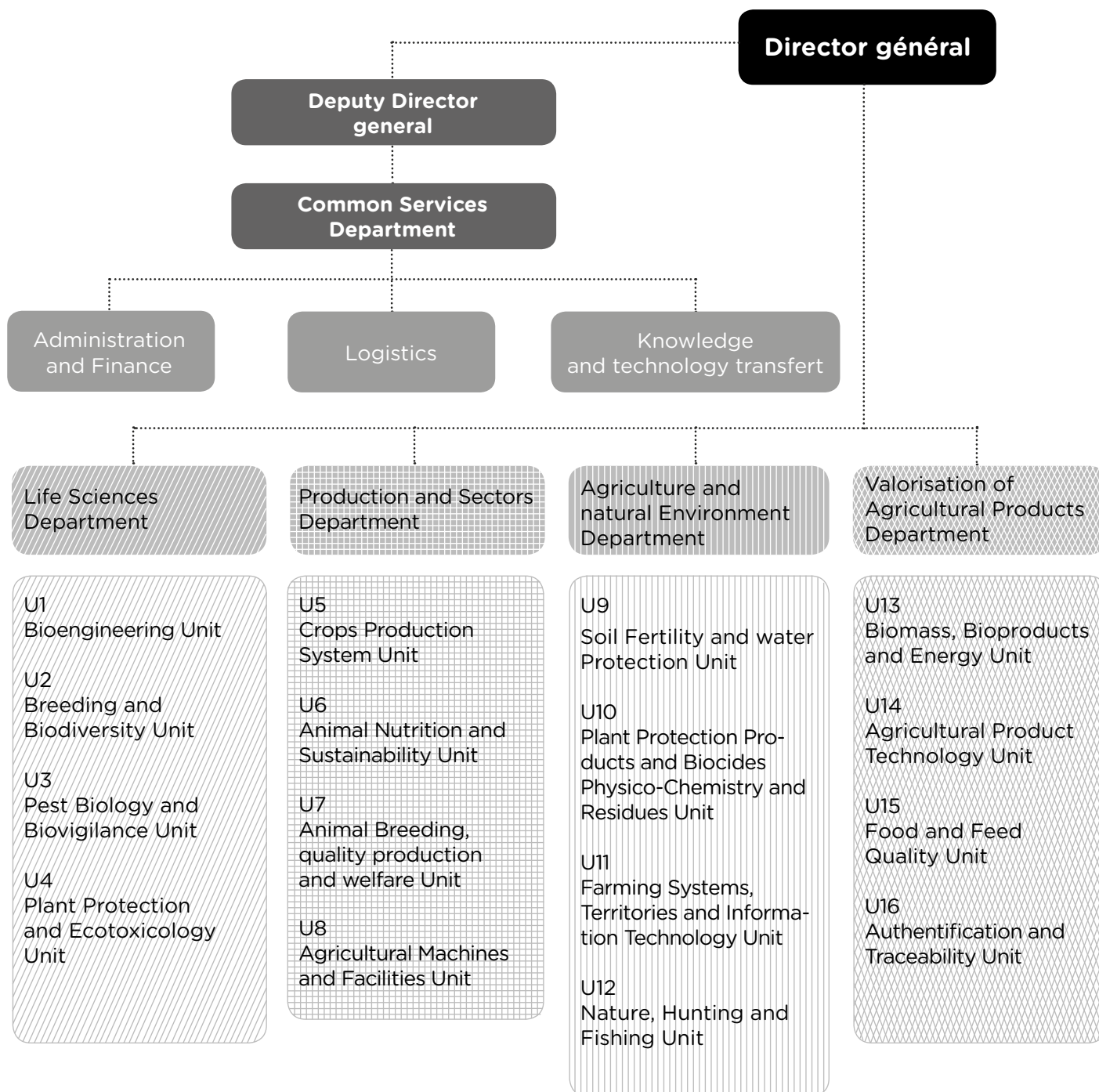
The same techniques are used for input quality assurance (cattle feed, plant protection products) and detecting adulteration (MBM or GMO in cattle feed) or contamination (mycotoxins in cereals).

Society's high expectations as regards the environment and animal welfare have been taken into consideration and, in particular, ways of reducing greenhouse gases (e.g., methane from ruminants) have been identified, a program has been developed for assessing the risk of water pollution by pesticides, herd management methods that minimise animal stress have been researched, and alternatives to surgical castration of male piglets investigated.

In the 2013-2015 research programme CRA-W intends to step up its work on alternatives to current production systems, which are likely to be undermined by the new CAP provisions, on the one hand, and rising energy and input costs, on the other. Ecologically intensive agriculture appears to be the way forward for Wallonia's farmers, for both the conventional and the organic routes, and CRA-W will continue to support its development..

**Jean-Pierre Destain**  
*Director general ff*

# Organisation chart of CRA-W

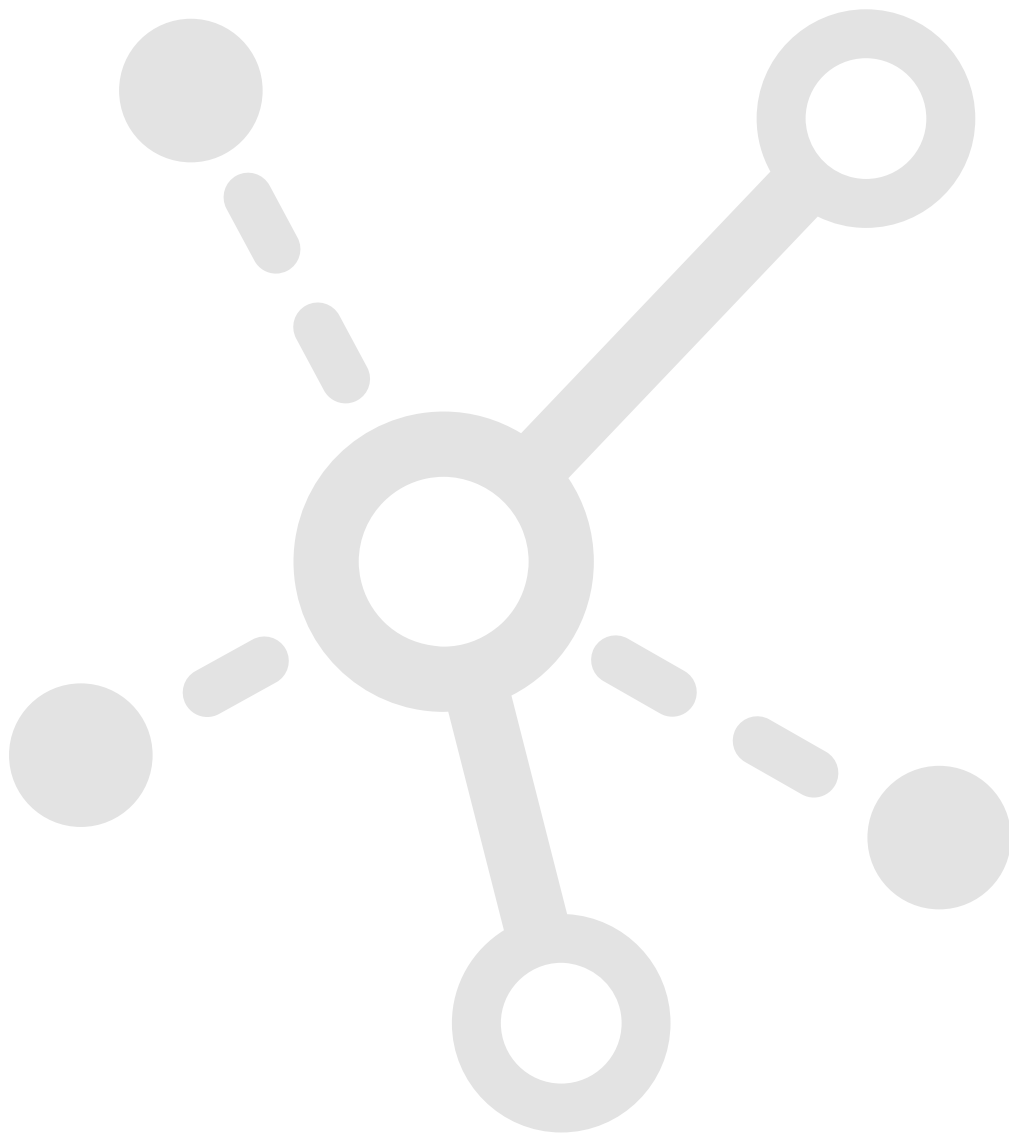






PART I:

Structure of CRA-W





## Department 1 “LIFE SCIENCES”

The work of this Department is based on a detailed understanding of the living world, its organisation, complexity and interactions. Drawing on recent progress in the various areas of modern biology, it thus contributes to designing new products and processes, maintaining genetic resources, improving cultivated species, protecting crops and the environment and optimising cultural practices.



### **Bioengineering Unit**

Develops and generalises mastery of biotechnology tools for the benefit of other agricultural research disciplines (developing innovative methods in the area of in vitro multiplication, genome and proteome characterisation and biomolecule interactions).

### **Breeding and Biodiversity Unit**

Devises strategies for maintaining existing biological resources and developing those resources by breeding new varieties that meet the latest requirements and constraints.

### **Pest Biology and Biovigilance Unit**

Combines approaches and tools for identifying and characterising bioaggressors and their impact on agro-ecosystems. The Unit also develops sentry systems for early detection of pest movements and spread.

### **Plant Protection and Ecotoxicology Unit**

Aims to improve disease and pest control knowledge, notably contributing to the managed use of biocides according to the agricultural, economic and environmental context.

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Life Sciences Department

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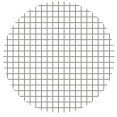
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## Department 2 “PRODUCTION AND SECTORS DEPARTMENT”

This Department’s research is aimed at productive agriculture with a high ecological value.

- Producing food, energy, materials and active ingredients in a limited area for a steady income.
- Producing differently by reducing energy intensity, endeavouring to develop more resilient systems in an unstable economic environment and climatic conditions, and integrating agriculture with the ecosystems within which it operates.

In other words, assisting the industry by developing more sustainable and suitable plant and animal products, taking a balanced and integrated approach to economic, agricultural, ecological and social interests.

### Crop Production Systems Unit

Produces benchmarks, in terms of crop management with special attention to choice of varieties and nitrogen fertilizer management, for all traditional crops in Wallonia and also for specialist, horticultural or diversification crops.

Develops decision support tools to refine this management approach and defines optimum cropping systems at rotation and crop sequence level.

Carries out analysis and monitoring of Wallonia’s agricultural economy and Common Agricultural Policy.

### Animal Nutrition and Sustainability Unit

Develops animal feed strategies that meet the animals’ nutritional and health needs, with special attention to the impact of those strategies on the environment and with the aim of producing human foodstuffs that have added value in terms of nutritional quality.

### Agricultural Machines and Facilities Unit

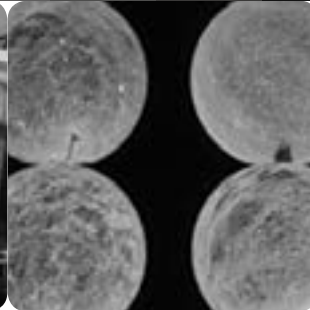
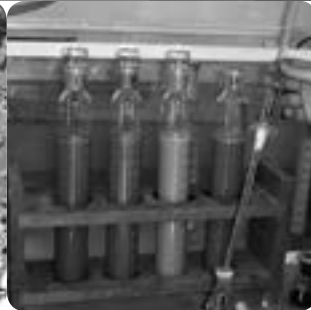
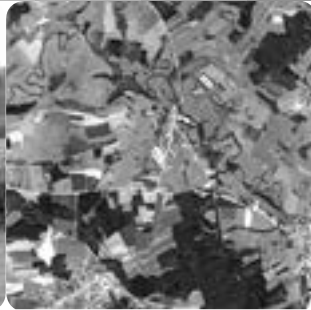
Rationalises the technical, economic and ergonomic resources used in terms of agricultural mechanisation and facilities, having regard to greater environmental protection in order to promote sustainable agriculture. Special attention is paid to efficient energy management in agricultural systems and sectors.

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## Department 3 “AGRICULTURE AND NATURAL ENVIRONMENT DEPARTMENT”

This Department’s research topics focus on sustainable agriculture, the adaptability of agro-systems to global changes, protection of natural resources and the environment and the balance between production methods and society’s expectations.

### **Soil Fertility and Water Protection Unit**

Provides benchmarks to guide choices in the area of tillage techniques and input use policy in order to maintain or improve soil fertility and to make production sustainable in terms of economics and environmental pressure.

### **Physico-Chemistry and Plant Protection Product and Biocide Residues Unit**

Studies the physico-chemical properties of plant protection products and biocides and their fate in crops, agricultural products and the environment.

Develops and validates analytical methods for active ingredients, impurities, residues and metabolites.

### **Farming Systems, Territories and Information Technology Unit**

Develops tools to meet society’s new expectations, and decision support systems to improve the technico-economic and environmental performance of farming systems.

Promotes a sustainable link between agricultural enterprises and the territories where they operate.

### **Nature, Hunting and Fishing Unit**

Researches ways of conserving nature, wildlife, game and fish, and biological water quality.

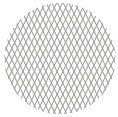


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## Department 4 “VALORISATION OF AGRICULTURAL PRODUCTS DEPARTMENT”

The work of this Department involves characterising products and diversifying Wallonia’s agricultural sectors in order, on one hand, to maintain sustainable production and, on the other, to ensure consumers are sufficiently supplied with healthy, quality products.

### **Biomass, Bioproducts and Energy Unit**

Contributes to socio-economic development and a better environment by making more complete, more efficient use of biomass in energy recovery and industrial applications.

### **Agricultural Product Technology Unit**

Investigates the suitability of plant or animal products for processing and researches new ways of utilising such products.

### **Food and Feed Quality Unit**

Develops analytical solutions for rapid, non-destructive, environmentally friendly testing of agricultural products, by-products and end products for food and non-food use.

### **Authentication and Traceability Unit**

Develops and applies molecular biology and microbiology analytical techniques in order to authenticate primary and processed agricultural products.

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Valorisation of Agricultural Products  
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## Department 5 “COMMON SERVICES”

The role of Common Services is to support the Research Departments, harmonise CRA-W's administrative and financial management, provide logistical services to underpin its development, and exploit research results more effectively. It comprises a team of fifty people working in three sections:

- Administration and Finance
- Logistics
- Knowledge and Technology Transfer

### **Administration and Finance comprises:**

**Human Resources**, which looks after all aspects of CRA-W staff careers, from hiring or recruitment through to the end of their posting with the Centre. As well as managing a large number of hirings and contract renewals, implementing the new civil service code and managing staff career development formed another part of the HR Unit's work in 2010. This section manages the staff organisation chart and has worked hard at implementing the Capello programme (pensions system).

**Salaries Management** administers payments to staff, i.e., salaries, bonuses, allowances and travel expenses, as well as sick leave, workplace accidents and business assignments. Several improvements have been made to the way the section is organised. Current major projects are optimised family allowance management and the staff management plan.

**Accounts** carries on its day-to-day work of CRA-W's accounting, financial and budget management. The unit also spent a considerable amount of time on the 2007 to 2009 year-end work.

Also as part of the new structure a **Purchasing Unit** was formed to handle all the Centre's 'non-scientific' supplies, services and works. In that capacity the unit issued and oversaw a number of procurement contracts, thus facilitating the operation of the research units. Finally, Administration and Finance houses **the administration and finance correspondents** who provide a front-line service in all the departments and research units and also within Common Services itself in connection with personnel management (work assignments, leave, records) and purchasing, in liaison with Human Resources, Salaries Management and Accounts. This is an essential service as CRA-W'S research departments and units are scattered over 10 sites (Gembloux and Libramont-Mussy).

**Logistics** comprises two departments: Facilities and IT.

**Facilities** carried out a major inventory of common equipment in the CRA-W buildings to identify the most pressing problems. Some of these were solved straight away and a plan of action was drawn up for 2011-2013. Likewise, the important matter of environmental permits and environmental upgrading of the CRA-W buildings is now handled centrally to speed up implementation. It may nevertheless be mentioned that since 2007 CRA-W has devoted nearly 3 million euros to making its facilities secure and upgrading them to meet environmental regulations. CRA-W has also embarked upon ISO 14001 certification, which is expected to be completed in 2014.

**IT** provides an efficient on-the-spot service despite being short-staffed. The unit is implementing the investment plan for improving and harmonising IT operations at CRA-W.

**Knowledge and Technology Transfer** currently comprises the Communications unit and the Quality Improvement Office.

As its name indicates, *Communications* handles the Centre's various communication activities in close cooperation with the research units represented in the Communications Unit. Among other things, Communications helps departmental staff to organise seminars and events such as Carrefour des Productions Animales, pork and poultry product seminars and White Book events. It sets up and runs our stands at agricultural fairs. It compiles, formats and publishes CRA-W Info, our quarterly newsletter.

*The Quality Improvement Office's* remit is to develop and improve quality throughout CRA-W. To that end it assists each department or laboratory in setting up and maintaining a quality system in line with its activities and with clients' and beneficiaries' requirements. To simplify and improve consistency between quality systems the Office, with the assistance of the departmental quality correspondents, has made it a priority to harmonise procedures between organisations and/or frames of reference.

The quality procedures developed by CRA-W are mainly applied to analytical services, based on the ISO 17025 standard and Good Laboratory Practice (GLP). Over the last two years, however, these quality systems have been extended to sprayer testing (ISO 17020 accreditation pending) and cereal assessment (DHS tests (Distinction-Homogeneity-Stability)), according to the CPVO (Community Plant Variety Office) frame of reference.

The Quality Improvement Office has successfully centralised CRA-W's ISO 17025 quality system. All our laboratories are now covered by a single accreditation, thus enabling CRA-W's quality drives to be rationalised and harmonised. The Office has also worked at devising a quality development programme for CRA-W's research activities. The preliminary three-year plan was completed in 2012 and will be followed by a second phase of putting research quality methods into concrete form.

The *Procurement Contracts Supervisory Unit* continues its work of assessing and validating all CRA-W's procurement contracts and research agreements/contracts. Its workload has steadily increased from year to year because of, firstly, the need to oversee security work and environmental upgrading of the CRA-W buildings and, secondly, the growing new activity of the Purchasing Unit. This unit now reports directly to the CRA-W Director General, along with the Financial Control and Health & Safety units.







PART II:  
Researches 





## Line 1

### Improving the living environment, protecting the natural environment and producing in a sustainable manner

#### AIM

PROTECTING AND MANAGING PHYSICAL RESOURCES (SOIL, WATER, AIR) BY ADAPTING CROP AND ANIMAL PRODUCTION SYSTEMS.

#### ► Cutting fuel consumption

Efficient 20 is a European project within the Intelligent Energy Europe (IEE) programme. The European Union has set a target of 20% energy savings compared to the projections by 2020. Efficient 20 is designed to encourage farmers and foresters to contribute to reaching that goal. The focus is put on fuel used in farming machinery, which represents more than 50% of the energy consumed in agriculture.

This three-year project, jointly financed by the European Union, was launched in May 2010 and spans nine countries.

In the light of steadily rising petroleum product prices and the ever-present environmental considerations, this project can provide some of the answers which the agricultural and forestry sectors increasingly expect, through data collection from farms, local initiatives by pilot groups of farmers, exchanges of views between partners, etc. The EFFICIENT20 project has therefore set up a European Network dedicated to fuel savings in these sectors. The network is currently producing documents for distribution to users.

[www.efficient20.eu](http://www.efficient20.eu)

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#### ► Reducing the volume per hectare in cereal weeding

Although the average volume per hectare applied to field crops in Belgium is still somewhere between 150 and 200 L/ha, the trend is a downward one. This reduction is altering the quality of the spray deposits, which could impair their biological effectiveness. The primary aim of the study is to determine the limits of such a reduction (200 → 100 → 50 L/ha) according to the mode of action of the plant protection product (systemic, contact), the type of nozzle (conventional flat fan or air induced), and possibly also the atmospheric conditions (RH% and T°). A secondary aim is to determine the necessary and sufficient characteristics of the spray deposit for satisfactory biological effectiveness. The results clearly show a drop in the contact treatment when the volume/hectare is less than 100 L/ha. Using conventional flat-fan nozzles can partly offset this adverse effect. As regards the deposit characteristics, the coverage (%) is a direct function of the volume per hectare applied. The density and size of the impacting droplets, on the other hand, depend more on the nozzle type and size. Temperature and relative humidity do not impact significantly on the coverage, but conversely they do affect the droplet size.

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► **N management, good agricultural practice and PLN in vegetable crops for the fresh market**

Launched in 2002, the PGDA scheme for sustainable nitrogen management in agriculture, which transcribes the 1991 European Nitrates Directive into Wallonia's legislation, aims to check the pollution of natural water by agricultural nitrates. The reference value used by the Government for this purpose is the Potentially Leachable Nitrogen (PLN) measurement. At present, a single PLN benchmark is established each year for vegetable crops, but only for produce for industrial processing. These standards do not currently cover market garden vegetables for the fresh market. However, previous research projects undertaken by CRA-W's Crop Production Systems Unit revealed recurring higher soil nitrogen profiles in a number of market garden plots, often far exceeding the PLN reference values set for industrial vegetables. Unless the growers concerned are made aware of the issue and encouraged to alter their nitrogen fertilisation methods, they are ultimately likely to find themselves unable to meet the PGDA scheme requirements.

Against this background the project aims to define the specific production systems used in the fresh market garden crop sector in order to identify those agricultural practices that should be outlawed or, conversely, fostered in order to achieve nitrogen profiles compatible with a sustainable market garden sector in Wallonia. The research conducted since July 2011 is based on a survey of growers, a soil sampling campaign and analysis of the resulting database. The project may lead to consideration, in close consultation with the PGDA supervisory structure, of the usefulness of specific PLN reference values for the fresh vegetable market sector.

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► **Managing late autumn grazing and the nitrate leaching risk**

Several European Directives, such as the Nitrates Directive and the Water Framework Directive, have been established in order to maintain and improve surface water and groundwater quality. Wallonia has implemented these Directives in a sustainable nitrogen management plan (Plan de Gestion Durable de l'Azote - PGDA) which gives pasture special status, allowing organic nitrogen application up to 230 kg/ha, including inputs from grazing animals. However, because of their heterogeneous distribution across the meadow and high mineral nitrogen content, grazing animal inputs represent a potentially high loss risk at the back end of the year. Grazing therefore has to be carefully managed to limit this risk.

To explore this problem, a five-year study of the possible link between the autumn stocking density (gradient from 135 to 366 LU.day/ha between 1 September and 30 October) and the nitrate leaching risk was carried out at the Mussy-la-Ville experimental site. Potentially leachable nitrogen (PLN) levels were found to be significantly affected by the year of measurement, with the values for 2010, averaging 9 kg nitric nitrogen per ha, being perceptibly lower than the 23 kg/ha recorded in 2005. The autumn stocking density proved to have only a marginal effect on PLN levels, with the highest densities resulting in average levels of 16 kg nitric nitrogen per hectare per year as against 12 kg at lower stocking densities.

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### ► **VEGEPHY: vegetable oil based formulations for plant protection**

European policy on the sustainable use of plant protection products requires member states to put in place measures to reduce the risks of their use. Belgium and France have joined forces on the VEGEPHY project, launched in January 2010 for a three-year term, with the intention of putting a new range of 'greener' plant protection products on to the market.

The project aims to replace the mineral oils used on potato plantlets with processed vegetable oils with similar plant protection properties. The project also aims to use the knowledge gained to produce vegetable-oil based ready-for-use additives to enable plant protection products to be applied at lower rates without compromising their effectiveness. Vegetable oils have the advantage of being non-toxic to mammals, readily biodegradable and having a low environmental impact.

This project pools both countries' private-sector and public-sector expertise: Mosseman SA, Vandeputte Oléochemicals SA, Redebel SA, Comptoir Commercial des Lubrifiants (CCL), Comité Nord (Plant de pomme de terre), Université de Technologie de Compiègne (UTC), Université de Picardie Jules Verne (UPJV), Gembloux Agro Bio Tech (ULg) and CRA-W. On the Walloon side the project is subsidised by SPW (Department of the Economy, Employment and Research) through the European Union (Eureka).

Within the framework of this project CRA-W is specifically investigating pesticide residue aspects in wheat and potatoes, to ensure that the use of these new products will not increase the risk of consumer exposure to pesticide residues.

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### ► **Assessment of pollutant flows from fertilizers used on agricultural land in Wallonia**

With the aim of pursuing sustainable development and preventing diffuse pollution from fertilizer use, the Department of Agriculture, Natural Resources and the Environment's Soil Protection Department asked CRA-W to make an assessment of potential sources of pollution by metal trace elements (MTE) occurring in the different kinds of fertilizers used in Wallonia.

An inventory was drawn up to determine the fertilizers most commonly used in the region and to identify those posing a potential risk to the environment. The assessment was made by sampling targeted fertilizers and determining their MTE content.

Fertilizer use databases were compiled from various sources in order to estimate the quantities of mineral fertilizer, farmyard manure and exogenous materials applied to farmland in different parts of Wallonia. MTE flows entering the soil are the product of the quantities of fertilizer applied multiplied by the analytical MTE content.

Of all the MTE covered by the study, farmyard manure was found to be generally the primary source of pollution, notably by As, Cr, Cu, Hg, Ni and Zn. Mineral fertilizers were a major source of As, Cd and Pb flows. Exogenous materials generally accounted for only a small part of the MTE flows, as the quantities spread were relatively small. Generally speaking, the calculated flows were perceptibly lower than the current standards and therefore, in the present state of knowledge, do not pose an environmental risk.

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## AIM

### ENHANCING AND PROTECTING BIOLOGICAL RESOURCES AND LAND AND AQUATIC ECOSYSTEMS

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#### ► **Earth observation techniques as a back-up to damage assessment systems in crop insurance**

Farmers in Europe could soon find their income becoming more unstable because of the risks of price fluctuations and the increasing prevalence of unusually severe weather events. Better provision for natural risks is therefore desirable. In Belgium, some agricultural risks are covered by the Disaster Fund and the department responsible for managing this fund wants to get the system operating more efficiently by improving the claim handling procedures (cutting the time taken to acknowledge disasters, standardisation of claim processing). Moreover, a European Commission Regulation now allows measures to be put in place to compensate farmers for their losses due to bad weather. The Regulation proposes claiming under crop insurance as a back-up or an alternative to the agricultural disaster scheme.

In this context the ADASCIS project has provided a tool for tracking yield indicator movements, identifying risk areas and assessing agricultural losses following a disaster. The prototype application developed uses data obtained from satellite imaging and agro-meteorological data and provides a general assessment of damage at regional level. With regard to crop insurance the tool maps the risks for a better understanding of the necessary conditions for developing products to serve the needs of the private sector and the authorities.

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## AIM

### IDENTIFYING, DESIGNING, DEVELOPING AND PROMOTING SUSTAINABLE PRODUCTION SYSTEMS AND METHODS

#### ► **Development of the industrial hemp sector in Wallonia**

An action plan to reintroduce industrial hemp growing in Wallonia was launched in 2011 within the framework of a development project funded by SPW, in partnership with the Walloon Hemp Association, covering the 2011-2014 period. Industrial hemp in fact offers attractive potential for diversification and development in Wallonia.

The project aims to:

- Make the sector more dynamic by giving the players a structure within which to operate and helping them to solve any problems arising. The project also aims to develop hemp-related activities in Wallonia, for example increasing the area under cultivation, finding new outlets, demonstrating and proving the quality of products made from industrial hemp.
- Promote the sector as a whole, by informing all the players (growers, processors, distributors and consumers) about industrial hemp's many properties in its various forms, making it clear that cultivated hemp is very different from illegal cannabis.

Some research and development projects have also been set up with different partners to look at hemp growing and various commercial products. CRA-W is involved in experiments in such areas as improving crop growing practices and harvesting methods, assessing the effectiveness of hemp mulching, and research into substances with therapeutic effects.

Following on from the work done in 2011 (in particular, a seminar bringing together potential players in Wallonia, who tend to operate in isolation), the sector showed real dynamism in 2012 and a number of Walloon associations were formed:

- Belchanvre (an agricultural cooperative with 30 members aiming to take charge of their own crop processing)
- IsoHemp (making hemp lime blocks for the construction industry)
- IsoNext (to produce insulating wools)
- CMH (association formed by three farmers who have purchased a mechanical cutter specifically for harvesting hemp)

Other players are already well established in Wallonia:

- ChanvrEco (produces hemp fibre pellets for the construction industry and horticultural mulching)
- EVIA partner (hemp lime render specialist)

In view of the dynamism shown by industry players in Wallonia, industrial hemp growing is well on the way to becoming re-established. The target area under cultivation in Wallonia is 200 ha in 2013.

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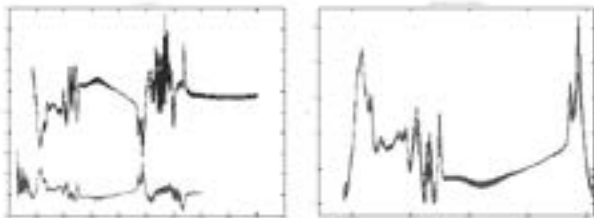


### ► Dairy farm management indicators - the usefulness of the MIR spectrum as an analytical tool

The OptiMIR project arose out of an association of research centres and milk recording bodies in six North European countries, the aim being to create new dairy farm management indicators directly from the mid infrared (MIR) spectrum of the milk. These tools will enable producers to check their cows' status and will thus facilitate herd management. The MIR spectrum of the milk is thus deemed to reflect the cow's physiological state at any given time. Indicators will be created for four areas of interest:

- cow health (e.g., detecting mastitis)
- fertility (e.g., detecting heat)
- nutrition (e.g., preventing acidosis)
- environment (e.g., methane emissions)

They will be designed by pooling the physiological and spectral data from all the countries taking part in the project in an international database. To be able to group and use MIR spectra from different equipment they need to be standardized in a common form. Because of its expertise in this field CRA-W has been appointed to take charge of this crucial stage of the project, i.e., developing a standardisation procedure. This will erase the response differences between the spectrometers used by the project partners so that they can be compared with one another and the appropriate spectral corrections for each instrument can be made.



Two cow's milk MIR spectra before and after standardisation

This project is subsidised by Interreg IVB and the Regional Government of Wallonia for a period of five years.  
<http://www.optimir.eu>

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### ► Integrated parasitism management in young dairy cattle at grass

Parasitism management is a key part of raising heifers. Practices vary considerably, however. This project was set up in cooperation with FMV-ULg to optimise practices. We monitored heifers in the first year of grazing, looking at grazing management, growth and feeding, and determining the parasite pressure. Continuous, moderate contact with the parasite activates the animals' immune systems without impacting upon growth.

Assessing the grass height avoids too close grazing, which increases the parasite risk, and the animals can be moved to another field or supplemented when the grass is less than 5 cm tall. An initial examination of the parasite pressure (faecal analysis) is carried out in summer to establish whether the cattle are excreting parasite eggs and if so, in what quantities. Heifer growth is also estimated by measuring heart girth. A second examination is made when the animals are brought indoors again, with another faecal analysis and growth measurement. Blood pepsinogen is also determined to provide information on the level of abomasum infestation by digestive strongyles.

The results point up three main prerequisites for managing parasitism in heifers: knowing the parasite (cycle), knowing the farm's parasitism history and having pasture management tools available. For the most effective treatment, grazing and animal growth need to be monitored and the best product to deal with the existing parasite pressure should be chosen.

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► **Using LCA to assess the environmental performance of livestock farming systems and identify systems to be promoted**

Anthropic activities play a prominent role in environmental damage, in particular through sizeable greenhouse gas (GHG) emissions and the use of non-renewable energy sources. These issues are challenging the way our societies operate and are increasingly becoming part of national, European and global policy. In this context the livestock sector is regularly criticised for its contributions to greenhouse gas emissions and, thus, to global warming.

How can these negative externalities be reduced without harming other dimensions (impact of systems on eutrophication, acidification, etc.)? This is what the Qualaiter and Acyvibo projects are exploring for the dairy and beef cattle sectors, respectively, using the life cycle analysis method. The literature review part of these projects has already highlighted the big part played by the production phase (farm and upstream) on a number of environmental impacts. The projects have therefore been oriented to the production phase. Impact assessment methods have been devised and tools (Simapro and Eden programs) and skills (training, conferences, exchanges of views with prominent researchers in this field) have been acquired for the purpose of carrying out life cycle analyses (LCA) in cattle production systems. Another significant area of work in 2011-2012 involved identifying and applying reference methods to take account of the specific features of the Walloon context (fertilizer management, pedoclimatic conditions, stocking density, etc.).

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► **Assessment and development of a tool for improving the energy and greenhouse gas (GHG) emission balances of Wallonia's agricultural systems**

The issues of saving energy on farms and developing renewable energy sources to meet their energy needs, together with the topic of greenhouse gas emissions, are at the forefront of current concerns at both economic and environmental level.

In this context, the results of the INTERREG OPTENERGES project illustrate the range of performance ratings on livestock farms with different management methods and intensity levels. For example, average GHG emissions from dairy farms vary from 7,000 to 11,000 kg CO<sub>2eq</sub>/ha (+ 57%) in the case of extensive systems in Lorraine and intensive systems in the province of Luxembourg, respectively, whereas under the same conditions the emissions per litre of milk are similar at 1.3 to 1.4 kg CO<sub>2eq</sub> (+ 8%).

These results show that not only pedoclimatic conditions but also national and regional legislation (land management and cost, transfer of rights, tax system, etc.) affect the type of stock farming carried on in a region and, thus, the environmental pressure brought to bear by that activity (per hectare GHG emissions). However, the environmental footprint of the product (kg CO<sub>2eq</sub>/litre of milk) remains very similar irrespective of the production system. Based on these findings CRA-W is developing a tool for adoption as a benchmark in Wallonia which will use specific regional emission factors to characterise.

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► **Optimising the socio-economic and environmental performance of dairy systems on the basis of a network of pilot farms throughout Western Europe**

Price volatility, new environmental regulations and society's demands are pushing dairy farmers to evolve and innovate. The primary objective of the DAIRYMAN project (an Interreg IV-B NWE funded project involving Dutch, French, German, Irish, Belgian and Luxembourg partners) is to help farmers to improve their environmental and economic performance in order to ensure the overall sustainability of the dairy industry. A number of descriptive parameters have been established and balances produced (nitrogen balance, economic audit, greenhouse gas audit, etc.).

The Netherlands and Flanders, for instance, can be considered very intensive, with a nitrogen balance of 195 kg nitrogen/ha on average, and very efficient in terms of production, losing only 10 and 15 kg of nitrogen, respectively, per tonne of milk produced. Wallonia, meanwhile, is close to the average for the project partners with a figure of 164 kg nitrogen/ha.

The carbon footprint of Walloon farms was also calculated with the aid of two tools. The results were 1.39 kg equivalent CO<sub>2</sub>/kg of milk and 12,761 kg equivalent CO<sub>2</sub>/ha. These results will be compared with results for other regions. They cannot therefore be considered 'high' or 'low', but correspond to the values obtained on another INTERREG project, the OPTENERGES project covering Lorraine, the Grand Duchy of Luxembourg (GDL) and the Province of Luxembourg. In this context the averages for 32 Walloon farms were the highest at 1.41 kg equivalent CO<sub>2</sub>/kg of milk compared with 1.28 and 1.33 for the GDL and Lorraine, respectively, and 11,029 kg equivalent CO<sub>2</sub>/ha compared with 9,267 and 7,152 for the GDL and Lorraine, respectively.

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► **Development and roll-out of a farm sustainability continuous improvement drive**

The food challenge and environmental issues have put farming at the centre of many debates nowadays. In view of the scope of the challenges facing the sector it must be helped to innovate, to take greater account of the people involved in farming, to integrate the environment more fully into farming choices and to open up promising new avenues.

The complexity of the constraints that have to be managed indicate development pathways which empower farmers in order to take greater account of the specific features of each farm, the surrounding area and the partners and sectors they work with. This approach gives rise to a continuous improvement process starting from the farm's current situation and level.

The 110 farmers involved in the Interreg DurAgr'ISO14001 project (65 in Picardy, 30 in Wallonia and 15 in Flanders) were endeavouring to ensure the agricultural and economic sustainability of their farms through specific, structured initiatives. The project partners helped them to put that desire into concrete form by setting up an internationally recognized ISO 14001 environmental management scheme and by defining an integrated strategy based on Corporate Social Responsibility.

The project was completed at the end of June 2012 with four main results:

- Transfer of a method initiated in France ten years ago, at the request of Picardy farmers acting as forerunners
- Adaptation of French computer tools to the Walloon and Flemish contexts (tools for environmental analysis and assessment of regulatory compliance)
- Creation of an ISO 14001 certified federal association of Belgian farmers
- Helping 18 Belgian farmers obtain ISO 14001 environmental certification. This is the first group environmental certification in Belgium's farming sector. These 18 farmers join the 215 French farmers already certified through the Terr'Avenir network.

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► **Development of a method for characterising and comparing stock farming practice systems with a view to integrating them into decision support systems developed for farmers**

The great structural and functional complexity of agroecosystems and the changing and uncertain context in which they operate have prompted the scientific community to develop a number of decision support systems (DSS). Essentially based on optimisation methods and experimental data, the models built from these DSS seldom include descriptors for the human aspect of farm management, i.e., the players' ideas, practices and motivations.

Within the framework of the MIMOSA project, funded under the Moerman Act on tax exemption, we developed a novel computer tool for modelling farmers' practice systems in cooperation with UCL-ELI.

Data collection and processing used methods derived from the social sciences (comprehensive interviews and coding of qualitative data) and computer science (modelling and programming). **Each interview was processed by the researcher to produce an individual cognitive chart considered to be a qualitative representation of the farmer's system of practices.**

In addition, the program provided (i) a statistical comparison of farmers' practices classed by typological groups (type of farming, regions, etc.) and (ii) identification of contrasting practice systems, using clustering methods.

The method thus developed was applied to a particular case in Wallonia: fodder management by stock farmers in the Ardennes and Famenne. Our method can, for example, be used to assess (i) farmers' ability to adapt and (ii) the resilience of farms and agroecosystems.

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► **Analysing the diversity of dairy and suckler farms, identifying innovative systems and analysing ways of transition towards sustainable stock farming models**

The thesis sets out to analyse the diversity of specialist dairy cattle systems in Wallonia in terms of sustainability in order to identify innovative production systems, analyse possible ways of transition from the present systems towards sustainable systems, and analyse the resilience of the systems considered with respect to the changing context in which they operate.

The method followed combines a technical approach (literature review, multivariate analyses and modelling) with a sociological approach (field surveys). At this stage, the diversity analysis has been performed for 2008 from data for a sample of 479 dairy farms. Five main systems, essentially differing in terms of structure (proportion of grassland within the fodder-growing area and proportion of crops within the UAA), production intensity (livestock density, production per head and per hectare) and economic and environmental performance, were identified. Within these systems, twenty-seven marginal farms stand out. Of these, seven were defined as innovative because they turn in a better environmental and/or economic performance than the main system of which they form part.

The next phase of work will focus chiefly on characterising these farms in greater detail. This analysis will also be linked to the results of the interviews with various players in Wallonia's dairy industry in order to characterise the way these players regard innovation and the sustainability of these stock farming systems.

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► **DODDE: impact of cattle pesticides on the insect fauna involved in cow dung degradation**

The DODDE2 project aims to create tools and develop expertise for assessing the ecotoxicological effects of pesticides administered to cattle and then to provide the best possible advice and support to farmers and vets with a view to more environmentally friendly pest control.

ULg is the project sponsor and is in charge of supervision and extension. CRA-W is responsible for the in situ trial aimed at validating the conclusions of the reference methodology established as part of the DODDE1 project for risk/benefit analysis of the environmental ecotoxicity of veterinary medicines.

The trial involves a comparison of the effects of various active substances having an antiparasitic action on the insect fauna responsible for cow dung degradation. The methodology used has been standardised at European level, but the monitoring method is novel and specific to CRA-W. It is an easy way of collecting in situ insect fauna (Coleoptera, Diptera and others) emerging from individual cowpats from cattle that have received different treatments, the cowpats subsequently having been exposed to natural insect colonisation.

The primary aim is to understand the qualitative and quantitative biodiversity of coprophagous insects developing in the faecal matter of cattle treated with various active ingredients. Secondly, the results will be utilised to point farmers towards the most favourable treatments in terms of protecting environmental biodiversity, considering not only coprophagous insects but also their predators, such as bats or the Loggerhead Shrike, whose survival depends on it.

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► **Determining a farm's sustainability, a necessary vision for a secure future**

An in-depth analysis of the sustainability of fifty dairy farms as part of the DuraLait project will help farmers to choose from the numerous options available in order to optimise the required efficiency of their operations. The study takes a practical approach, focussing solely on certain production methods. Three audits will be carried out on each farm: a sustainability audit (IDEA method) and two more specific audits of the economics and working time (labour audit method). Production methods differ in terms of economics, sustainability and management. With regard to working time, farm size and labour are generally the most significant factors. Each production method has its advantages and drawbacks and these are what the DuraLait project aims to point up.

In 2008, the cost price was €44.5/100 L of milk, factoring in family labour. That resulted in a book loss of €2.2/100 L. However, leaving out the 'family labour' component, the book profit was €10.7/100 L. One of the defining characteristics of dairy farming is the high level of work required (daily tasks). On average, it takes one hour's work to produce 152 L of milk. Milking takes up half of the time. Seasonal work accounts for 102 days' work per year. Overall, 25% of farmers have too heavy a workload. That leaves them short of time for dealing with the paperwork, coping with incidents and - above all - spending time with their families.

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### ► **The *Aphanomyces euteiches* test: a plant health risk management tool for pea crops**

Pea growers have for several years been faced with a disease which causes significant yield losses in both field peas and peas for canning. The causal agent of the disease *Aphanomyces euteiches*, is a pathogenic fungus that can survive in the soil for many years, and that makes it a dreadful pest. In a pea crop it causes necrosis of the root system followed by yellowing and wilting of the whole plantlet. Curative control of this pathogenic fungus is virtually unknown and choosing healthy soil is therefore a key factor in managing the *Aphanomyces* risk.

That being so, providing Wallonia's farmers with a tool for assessing the level of plot infection by *A. euteiches* was considered essential. To that end CRA-W validated a test developed by INRA in Rennes and successfully took part in the 2012 ring test for detecting this soil pathogen. The test consisted of sowing peas highly susceptible to *A. euteiches* in the soil sample for analysis and then assessing the root necrosis index in the young plantlets a few weeks later. This index, determined on a rating scale of 0 to 5, can be used to tailor the recommendations made to growers according to the level of infestation in a particular plot.

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### ► **Self-sufficiency for dairy farmers**

Milk producers nowadays have to take some strategic decisions to make their farm as efficient as possible. With animal feed often accounting for over 50% of the operating cost, achieving greater feed self-sufficiency (in terms of both energy and protein) is one way of reducing feeding costs. Whereas the production system ('zero grazing' vs 'grass' vs 'maize') impacts directly on the feeding cost (€6.0/100 L vs €4.0/100 L vs €4.8/100L, respectively), greater self-sufficiency is economically attractive in the three production systems studied, as well as making farmers less exposed to market fluctuations.

From a feeding point of view, energy self-sufficiency is relatively well assured and protein self-sufficiency less so. The study showed considerable regional differences in feed production costs. For example, maize growing is perceptibly more expensive in a grassland region ('grass' system) due to the systematic use of contractors, but the region's farmers have the grass-growing skills needed to produce green fodder at least cost.

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AIM HELPING TO DEVELOP AND MANAGE  
THE COUNTRYSIDE AND FORESTS

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► **Walloon forest health monitoring**

The Walloon Forest Health Monitoring Organisation was formed in April 2011 with the aim of preserving Wallonia's forests from the threats of climate change and biological invasions. CRA-W contributes to the Organisation's work by carrying out scientific monitoring of the health problems of woody forest species, performing diagnoses and training the Organisation's observer correspondents.

In addition to this work, various problems arising in forests, such as ash dieback and red band needle blight, have also been studied. *Dothistroma septosporum*, the red band needle blight causal fungus which is currently not very widespread in Wallonia, was monitored in a network of thirty plots. The pathogen *Chalara fraxinea*, which causes ash dieback, on the other hand, is more widely distributed in Wallonia's forests. The resulting symptoms were monitored in adult trees and its spore dispersion ability was also studied.

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# AIM 5

## CONTROLLING PRODUCTION AND INVESTIGATING THE FATE OF EFFLUENTS AND RESIDUES

### ► Added value from green gold and brown gold on our farms

The level of utilisation of home-grown fodder resources and farmyard manure was assessed by CRA-W in cooperation with the Fourrages-Mieux association and the Haute Sûre Forêt d'Anlier nature reserve, with backing from the Leader+ programme.

To this end, 18 farms were monitored. Two-thirds of them were 'beef cattle' systems with moderate (1.5 LU/ha) to very high (> 2.5 LU/ha) stocking densities. The other third comprised dual-system cattle farms with both a dairy and a suckler herd (2 to 3.2 LU/ha); two farms had only one dairy herd. Pasture accounted for 86% of the UAA on average [75 - 100%].

The fodder produced was characterised in terms of quantity and quality. A simulation was performed to optimise the utilisation of this fodder on the farm. The stocks of supplements necessary were then determined and compared with the supplements actually fed. Even though the quality of the harvested fodder was not always up to the mark, the results showed that for more than 75% of the farms the home-produced resources were fairly well utilised through the farmers' feeding practices.

Utilisation of farmyard manure (dung and slurry) was assessed via a comparison of the expected fertilisation levels based on the recorded fodder production figures and the actual amount of manure applied. This was evaluated for the 14 farms for which all the data were available. Fodder production levels were determined on the basis of the recorded stocks and the grazing animals' needs. The nitrogen requirements of the meadows and fodder crops in order to attain those production levels were then established. The VALOR program was used to compare the requirements of each type of crop (grazed, mixed and hay grassland, silage maize, cereals, etc.) with the availability of farmyard manure. For the 14 farms for which complete data were available this approach was used to verify the correlation between the recommended mineral fertilizer applications and the fertilizer actually applied (Figure 2).

The margins of progress for the farms above the line were also highlighted. Figure 2 shows the wide diversity of fodder intensity among the farms monitored.

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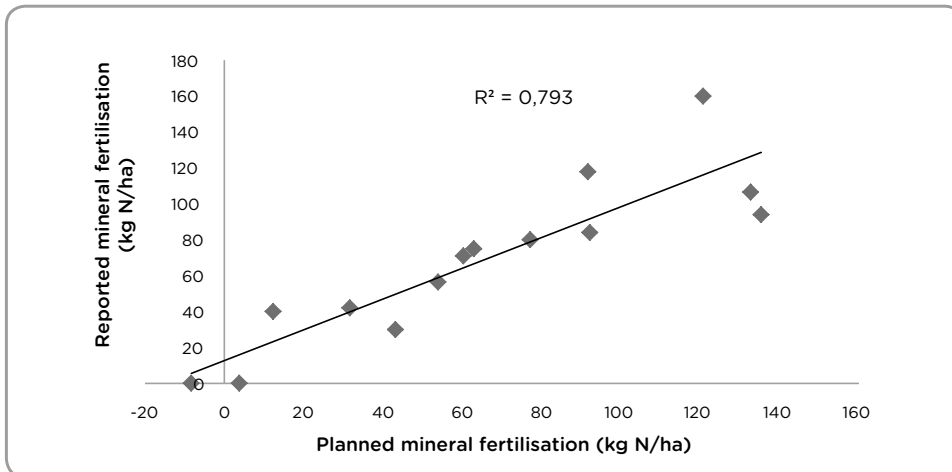


Figure: Comparison of reported and planned mineral fertilisation based on the different assumptions: (1) Basic grassland productivity 5 T DM/ha without added N, (2) effective N contribution via farmyard manure = 80% of the total nitrogen occurring in the manure in addition to the effective restoration from grazing and (3) production of 25 kg DM/kg effective N contributed.

### ► Tying ridges: development

As a follow-up to the project on controlling runoff and its impacts in potato crops in Wallonia in 2009-2010, a demonstration trial was set up at Huldenberg in 2011 at the request of Bayer CropScience and funded by that company. As a reminder, tying ridges means forming little walls between potato hills so as to promote water seepage and minimise runoff. The results of this new trial year confirmed the effectiveness of this technique in terms of a very marked reduction in runoff and the associated losses of sediments and plant protection products (principally herbicides and fungicides), along with a rising trend in tuber yields.

This trial received greater prominence through visits by the client, Bayer, as well as by European Union officials in the context of an awareness-raising campaign directed at the authorities.

At the same time, extension and practical implementation of the method began in 2010, with the aid of FIWAP and the Walloon Potato Pilot Centre, and it has been widely adopted by potato growers in both Wallonia and Flanders.

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### ► Greenhouse gas emissions: development and application

The approaches, some of which were pursued in cooperation with UCL, were aimed at developing a frame of reference for greenhouse gas emissions suited to our beef production systems.

The criteria considered were cowshed emissions and emissions from stored farmyard manure. The influence of the type of feed on direct emissions from animals was shown to be significant. Direct methane emissions from Belgian Blue heifers were found to vary from  $88 \pm 16$  to  $402 \pm 75$  g CH<sub>4</sub>/kg live weight gain on rations where the proportion of concentrate (as dry matter) ranged between 80% and 36%, respectively. The relationship between feed quality (fibre) and methane production was studied and will be considered in order to estimate CH<sub>4</sub> emissions by beef cattle on a bigger scale (LCA).

Reference values for greenhouse gas emissions from stored farmyard manure were also measured and factors affecting these emissions were identified. It was thus shown that in systems that produce soft manure (tethered stalls), winter emissions from stored farmyard manure were very low, amounting at most to 10% of all winter emissions (animals plus stored farmyard manure). This proportion varied considerably with temperature, resulting in values of between 1 and 10% in storage during colder periods (1.2°C on average) and less cold periods (8.3 °C on average), respectively.

In systems that produce more strawy manure, the emissions in storage were similarly affected by temperature but the GHG emissions were perceptibly higher, amounting to as much as 50% of all winter emissions (animals plus stored farmyard manure), i.e., an equivalent quantity to the animal emissions. Also, in the context of the same trials and therefore under these specific conditions, element audits were performed in order to refine the nitrogen emission standards with a view to updating the sustainable nitrogen management plan (Plan de Gestion Durable de l'Azote – PGDA) and considering the carbon and phosphorus flows in the systems. For instance, the excretion values measured in the trials on Belgian Blue females were  $1.46 \pm 0.07$  g N kg live weight 0.75/day and thus identical to the standard values (PGDA). Emissions from the bulls, on the other hand, were  $1.84 \pm 0.06$  g N kg live weight 0.75/day, thus exceeding the standard values (1.30 g N kg live weight 0.75/d).

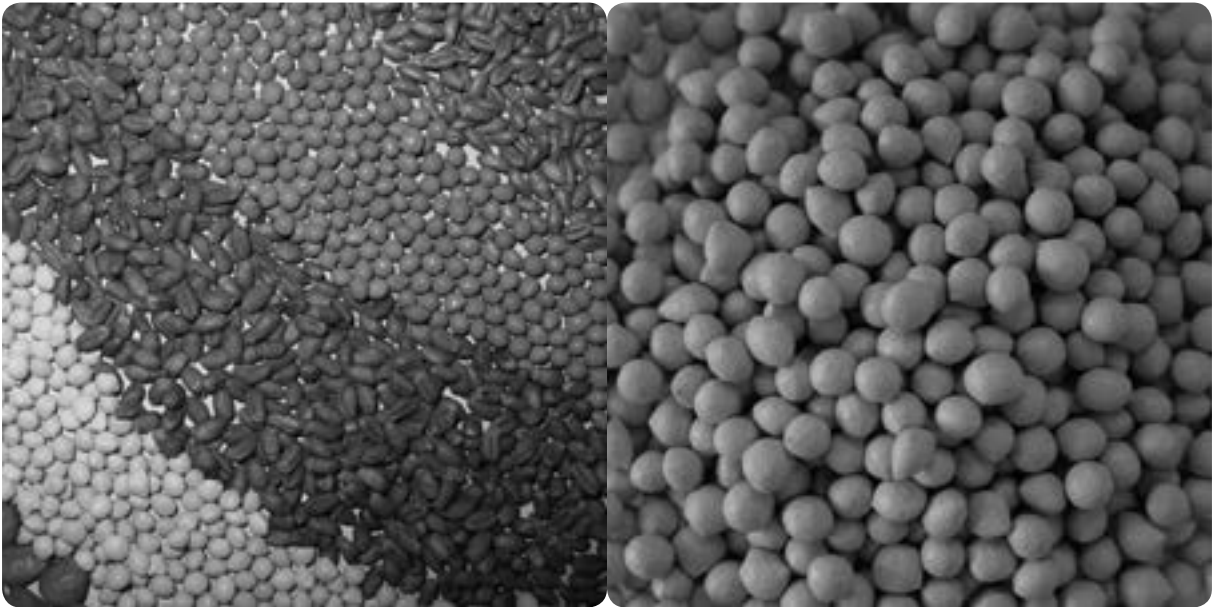
Nitrogen losses in storage were also shown to be closely linked to carbon losses and affected by the type of farmyard manure (DM content) and the storage duration and temperature.

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# Line 2

Improving human nutrition, protecting consumer health and understanding consumer behaviour



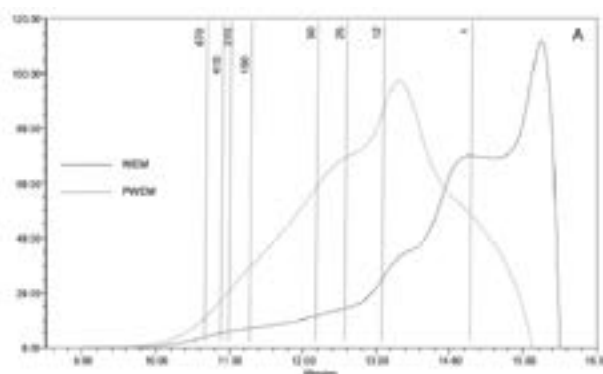
# AIM

## DETERMINING THE NUTRITIONAL VALUE AND ORGANOLEPTIC QUALITY OF PRODUCTS

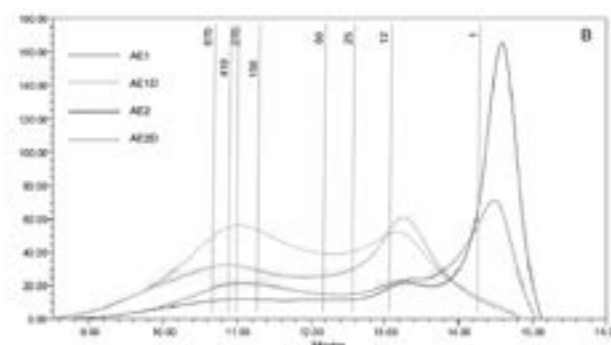
### ► Defining the characteristics of spelt fibre

As a result of comparison with the fibre composition of wheat grains, spelt grains and spikelets have been characterised in more detail. With the initial investigation having revealed the hemicellulose-rich nature of the spelt grain, subsequent research then focused on the arabinoxylans contained within the grain. Arabinoxylans were therefore chemically extracted to enable definition of their characteristics, or were modified for transformation into functional ingredients. As an initial step, the techniques required to remove starch and protein were developed for use with spelt bran. The extractions suggest that the molecular weights of both water-soluble and water-insoluble arabinoxylans (extracted from spelt bran using hydrogen peroxide in alkaline conditions) exceed the molecular weights of arabinoxylans extracted from wheat bran under the same conditions. The enzyme transformation of spelt bran arabinoxylans has shown that there is potential for production of arabinoxylan oligosaccharides, which have properties that offer health benefits. The results of some enzyme combinations are very promising for an initial investigation, suggesting that further research may create higher-purity products.

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(A) Chromatograms of water-extractable arabinoxylans (WEM,) and purified water-extractable arabinoxylans (PWEM) ;



(B) Chromatograms of arabinoxylans obtained from first alkaline extraction (AE1, shown) then dialysed (AE1D) and arabinoxylans obtained from a second alkaline extraction (AE2), then dialysed (AE2D) (B). Vertical lines are used to represent values for dextran molecular weight standards, in kDa.

► **Near infrared spectroscopy as a tool for product quality control in preservation processes**

The Consalim project (part of the Wallonia Marshall Plan's WagrALIM competitiveness cluster) investigated the potential of infrared spectroscopy in monitoring the ageing of Walloon industrial products. CRA-W's expertise includes the development and application of non-destructive, rapid analysis techniques for use in laboratory controls or in a production line setting. Investigation undertaken during the Consalim project focused on the application of near infrared spectroscopy techniques to the study of ageing in fresh meat products (such as ham, minced meat and pudding), starchy foodstuffs such as pancakes or chips, and fermented drinks, such as beer. Compositional and physico-chemical changes in product condition in different preservation processes were monitored using near infrared spectroscopy and imaging.

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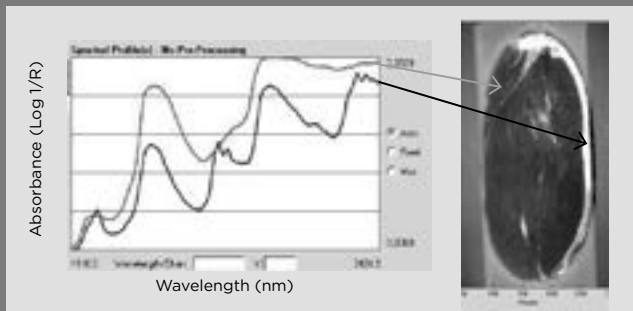


Fig. B

Fig. A

Figures :  
 (A) Image of a slice of ham, showing  
 (B) near infrared spectra of fat (curve of bottom) and muscle (curve of the top), obtained using near infrared imaging.



Figure : Analysis of minced meat using a near infrared spectrometer equipped with a fibre optic.

## AIM

### GUARANTEEING THE CHEMICAL AND BIOLOGICAL SAFETY OF FOOD

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#### ► Impurities in plant protection products and biocides

CRA-W was certified GLP (Good Laboratory Practice) in 1994 for physico-chemical studies of plant protection products and biocides. Such studies include determining the impurity content of technical compounds and formulations. All impurities occurring at contents greater than 1 g/kg of active substance and all relevant impurities irrespective of their concentration need to be determined. The FAO and/or WHO specifications and the European authorities establish legal limits and list the impurities that must be determined.

The CRA-W is also active in developing and validating rapid analytical methods for determining impurities in pesticides. The validation parameters are defined, in particular, at European level by the Directorate General for Health and Consumer Policy (SANCO document 3030/99). They include specificity and non-interference, linearity, limit of quantification (LOQ), accuracy (recovery at different levels) and repeatability.

Various techniques are used, such as liquid or gas chromatography coupled with conventional detectors; however, new cutting-edge techniques using mass spectrometry for detection (GC-MS, GC-MS/MS and UHPLC-MS, UHPLC-MS/MS) are frequently used to back up non-specific detectors in confirming the identity of the substances determined. Because they are also very specific and have the advantage of achieving very low sensitivity levels (traces), they reveal previously undetectable impurities.

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► **Complete description of the physico-chemical characteristics of seed treatment products**



Seeds have become a high value added product combining genetic progress with chemical protection that is expected to be effective against pathogens and pests. There are two main approaches to seed treatment: film coating, which wraps the seed in a protective film that includes the active ingredient (used in cereals); and seed pelleting, a more sophisticated approach which incorporates the active ingredient into a carrier surrounding the seed (used in sunflowers and beetroot). For seed treatment with crop protection products to be effective, the active ingredient must be delivered at the correct dose and distributed consistently from seed to seed. Under-dosing may result in ineffective seed and plant protection, while over-dosing may increase the risk of phytotoxicity.

As with any plant protection product, the characteristics of seed treatment products must be correctly described. CRA-W undertakes a wide range of tests to provide comprehensive information for the approval of plant protection products, and seed dressing products in particular. The product itself is generally subjected to the following tests: active ingredient content, product pH, pH of a 1% aqueous suspension, persistent foam, suspensibility, spontaneity of dispersion, wet sieving, pourability and rinsed residue, and hot and cold stability.

The quality of the seed treatment is also verified using tests for dust content, seed adhesion and average active ingredient content per seed, consistency of active ingredient distribution from seed to seed, and active ingredient content in stored seeds.

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► **The use of near infrared spectroscopy and imaging in the detection of food chain contaminants: the case of melamine and NIR**

The complete protein profile of soy meal makes it a key ingredient in use in the animal feed industry. Demand for soya products is increasing year on year, stimulated primarily by the Chinese market.

In recent years, melamine adulteration of soy meal (to increase protein levels) has been detected: in 2007, melamine was added to animal feed during manufacture and in 2008, milk powder-based infant formula was also adulterated. Evidence has shown that melamine can lead to acute renal failure and a risk of death.

However, the classic analytical methods for detecting melamine in foodstuffs are costly, difficult to implement and do not lend themselves to application in factory settings. The ideal method would offer rapid detection of deliberate or accidental introduction of contaminants, or any other non-conformity, as early as possible in the production line.

Methods based on infrared spectroscopy and near infrared imaging have been developed for this purpose and present the advantages of speed, non-destructiveness, ease of use and respect for the environment. They can also be applied in line, and offer the capacity for simultaneous detection of a number of contaminants and/or additives. Research has illustrated the capacity of near infrared spectroscopy to detect contamination with melamine or a melamine derivative, such as cyanuric acid. This work has been carried out largely within the Quality and Safety of Feeds and Food for Europe project, QSAFFE (FP7-KBBE-2010-4, 265702), which forms part of the 7<sup>th</sup> European Commission Framework Programme.

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► **Detecting authorised and unauthorised GMOs**

The GMOseek project has established what is, at the time of writing, the most comprehensive database of information on the various screening elements encountered in a wide range of transgenic plant events. With the continued growth in transgenic events - authorised or otherwise - in the European Union, this type of tool is essential, particularly since an Excel application allows for rapid data sorting. Tests targeted to new screening elements have also been developed and validated in-house.

Amongst the newly-developed tests, one trial in particular is worthy of note; this aims to determine whether the presence of the cauliflower mosaic virus p35S promoter (a virus that is encountered in brassicas in general) results from integration of the promoter within a transgenic construct, or from the presence of the virus, as the natural donor of this promoter. Older tests which were supposed to provide a solution to this problem are now obsolete, in fact: their target was a viral nucleotide sequence that too closely resembled the promoter, and this part of the viral genome is now also found in some transgenic constructs. The test in question focuses on a capsid gene and provided a solution in a practical instance where the presence of an unknown GMO was suspected.

EU Decision 2011/0884/EU on research into unauthorised transgenic rice originating from China was transposed into trials undertaken by CRA-W, which involved a few samples in 2012.

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AIM 

## DEVELOPING FOOD SAFETY AND FOOD QUALITY RISK ANALYSIS

**► Monitoring the level of  $\Delta 9$ -THC in hemp and hemp oil**

Since the Walloon Regional Government's Department for Supervision first requested it in 2007 in relation to eligibility for EU subsidies for hemp production, CRA-W has undertaken testing to verify that the psychotropic substance  $\Delta 9$ tetrahydrocannabinol ( $\Delta 9$ THC) is absent from industrial hemp. The protocol applied is based on European legislation and uses a gas chromatography-flame ionisation detector system.

This has naturally resulted in hemp growers, keen to promote their hemp fibre and grain-based products, asking CRA-W to test the oils they produce for compliance with the requirements for marketing these products. This has led CRA-W to develop a gas chromatography-mass spectrometer (GC-MS) method for quantifying the possible presence of  $\Delta 9$ THC in the oil, at concentrations in compliance with legislation (LOQ < 10 % of the authorised limit). In parallel, CRA-W has also described the characteristics of the fatty acid composition of oils on the market (where the ratio of  $\omega 6/\omega 3$  is particularly beneficial to human health).

Hemp is rich in bio-active compounds, and the hemp sector has sought support from CRA-W to derive best advantage from the plant through the use of these substances. A GCMS protocol under development aims to quantify three compounds (cannabidiol, cannabidiolic acid and cannabigerol) and potentially, to identify other substances. This new protocol can thus be applied to Walloon hemp to describe its characteristics and use it to the full.

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**► Detecting contaminants in cereals - Confidence**

Near infrared hyperspectral imaging technology has proven useful over the last few years in the control of cereal quality, allowing both spectral and spatial information to be obtained from a single test on a grain-level sample.

This technique allows the qualitative or quantitative analytical result to be associated with morphological information. Cereals may contain impurities such as straw, insects, seeds from other plants or crops, or toxic contaminants such as ergot (sclerotia of *Claviceps purpurea*), which has an alkaloid content that poses a risk of food toxicity to humans and animals where it is present in cereals.

As part of the Confidence (EC FP7) project, CRA-W has developed a method for production line detection and quantification of ergot using hyperspectral near infrared imaging. The basis of this decision support tool was the application of chemometric discrimination models and morphological identification rules to hyperspectral near infrared images. The methodology has been migrated from CRA-W's pilot hyperspectral near infrared imaging system to an industrial-scale system at the Netherlands-based company, Nutreco (see figure below). An investigation is under way in collaboration with Belgian bio-ethanol producer, Biowanze, to expand the use of the method to multiple impurity detection.

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### ► CRA-W contributes to the 'Green Bible'

At the request of the American Oil Chemistry Society (AOCS), an organisation of US experts in agri-food microscopy, CRA-W has contributed to a new edition of a microscopy manual which has been an authoritative source for scientists, toxicologists, veterinary surgeons and agronomists for over 50 years.

The last edition, published in 1992 and often referred to as the 'Green Bible', required a wholesale update to reflect the emergence of BSE variants and the need to eradicate them. Released in January 2011 and entitled, 'Microscopic Analysis of Agricultural Products - 4<sup>th</sup> Edition', this volume is THE reference work on the detection of animal products and subproducts, plant contaminants, the identification of minerals in agricultural products, animal feed and the composition of fertilizers. CRA-W's expert contribution consisted in writing a number of chapters and providing reference micrographs, taken by the Valorisation of Agricultural Products Department's microscopy laboratory and sourced from the EURL-AP online collection.

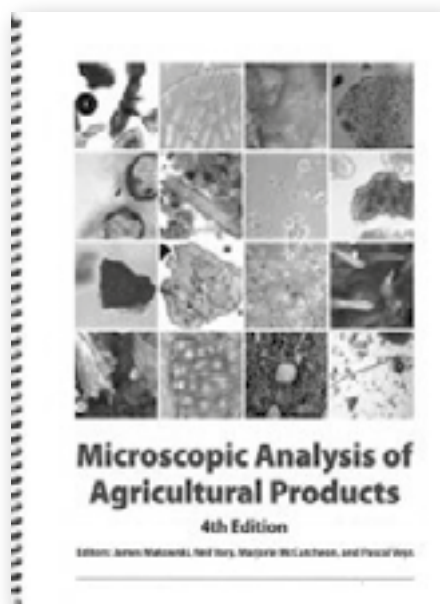
CRA-W's experience in agri-food microscopy and a variety of combined observation techniques (including interference contrast, polarisation, light background and fluorescence) has contributed to the creation of a reference work that provides a rigorous, comprehensive illustration of structural diversity. Scientists from Messiah College in the USA authored the volume in collaboration with the Canadian Food Inspection Agency and the West Virginia Department of Agriculture (USA). A CD version is also available.

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### ► Real time PCR, a new tool for control of animal proteins

The European Union Reference Laboratory for Animal Proteins in Feedingstuffs (EURL-AP) declared on 9 March 2012 that TNO Triskelion bv's real-time PCR method for the detection of ruminant DNA was valid, based on results from the inter-laboratory investigation organised by the Laboratory. The method has since been implemented in the national reference laboratory network and has been released for public use. The test is becoming an essential element in the control of processed animal proteins in animal feed, supplementing analyses undertaken using the current reference method, conventional microscopy. Its role is particularly crucial in the light of the decision by the European Commission's Standing Committee on the Food Chain and Animal Health (SCFCAH) to reintroduce non-ruminant proteins into farmed fish feed; this comes into force in June 2013. Reintroduction is a response to the requirement for sustainability in the aquaculture sector and should enable a reduction in Europe's protein dependency.

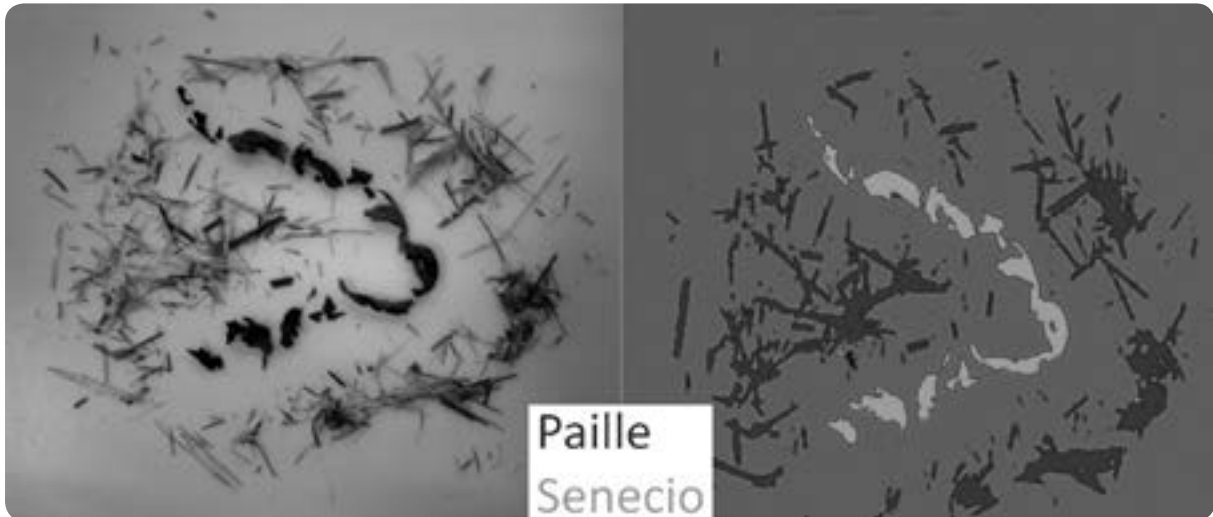
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## Line 3

Diversifying products and their uses and making producers and enterprises more competitive



# AIM

## CHARACTERISING AND PREDICTING PRODUCT QUALITY AND SPECIFICITY

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### ► **Development and validation of a new, rapid analytical method for phytoestrogens in animal and plant products**

In the last fifteen years or so, since their human health benefits became known, scientists have taken increasing interest in phytoestrogens, plant-derived substances with a structural similarity to oestradiol. CRA-W accordingly decided to investigate the effects of phytoestrogen-rich feed on the quality of animal products and the associated health benefits.

In order to select phytoestrogen-rich grazing plants, monitor their metabolism in the animal organism and determine the quantities occurring in end-products, the first step was to develop and validate a simple, rapid, sensitive and reliable analytical tool. The Centre therefore chose ultra-high performance liquid chromatography coupled with tandem mass spectrometry (UPLC-MS/MS) as a means of quantifying, simultaneously and as accurately as possible, several of these plant-derived oestrogen substances and their microbial metabolites, specifically equol. Determination of this substance is in fact crucial in view of its many health benefits including antioxidant, antibacterial and thyroid regulating properties.

The analytical method will ultimately be used in other projects to select new, phytoestrogen-rich cultivars, understand their metabolism in animal organisms and determine the phytoestrogen and derivatives content of food products.

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### ► **Authentication of plant species by NIR hyperspectral imaging**

Laboratories use a number of complementary methods to analyse technological quality and identify plant species. Several studies conducted by CRA-W have shown the usefulness of near infrared hyperspectral imaging in identifying plant species.

One such study was concerned with identifying barley cultivars from multi-site trials carried out over several years for registration in the national catalogue. The trial aimed to provide the seed industry and the food industry with a rapid, reliable method for distinguishing between winter or spring barley varieties for animal feed or brewing. The models were able to discriminate cultivar classes with over 80% correct classification.

Another study was aimed at identifying the *Senecio* genus, which is known to contain pyrrolizidine alkaloids, which are toxic to cattle. These plants grow in profusion at crop margins and in pasture. The conventional detection method relies on analytical chemistry methods which are expensive and slow. Microscopy can be used in screening for identification on the basis of morphological criteria, but detection is often chancy due to the delicacy of the structures concerned. Hyperspectral imaging is a promising alternative; as a first approach, the characteristic spectral profile has allowed identifying fragments of toxic *Senecio* in a matrix containing other species. This opens up new prospects for fodder quality analysis.

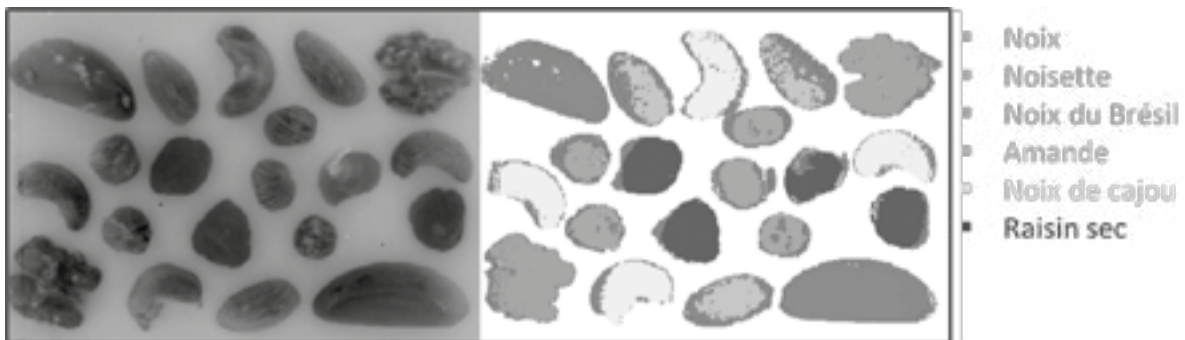
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### ► Chemometrics Serving a Multivariate World

Multivariate analysis is a branch of chemometrics, a discipline of chemistry that uses mathematics and statistics to supply as much relevant chemical information as possible via analytical data, and to gain knowledge of chemical systems. Chemometrics is increasingly recognized as a necessary step in the various analytical processes, from establishing an experimental design through to the ultimate conclusion. The future of chemometrics will involve devising effective treatments for large series of complex data and developing efficient and more robust methodologies for determining outliers, error measurement and merging data.

CRA-W has a lot of chemometrics experience and uses it in various areas of the agricultural world (e.g., quality control, detecting adulteration or contamination) on all kinds of agricultural produce, applying various analytical methods generating a large body of data in a very short time. CRA-W regularly carries out various research assignments and holds chemometrics training courses or seminars in order to fully study the complexity and variability of this multivariate world.

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► Images showing a series of nuts and dried fruit and the results of a PLSDA classification model.



► **Using molecular biology to characterise the geographical origin of a product or its production system: application to wheat (BiogeoCarbo)**

The BioGeoCarbo project is concerned with analytical methods for authenticating organic as against conventional cereals, ways of distinguishing between local and imported products, the carbon balance of cereal products, and socioeconomic and analytical aspects of the costs of the organic cereal production chain.

A study of the organic cereal sector was made in order to gain a better understanding of field practices, end-uses of products and volumes imported and their origins.

From an analytical point of view the sole currently accepted method for distinguishing between organic and conventional products relies on pesticide residue analysis. CRA-W is developing a method specifically for cereal products. However, these plant protection products need to have sufficient persistence or to have been applied sufficiently recently for residual traces to be detectable.

Other analytical methods are under investigation. These are based on molecular biology tools and a study of microbe communities (microbiomics), working from the assumption that samples which grew in different environments or were grown under different cultural practices (organic vs conventional) were in contact with different microbial flora. Analysing the flora could, therefore, reveal different profiles. Conventional microbiology and PCR-DGGE methods have already been tried on samples collected in 2011. A metagenomic approach using high-speed sequencing is also being tested.

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AIM PRODUCING FOOD WITH CONTROLLED CHARACTERISTICS

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**► Linseed in duck force feeding: consequences for the technological quality of foie gras**

Earlier studies showed that lipid melt decreased with the supplementation of 2% extruded linseed (ELS) to the duck force feed. This decrease is attributed to the greater elasticity of the liver cell membranes resulting from omega-3 fatty acid enrichment.

This research, funded by SPW-DG03, has continued in order to verify the hypothesis by looking at the effects of duration [pre-cramming plus cramming (34 days) or cramming alone (13 days)] and the proportion (2 or 3%) of extruded linseed on foie gras lipid melt and the phospholipid fatty acid composition. Lipid melt tends to decrease (-24%) at supplementation rates of 2 and 3% ELS in the cramming alone. However, a significant loss of liver weight (-21%) was recorded at the highest level of ELS supplementation. This may be due to increased stimulation of the lipoproteins, which are responsible for lipid transfer to the peripheral tissues. Deterioration of the liver cell membrane is probably responsible for the lipid melt increase (+62%) at the longest supplementation duration (34 days). Major changes were in fact observed in the membrane phospholipid composition, with a decrease in saturated and polyunsaturated fatty acids and an increase in monounsaturated fatty acids. It was not possible to validate the initial assumption because of a lack of correlations between lipid melt and the omega-3 fatty acid content.

The results indicate that the addition of not more than 2% ELS during force feeding is the only one of the practices considered that reduces lipid melt with no significant loss of liver weight.

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**► Producing food with controlled characteristics**

Controlling the ultimate characteristics of a foodstuff requires exhaustive knowledge of its intrinsic composition and, above all, the raw materials from which it was made.

Characterisation tools have been created and used for this purpose in the Aliferm project.

The main aim is to produce, on the one hand, fermentation substrates from local cereals by using every part of the grain (*wholegrain* concept), and on the other hand breadmaking starters with organoleptic and texturizing properties in line with the latest market requirements, such as 'all natural', 'health food' and 'sustainable production'.

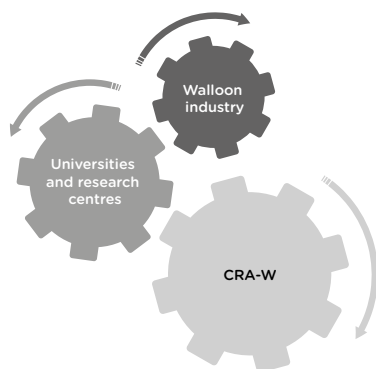
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► **CRA-W is working to develop Wallonia’s plant heritage and promote the region’s food industry**

CRA-W is involved in various projects under the Second (Green) Marshall Plan which are subsidised by the Regional Government of Wallonia as part of the Wagraim initiative and utilise its expertise in Raman spectroscopy, near and mid infrared rapid analytical methods and in developing fruit germplasm collections.

The Centre is currently working, firstly, on devising an appropriate analytical method for improved utilisation of the agro-industrial by-products of Wallonia’s apple industry (Capple project), secondly, on promoting differentiated quality apples (the QualiPomme project, financed by the Department of Agriculture, Natural Resources and the Environment) and, lastly, on using natural polyphenols to stabilise polyunsaturated fatty acid rich oils (POLYOIL project).

CRA-W’s role involves internal cooperation between the various units as well as external cooperation with companies like Oxylent, Galactic, Vandeputte and Stassen and scientific research institutions such as CELABOR, Louvain Catholic University (UCL) and the University of Liège (ULg).



CRA-W cooperative links under the Second (Green) Marshall Plan

Interaction with this network of partners has increased its role in developing analytical tools to meet the needs of industry and for rapid analysis of raw materials, production processes and/or end products.

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► **Screening methods to detect phenol compounds in plant material**

Consumer demands are increasingly focusing on the organoleptic and nutritional and functional quality of food products. That makes it important to create, validate and refine tools to identify and highlight the nutritional and functional properties, complementarities and/or synergies of the compounds occurring in our food. In that context CRA-W is engaged in developing an analytical method for identifying and highlighting these properties.



Apples contain polyphenols beneficial to health (Coxybelle - AG 90)

CRA-W is involved at both national and international level. The Centre is currently working on developing its native fruit collections (chiefly the apple tree collections) and developing food products from the Andean and Amazon regions (PIC project) in cooperation with Louvain Catholic University, Brussels Free University, Para Federal University (Brazil) and La Molina National Agrarian University (Peru).

Together with these partners it is taking part in various projects aimed at establishing a rapid analytical screening method with tremendous potential on the domestic and international markets. This would ensure the constant quality of polyphenol-rich raw materials and/or reveal new sources of bioactive compounds (species or variety) that could be exploited.

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► **Controlling agri-food processing technologies  
Utilising Wallonia's agri-food industry by-products**

Processing technologies produce finished products that meet stringent criteria. Processing invariably also generates by-products. If these are not utilised they may represent a considerable loss for the processing industry.

With this in mind the Wal-Aid project was launched and a platform bringing together technological, economic and environmental expertise was created to provide enterprises in Wallonia with assistance with all aspects of developing and validating sustainable, innovative methods for processing by-products.

It is hoped that this approach will enable enterprises to utilise their process by-products as efficiently as possible and thus maximise their added value.

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## AIM

### DEVELOPING NON-FOOD USE APPLICATIONS, IN PARTICULAR BIOENERGY OR GREEN CHEMISTRY

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#### ► **Suitability of fibre biomass for conversion to energy by anaerobic digestion, ethanol fermentation and combustion**

Finding alternatives to using non-renewable energy sources is becoming a priority in order to move towards a more sustainable energy system. Europe currently aims to meet 20% of its energy needs from renewable, sustainable resources by 2020. One alternative is to produce energy from fibre biomass. Such biomass is especially promising as, unlike biodiesel and bioethanol produced from food crops, it comes from low-intensity crops, thus minimizing competition with food production, which have few requirements in terms of pedoclimatic conditions. Despite the latter characteristic such biomass has acceptable per hectare dry matter yields.

There is generally a preferred energy recovery method for each type of plant biomass, due to the intrinsic chemical properties of the biomass and the specific features of each process. Optimum utilisation of plant biomass for energy and/or bio-products requires detailed knowledge of the content and molecular composition of their chemical constituents. Chemical characterisation of various kinds of fibre biomass for energy has shown meadow herbaceous biomass (such as tall fescue and a cocksfoot/lucerne mix) and energy maize to be particularly suitable for processing by anaerobic digestion (biomethanisation). Woody grass biomass (for example, *Miscanthus giganteus* and switchgrass) and cereal straw (e.g., spelt straw) lend themselves to production of liquid biofuels, such as second generation bioethanol. Late winter miscanthus is also very suitable for energy recovery via combustion.

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#### ► **Technical, economic and environmental optimisation of the supply, processing and conversion into energy of solid biofuels**

In Europe, bioenergy is seen as an answer to the need to reduce greenhouse gases, deal with rising fossil fuel prices and develop renewable energy sources. In other parts of the world, like Africa, bioenergy is still the main energy source. Biomass is rarely available for energy use immediately after harvesting. Instead, it has to be transported, prepared and conditioned to comply with the specifications of the various energy conversion systems or to meet consumer expectations.

The main purpose of conditioning is generally to enhance the quality of the fuels produced. However, preparing the raw material involves a considerable extra cost which has to be offset by the downstream added value. CRA-W is therefore involved in developing objective indicators for biofuel quality. These include pellet mechanical durability and net density, woodchip and pellet component particle size, and biomass crushability. The limits associated with these indicators are transposed into standardisation documents (CEN or ISO) or quality labels.

Optimising the various stages of biomass treatment (grinding, drying, and densification) with an eye to energy recovery limits its environmental impact and increases the reliability of these supply sources. From that point of view, producing pellets from torrefied materials (mainly wood) offers interesting prospects. Moreover, the product characteristics open up markets for solid biofuels that were previously the preserve of coal.

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AIM 

## CONTRIBUTING TO INTEGRATED SECTOR DEVELOPMENT

► **Supporting the development of a biomass-for-energy industry**

The economy of the countryside, both agriculture and forestry, has to face up to some big challenges: maintaining or creating economic activity; producing sustainably and securing new outlets; helping to protect the environment by combating climate change, for instance.

The sectors that use biomass to produce biogenous products or green energy are rising to these challenges, but they have to contend with a number of obstacles, not all of them technological.

In this context the Bioenergy Sectors area of research is aimed at two target groups: on the one hand, political decision-makers, by providing them with planning tools that incorporate socio-economic development and environmental and energy challenges and, on the other hand, the players involved in or concerned with bioenergy, in order to equip them with tools to develop bioenergy projects. Environmental impact and socioeconomic studies of the bioenergy sectors have been undertaken. Assessment tools such as life cycle analysis were used to compare the different routes and methods. Methods for assessing and tapping biomass resources were also being developed from a technical, economic and financial point of view. The factors and mechanisms likely to influence the players involved or concerned are identified. To promote the successful development of the industry the players were given information and support in particular through working groups, material produced for distribution and extension, and individual advice.

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► **Study of potential alternative uses for Wallonia's cereals. Environmental impact and socioeconomic assessment**

More than half of the cultivated arable land in Wallonia is given over to cereal growing.

Against a background of increasingly scarce non-renewable energy sources and world population growth, the ALT-4-CER project (financed under the Moerman Act) aims at assessing the environmental and socioeconomic performance of potential scenarios for using Wallonia's cereals in food and non-food applications by 2030.

Based on data collected from industry players, material flow estimates were drawn up under the four headings of Food, Feed, Fuel and Fibre and a qualitative and quantitative picture of the use of Wallonia's cereal resources in 2010 was thus produced, incorporating the key aspects for the cereal sectors.

Four contrasting scenarios were mapped out in consultation with industry players: (i) a 'trend' scenario, (ii) a 'strategic' scenario, (iii) a 'location' scenario and (iv) a 'globalisation' scenario.

The Feed sector dominates the 'trend' scenario, whereas the Food and Fuel sectors account for the greater part, as regards both grain and straw, in both the 'strategic' and the 'location' scenario. Lastly, exports of high added value products soar in the 'globalisation' scenario. Based on these results, the next step in the project is to run parallel Life Cycle Environmental Analysis (LCEA) and Life Cycle Social Analysis (LCSA) studies of the present situation (2010) as regards the use of Wallonia's cereals and the four scenarios. The aim of using LCEA and LCSA methods is to guide decision-making by players and stakeholders in Wallonia's cereal industry with regard to the best uses for the region's cereal crops.

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► **Recent developments and new activities in field crops**

For more than seven years now the Wallonia Field Crops Promotion Board (CFGCW) has been driving the development of field crop sectors in Wallonia, in particular by networking the players concerned with issues like mycotoxins (setting up a warning network, organising a conference on the topic, etc.), varieties, regenerating the hop industry, and so on.

In 2011-2012 the CFGCW focussed particularly on quality products from Wallonia:

- The first Best Belgian Beer of Wallonia competition was held in cooperation with APAQ-W (Walloon Agency for Promotion of Quality Agriculture), OPW (Office of Walloon Products), DGARNE (Department of Agriculture, Natural Resources and the Environment), POB and AJBB (Association of Belgian Brewing Journalists) and prizes were awarded to ten beers from Wallonia. A press conference on this topic was held at the Abbey of Rochefort.
- Specifications for a differentiated quality Walloon bread were established.
- A conference on local products, from the field to the consumer, was held in Chièvres on 6 June 2012.
- CFGCW participated in activities relating to milling, to familiarise the general public and industry players with this vital operation. These included a conference on the bread industry, in partnership with RAWAD, including a tour of the Statte and AGRIBIO mills and the open days at the Ferrière mill in cooperation with the Gesves Local Development Agency and a number of local associations.

The Promotion Board also attended several agricultural events including Libramont Fair, Sautin Fair, Bonne-Espérance Harvest Festival, the Erquelinnes Hop Fair, the Bakery Fair, farm open days, etc.

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► **LaitHerbe: sustainable milk with good cheesemaking ability**

The LaitHerbe project aims to build up a complete, sustainable industry around PDO Herve cheese, pursuing two main lines of development: producing sustainable, differentiated quality milk by controlling the cows' feed, and innovating in terms of cheesemaking technology. The objectives are to develop the typical characteristics of Herve cheese, strengthen the link with the local area and increase the product's added value in order to enhance the value of all the links in the chain (farm, feed manufacturer, cheese plant...).

Sustainable, high quality production based on grazing is ensured by a specification. That enables farmers to carry on producing milk within a grass-based system as traditionally in the Herve area. Assay performed with the CRA-W's experimental herd have shown that the feed devised for the project enables farmers to maintain the milk's high cheesemaking value (milk casein content maintained at 2.9 g/100 ml) while producing it from local raw materials.

LaitHerbe is subsidised by the Regional Government of Wallonia for four years.

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- ✓ Link to "terroir"
- ✓ Local feed, based on grazing
- ✓ Specification to insure a differentiated quality of milk
- ✓ Cheesemaking ability of milk
- ✓ New technology for milk treatment
- ✓ Local ferments

Website: <http://www.laitherbe.be/>

► **ENERBIOM: Sustainable production of biomass for energy in areas with heavy environmental constraints: what alternatives for what sectors?**

ENERBIOM is an Interreg IV-A Greater Region project jointly financed in Wallonia by the ERDF, the Regional Government of Wallonia and CRA-W. It was completed in March 2012.

This project aims to establish and disseminate agricultural biomass for energy production methods to enable them to develop in harmony with the local area and the sectors' requirements. The crops chosen for the purpose include perennials such as miscanthus, switchgrass and tall fescue along with annuals like maize, sorghum, spelt, rye and hemp.

The results for a cross-border reference network representative of the Greater Region's contrasting pedoclimatic conditions underscored the potential of perennials like miscanthus and sorghum, which require little input: 80 kg nitrogen per hectare is sufficient if development is not held back by low temperatures. These no-till species are also favourable to earthworm populations and help to maintain biodiversity.

The value of biomass for biomethanisation, combustion and bioethanol applications was studied. Biomass with a high dry matter content (miscanthus or dry harvested switchgrass) are most suited to combustion. Biomethanisation is suitable for readily degradable biomass rich in organic matter (green harvested miscanthus, maize and sorghum). Bioethanol production depends on the sugar content (1<sup>st</sup> generation) and fibre content (2<sup>nd</sup> generation).

Two assessment tools have also been developed, based on these results and a literature review. ENVINECO determines the economic, energy and environmental impact of the biomass-to-energy routes. SIGENERBIOM is a Geographical Information System (GIS) for identifying the potential of energy crops in the Greater Region's different pedoclimatic zones.

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## Line 4

### Adapting species, practices and production systems to changing contexts



AIM 

## DEVisING GENETIC AND AGRICULTURAL STRATEGIES FOR ADAPTING PLANTS TO A CHANGING ECOLOGICAL AND SOCIOECONOMIC ENVIRONMENT

► **Soleil, CRA-W's new wheat variety**

*Soleil*, registered in the Belgian national catalogue of wheat varieties in 2011, is a 50-50% cross between wheat and spelt whose main characteristic is its hardness. This type of cross is very rare and the resulting line is very difficult to stabilise. In terms of agricultural characteristics *Soleil* has good resistance to winter climate, yellow rust and brown rust. This variety performs well when grown under 'low input' conditions, without fungicide or growth regulator treatments and with a reduced nitrogen supply of 30 UN/ha. Yield is lower than with other varieties, but this is offset by its breadmaking quality. Both specific weight and protein content are high and the Zeleny/protein ratio is notable. The Chopin alveograph shows suitability for breadmaking and for correction of a variety with too low a P/L. The value for *Soleil* is around 2 and the W is about 300. For breadmaking, *Soleil* would complement spelt varieties perfectly.

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► **First elite lines of *Abies nordmanniana***

Christmas trees are Wallonia's main horticultural product. Four million trees are produced annually on an area of 5,000 ha, 80% of them nowadays being *Abies nordmanniana*.

An orchard of *A. nordmanniana* selected for their attractive growth characteristics was established at Neufchâteau between 1996 and 2004 by grafting branches in the field to allow thirty 'elite' lines to cross-pollinate freely and create single seeds of controlled origin. Orthotropic (straight) shoots were rapidly achieved by using well established, aged rootstock and this proved determining for earlier fruiting, which takes place naturally at the last four or five verticils on the side shoots of adult trees.

The first significant seed harvest was gathered in 2011, after only 15 years. Sown in 2012, these seeds are expected to produce some 48,000 trees which will be assessed by the growers. This success is the result of long-term projection of the expression of fundamental physiological floral induction properties passed on by the rootstock. It is expected to lead to the same method being used for future new seed orchards and faster development of interspecific crosses aimed at meeting the quality criteria expected by Christmas tree fans.

Several elite lines have been established in vitro after somatic embryogenesis as part of the current project conducted in conjunction with the General and Organic Chemistry Unit at Gembloux Agro-Bio Tech university, the main focus of which is the fir's aromatic profile. *Project subsidised by SPW-Department of Research (DGO3: subsidy D31-1239).*

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## ► Potato breeding

A breeding program was launched at the Breeding and Biodiversity Unit on the Libramont site in 2005 with the aim of improving resistance to potato blight, *Phytophthora infestans*. Since 2005, 200,000 clones obtained from more than 200 crossings have been assessed. For the first four years of the program, the selection principle consists of observing the plants and their tuber formation. Later, once enough of potato seeds had been produced, assessment of the agricultural behaviour of the clones got under way: yield, technological quality and blight and virus resistance. The trials are repeated for at least three years at sites located at Libramont, Gembloux, Bologna (Italy) and Brasov (Romania). The number of clones assessed each year is increasing and the following developments are planned for the future: increasing the number of true potato seeds, widening the germplasm base, carrying out a pre-breeding programme and developing marker-assisted selection.

Apart from clone assessment, the project also requires the cooperation of potential users such as seed potato producers and distributors, traders and industry. This is the essential challenge we started to tackle in 2012, by writing articles, attending "Potato Europe" and Interpom, organising visits to trial sites and holding informative events in close cooperation with the Walloon Association of Seed Potato Producers, the Potato Pilot Centre and APAQW. Except the Gasoré variety, a CRA-W accession registered in 1996, not any other 'Belgian' potato varieties exist. Surely a typically Belgian or Walloon product should be a sales argument as regards the supermarkets?

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## ► Assessment of cultivars in Wallonia (agronomy and fruit growing)

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### CEREALS

#### *Official trials (DUS and VCU)*

Research Unit 5 is fully geared to cereal cultivar assessment. Lines submitted by active Belgian seed breeders/owners are presented for official trials (DUS and VCU). These trials are conducted without fungicide protection and allow the lines that demonstrate attractive potential to reach the market and acquire 'variety' status.

Three varieties of winter barley and 11 varieties of winter wheat were registered in 2011. The results for 2012 became official on 20 September 2012.

In 2011, CRA-W Unit 5's plant accession team was officially accredited at European level by its appointment as Belgian cereal variety testing agency for DUS testing by the CPVO (Community Plant Variety Office). This is essential fate if DUS testing is to continue at CRA-W Gembloux. This step was made possible by the commitment of two technicians, the creation of seed collections (wheat, barley and spelt) and compliance with the Quality Insurance system operating at the CRA-W.

Wheat variety trials were also conducted in 2011 under organic farming conditions, in cooperation with the organic pilot centre (CP-Bio) and provincial institutions (CARAH and CPL-VEGEMAR). The Belgian catalogue varieties show very good potential compared with the varieties promoted by ITAB, the French Organic Agriculture Technical Institute. In future it is planned to set up a registration and post-registration system specifically for cereal varieties suited to organic farming.

### **Post-registration cereal trials**

The varieties registered in the Belgian catalogue and the Community catalogues are all characterised in a network of post-registration trials (five sites in Wallonia). Conducted with similar protection against lodging and disease to that provided in agricultural practice, post-registration trials lead to a better knowledge of the new varieties, enabling farmers to be given sound advice on choice of varieties compared with the varieties already on the market. The new varieties obtained from a number of breeders or private agents are also compared with one another in these trials, which thus provide farmers with a very comprehensive assessment, backed up by a number of field trial visits in June and various extension seminars in September/October, just before the farmers make their variety choices. Knowledge of varieties' technological characteristics is also useful to the downstream sector as an aid to forming lots of identical quality.

### **MAIZE**

Sixteen silage maize varieties and two maize grain varieties were registered in the national catalogue in 2011 after passing the three-year test. An experimental precision seeder acquired in 2012 will make sowing more autonomous and flexible in future.

### **INULIN CHICORY**

Official tests have resulted in two varieties being registered.

### **RAPE**

In winter rape, the two growing seasons have clearly confirmed the greater potential of hybrid varieties as opposed to conventional lines. The range of new hybrid varieties is growing steadily, fully justifying variety trials conducted in Wallonia's growing conditions so that farmers can be given all the information they need for a successful rape crop.

### **FRUIT TREES**

Twenty-two sweet cherry varieties, obtained from plant material supplied by eight breeding centres between 1999 and 2003, completed their assessment in Belgian soil and weather conditions on Damil® rootstock.

The data sheets containing the agronomic, commercial and taste characteristics of these 22 varieties have been published as a supplement to the 161 previous data sheets in the 'Cherry in Intensive Orchards' list (see <http://www.cra.wallonie.be/index.php?page=52&id=32>).

### **STRAWBERRIES AND SMALL FRUIT**

As regards strawberry variety development, twelve June-bearing varieties were tested in 2011. In 2012, seven June-bearing varieties and five day-neutral varieties were selected and tested in pots as soilless culture system. Among the varieties tested, the Italian ones appear to be of interest for growing in our region. They will be grown again in 2013 to confirm the initial results.

In late 2011, a range of new woody small fruit varieties was established on the CRA-W plot, with the aim of giving the growers a wider choice. These small fruit varieties were selected for their taste characteristics, yield and disease resistance. They are grown under a rain shelter and in plastic tunnels





### ► Improving nitrogen fertilizer recommendations in Wallonia - Interreg SUN project

AzoFert is a nitrogen fertilization recommendation software based on the provisional nitrogen balance sheet at field scale, developed and configured by INRA, Laon (French National Institute for Agricultural Research, Aisne, France) and in use in the North of France since 2005. Within the framework of the Interreg SUN (Sustainable Use of Nitrogen) project, since January 2010, CRA-W has worked hand in hand with its French partners at INRA and LDAR (Departmental Analytical and Research Laboratory, Laon, France) on adapting the software parameters to Wallonia's pedoclimatic conditions.

One special feature of the software compared with the nitrogen fertilization recommendation tools currently used in Wallonia is its dynamic approach to assessing the nitrogen input from the soil. This requires a large volume of meteorological data, representative of the prevailing weather on the concerned field. These data are provided by a non-profit organisation called "Pameseb", which registers weather from 30 stations established throughout Wallonia, and subsequently processed by CRA-W to the appropriate format for AzoFert. Data on the crops nitrogen requirements, the average nitrogen composition of farmyard manure and the characteristics of Wallonia's most common soil types are also adapted for the purpose. These parameters are then validated by using data from field trials with increasing nitrogen fertilizer rates carried out in Wallonia, enabling the accuracy of the recommendations produced by AzoFert to be tested in field conditions and the software parameters to be corrected if necessary.

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### ► Development of new nitrogen fertilizer management strategies for field crops based on an assessment of the biomass nitrogen status

Sustainable nitrogen fertilizer management strategies rely on the use of optical tools to assess the plant's nitrogen status during the season and manage nitrogen supplementation. Tools already tested by CRA-W in potato crops provide an evaluation of the leaf chlorophyll content. These tools are the Hydro-N tester chlorophyll meter and the Crop-scan radiometer, which measure foliar transmittance and reflectance, respectively, of electromagnetic radiation in the field. Other, newer tools that evaluate the phenol compounds occurring in the leaves of the plant are being studied as part of the POTFLUO project, financed by PSW (Public Service of Wallonia). Dualex and Multiplex, developed by Force-A (Orsay, Paris, France) both measure the chlorophyll fluorescence caused by electromagnetic radiation in the ultraviolet and visible wavelengths.

The research aims to assess the potential of chlorophyll fluorescence measurement as a means of assessing the potato crop's nitrogen status during the season. The working method involves comparison with the various optical methods already tested. The ultimate aim is to identify the tool or tools that will provide a rapid, sensitive, specific, accurate nitrogen status measurement which is stable over time and then to be able to integrate the data into decision support systems concerning the requirement for nitrogen supply during the plant growing season.

Based on these preliminary results, measurement of chlorophyll fluorescence, either on its own or combined with transmittance or reflectance measurements, appears to provide a very useful way of assessing a crop's nitrogen status.

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► **Mixed cropping with winter cereal/grain legumes in organic farming**

Winter or spring cereal/field pea (*Pisum arvense* L.) mixed crop are widely practised and often well managed on organic farms. However, in such mixed crop, the percentage of peas harvested cannot exceed 20% without a significant risk of early crop lodging. It is hoped that growing other grain legumes such as pea cultivars and field beans (*Vicia faba* L.) together with a cereal, will increase the proportion of legumes grains in the harvested crop and its feed value as a concentrate.

Within the framework of the INTERREG VETABIO project, partners from Nord-Pas de Calais (CA59), Flanders (PCBT) and Wallonia (CRA-W and CEB) have established a network of trials for comparison of different winter cereal/grain legumes mixed crops. The annual results vary somewhat according to the climate conditions and growth sites. In the Ardennes area, the cereal cultivar/pea crop increased the dry matter yield and improved the feed value compared with sole crops, while also limiting the risk of lodging and weed infestation. The proportion of peas in the harvested crop is inversely proportional to the yield of the cereal grown as a sole crop, which points up the importance of plot soil fertility, and also depends on the pea variety (Figure 1).

The winter triticale/ field bean mixture showed very interesting potential in Flanders area after a mild winter, but does not appear suited to the Ardennes area.

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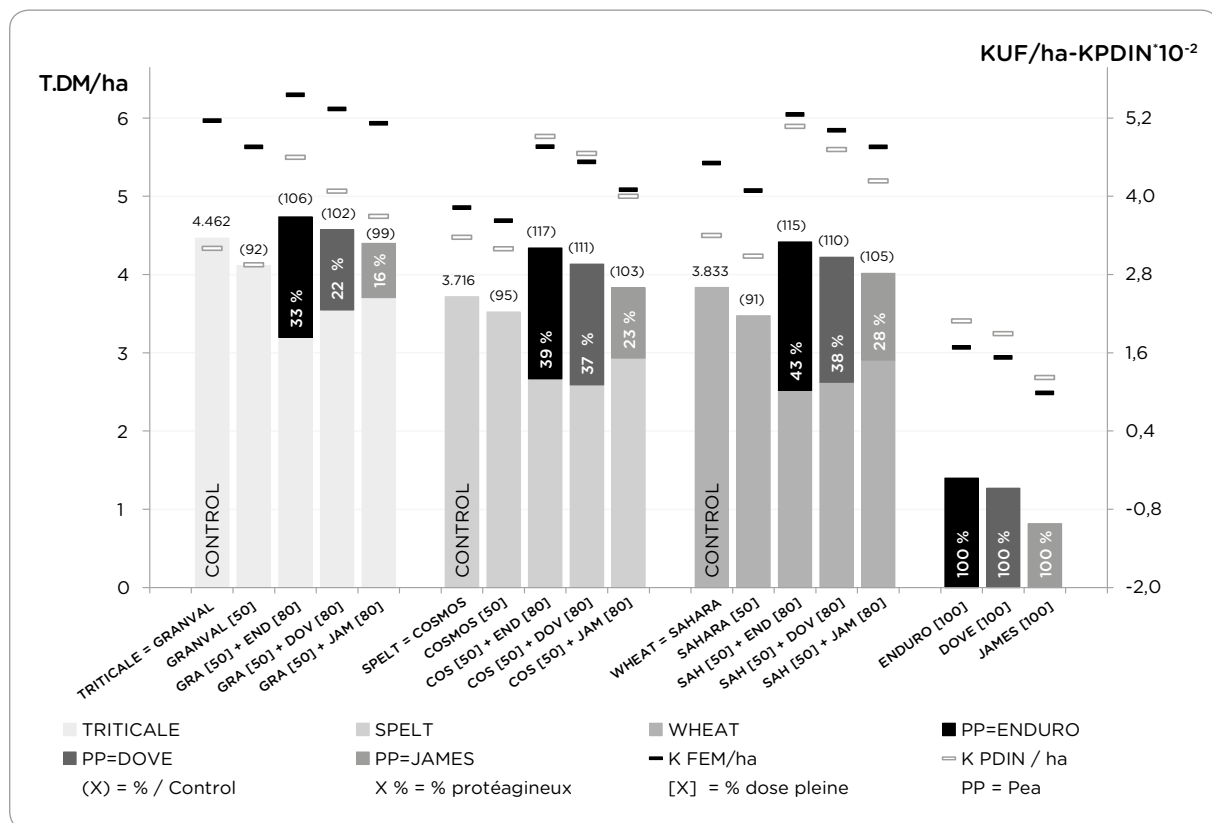


Figure: Winter cereal/cultivar pea mixed cultures: effects of pea cultivar (Enduro, Dove or James) and cereal species (triticale, spelt or wheat) and comparison with sole crops. CRA-W 2011 Ardennes. (\*) French forage Unit/1,000 and kg PDIN (Intestine digestible proteins) /100 [x] = sowing density as % of full rate, (x) = dry matter yield as % of sole cereal crop, x% = percentage of field peas in the harvested crop.

## ► Potential of soil microbial activity stimulants in pasture

Pasture accumulates not inconsiderable amounts of organic matter. Although this plays a positive part by slowing the increase in atmospheric CO<sub>2</sub> concentrations, it may be advantageous to stimulate mineralisation so as to make various nutrients available to the cover in situ. In this context the effectiveness of two major product families – one aimed at stimulating soil microflora and microfauna activity in the form of lime (products manufactured by TMCE and PRP), the other directly supplying a cocktail of microorganisms (products such as Bacteriosol and Mycosol) – was assessed over a three-year period in a permanent mowed pasture in the Central Ardennes region. For the purposes of the research the meadow received no phosphorus or potassium input other than fertilisation with 30 tonnes of manure per hectare per year. Nitrogen applications ranged from 0 to 120 kg/ha/year, according to the system in operation.

After three years of monitoring, it has to be said that, compared with an untreated control, the test products did not succeed in curbing the fall in soil P and K levels caused by their removal in successive hay harvests.

Nevertheless, as illustrates at figure 2, an effect on average yield of between 8,300 kg DM/ha without product application and 9,600 kg DM/ha with application of Mycosol was shown, with no impact on the quality of the biomass harvested. These effects are partly explained by the nutrient content of these substances. Mycosol, for instance, contains about 12% K and 7% N. On the other hand, PRP, which contains little of these, also slightly boosts performances (+ 9%). Taking into account the cost of the materials tested, the cost per additional ton of dry matter harvested is €100, €260, €340 and more than €500 with Mycosol, PRP, Bacteriosol and TMCE, respectively. Using conventional fertilizers results in similar performances at a much lower cost. Conventional fertilizers cost €106/ha whereas Mycosol, PRP, Bacteriosol and TMCE cost €244, €298, €263 and €241/ha, respectively, representing a not inconsiderable extra cost of between €135 and €192/ha.

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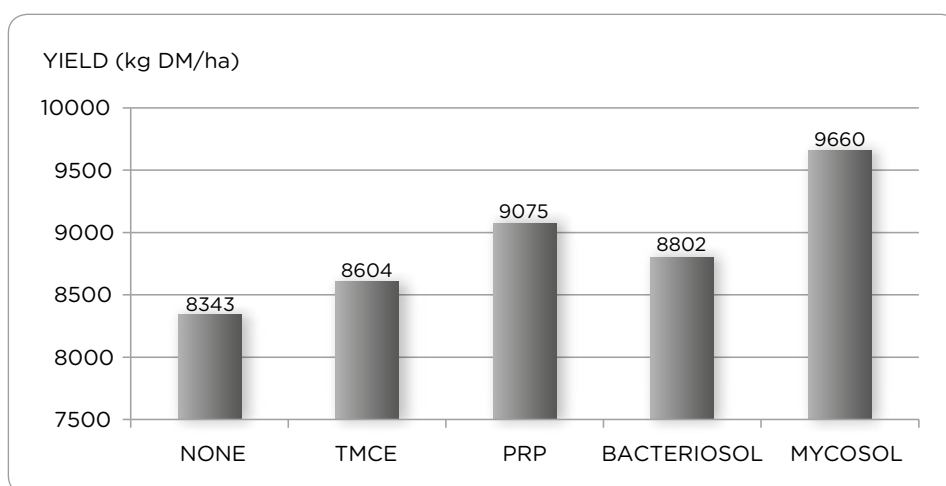


Figure: Cumulative average quantity yields over 3 years  
Grass yield noted "kgMS/ha" means yield expressed in Dry Matter (DM) kg/ha



► **Study of emerging bacterial disease with a view to preserving the chestnut tree**

The future of the horse chestnut tree in Western Europe is threatened by the insect *Cameraria ohridella*, which mines the leaves and weakens the tree, and the bacterium *Pseudomonas syringae* pv. *aesculi*, which attacks the trunk and can kill a tree in a few years. These problems are major obstacles to planting new horse chestnuts. A study of horse chestnut canker has therefore been commissioned by the Brussels-Capital Regional Government.

Results showed that this is not a new pathogen in horse chestnut. The bacteria grow on the aerial parts of the tree without requiring alternate host. The cortical tissues of the trunk and branches are then infected. The aggressive internal cycle may or may not be continuous, indicating some tree resistance. A single infection can cause considerable damage over time. Stress is thought to aggravate its severity, in particular under major attacks of the leaf miner.

A small number of substitution *Aesculus* species or varieties with some resistance to horse chestnut canker were selected in the context of the research project. It has been shown that nurseries are sources of pathogen and that its occurrence is, however, neither systematic nor unavoidable. A healthy horse chestnut plantation can be maintained over the long term and new plantations can therefore be considered. The disease could thus be controlled by effective prevention.

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► **Toxigenic potential of *Fusarium graminearum* strains in winter wheat crops in Wallonia**

*Fusarium* head blight in winter wheat causes yield loss and quality impairment due to mycotoxins production. These substances can enter food and feed chains, causing various health problems. A recent study in Wallonia showed that wheat seeds could be infected by various toxigenic fungi responsible for causing *Fusarium* head blight, the most prevalent species being *Fusarium graminearum*. Within that species there are two types of isolates based on their production ability (chemotypes): isolates that produce deoxynivalenol, a mycotoxin which is regulated at the European level, and isolates that produce nivalenol. This latter mycotoxin is unregulated but considered more toxic than the former.

In order to assess the proportions of each chemotype in Wallonia, more than 180 *Fusarium graminearum* isolates were collected from wheat seeds taken from the cereal growing area between 2003 and 2009. Molecular analysis showed that less than 4% of the collected isolates were nivalenol producers. In view of the toxicity of nivalenol and the absence of European regulations to limit its presence in crops, the fact that nivalenol-producing isolates were only very rarely observed is reassuring for consumers. It was not possible to establish a correlation between the occurrence of these particular isolates and other parameters like geographical origin, year of collection or wheat variety. *Fusarium graminearum* isolates were collected in 2010, 2011 and 2012. Their chemotype will be determined in a biovigilance context.

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## AIM

### CONTROLLING AND UTILISING BIOLOGICAL PROCESSES THAT CONTRIBUTE TO PLANT AND ANIMAL PRODUCTION

#### ► **Effects of Lianol Solapro® on sow performance in the farrowing pen**

Lianol Solapro® (Huvepharma NV) is derived from fermented potato protein. Its active principle, comprising peptides, promotes the metabolic activity of animals that have a negative energy balance. Trials were conducted at CRA-W to boost sow performance by improving neonate vitality and cutting the suckling mortality rate. This is an important issue, as whereas there has been a substantial rise in the number of piglets born in recent years, the proportion of piglets failing to reach weaning has increased.

Our study involved 40 sows, half of which were given the product at a rate of 10 g per day as top feeding *peri partum*; it was then added to the milk replacer at a rate of 1‰.

It is noteworthy that the piglets born of sows fed with the product consumed more colostrum ( $P < 0.05$ ) and gained more weight over 24 hours ( $P < 0.05$ ). Colostrum production was 20% greater ( $P < 0.01$ ). These sows had significantly higher plasma IGF-I levels at day 4 of lactation and at weaning. Although colostrum and milk IGF-I levels were unaffected, the piglets from FPP sows fed with the product had higher plasma IGF-I levels at age 4 and 24 days ( $P < 0.001$ ). Their daily weight gain was 22% greater in the first four days ( $P < 0.05$ ). The intake of IgG through colostrum was also higher by 30% ( $P < 0.05$ ). After weaning, the sows came into heat at an undiminished rate, with a similar weaning-mating interval and a higher parturition rate. In the next cycle the survival rate of piglets at age 4 days was higher ( $P < 0.05$ ) and the intra-litter weight variability was lower ( $P < 0.05$ ).

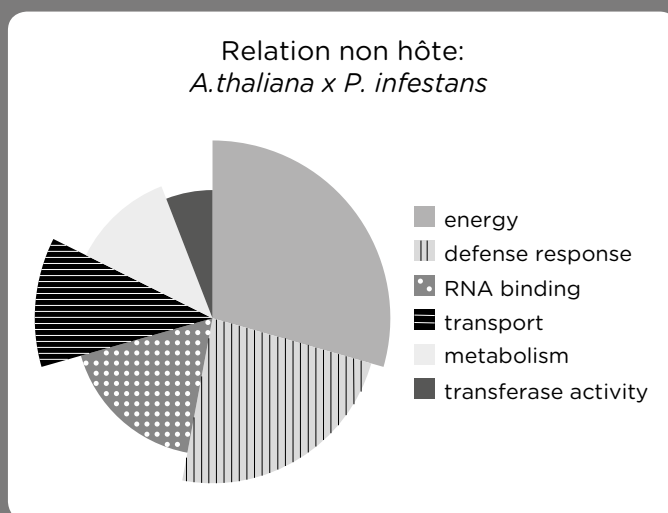
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#### ► **Systems biology: a step towards characterising and exploiting lasting resistance**

Unlike conventional approaches, which analyse complex biological processes in terms of a few or even a single gene and/or protein, systemic or integrative biology generates and incorporates a mass of data (omic techniques, bioinformatics, imaging) into the functional models developed.

Expressive and interactive proteomic techniques contribute to the development of this emerging field of research by looking at all the proteins present in cells and how they interact in order to function.

Applied to analysing the potato/blight pathosystem, they can be used to identify the metabolic processes that guide the dynamics of the interaction in the direction of resistance or susceptibility.



Various metabolic processes affected by the compatible *S. tuberosum* x *P. infestans* interaction

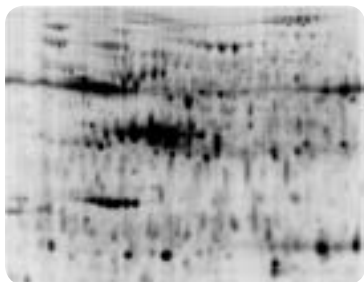
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Collaboration with B. Colignon, *FRIA scholarship holder* and M. Raes (University of Namur)

### ► Identifying protein contamination of meal for animal feed

The introduction of new regulations on reintroducing meat and bone meal into animal feed (ref. COM (2005) 322) depends on test methods being developed that meet the criteria of specificity, discrimination and quantification of proteins in feed. None of the analytical methods - including the official method - currently in use or under development satisfies all these criteria.

The use of quantitative proteomic techniques based in particular was considered, due to its putative ability to meet the criteria. The results indicate that the method is applicable to unheated or only slightly heated feed materials, such as fishmeal.



Resolution by bidimensional electrophoresis (2D DIGE) on polyacrylamide gel of a fishmeal mix

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Collaboration with M. Raes (University of Namur)



## AIM

### UNDERSTANDING ANIMAL BEHAVIOUR AND PROMOTING ACCEPTED REARING METHODS

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#### ► **Stress and pain management in piglets under 8 days old; comparison of two non-steroid anti-inflammatories**

A European Declaration introduced in January 2012 encourages the use of anaesthesia followed by prolonged analgesia when performing surgical castration of piglets under 8 days old. Only Metacam® (meloxicam) has been granted a marketing agreement for this use. Other non-steroid anti-inflammatories (NSAIDs) that have analgesic properties are available. Research was conducted with the FVM to compare the effects of another NSAID, tolfenamic acid, on pain and stress in piglets during and after surgical castration. To that end a number of lesions, physiological and behavioural criteria were compared in 66 piglets from 12 litters randomly distributed over four treatments: (1) castration at age 5-6 days preceded by an intramuscular injection of physiological serum, (2) Meloxicam or (3) tolfenamic acid, and (4) simulated castration or injection.

The castrated piglets spent significantly more time trying to escape from handling than the uncastrated ones. They vocalised more loudly and displayed more scrotal scratching than the sham group. Loudness of vocalising, time spent vocalising, cortisol level and heart rate did not vary between castrated and uncastrated animals. This shows that the restraint created considerable stress. NSAIDs appear to reduce the pain and stress by minimising the expression of certain distress behaviours. Specifically, tolfenamic acid tended to be more effective than Meloxicam, during castration (attempts to escape, time spent vocalising, intensity of vocalising) and afterwards (isolation, scrotal scratching, tail agitation).

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## Line 5

### Providing decision support for public and private-sector players

#### AIM

ANALYSING NATIONAL AND INTERNATIONAL POLICIES

##### ► Status of pests in Belgium

An International Plant Protection Convention has been established under the aegis of the FAO to develop international strategies for limiting the entry and spread of quarantine organisms. The signatory countries implement international plant protection regulations through a National Plant Protection Organisation – in Belgium, the Federal Agency for the Safety of the Food Chain (FASFC) and Federal Public Service (SPF) Public Health, Safety of the Food Chain and Environment.

Through their quarantine research activities the Mycology, Virology and Bacteriology Laboratories have worked on several projects aimed at assessing the risk of pest introduction into Belgium (*Chalara fraxinea* fungus on the ash tree, stolbur phytoplasma on the potato and the vine) or characterising endemic populations (*Erwinia amylovora* bacteria on the pear tree, cotoneaster and hawthorn). As a national reference laboratory under the FASFC, CRA-W participates in the surveillance plan for fungi, viruses, viroids and quarantine phytoplasma. Through its participation in the European and Mediterranean Plant Protection Organization (EPPO) Diagnostic Panels, its involvement in European initiatives (COST, EUPHRESKO) and its contribution to plant health monitoring projects (Walloon Forest Health Monitoring Organisation), the Centre is promptly informed about new threats to plant health and can interact with the appropriate authorities to put the necessary measures in place.

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#### AIM

PARTICIPATING IN THE INNOVATION PROCESS AND PROTECTING KNOW-HOW

##### ► CRA-W's involvement in Marshall Plan projects

As a public research institution, CRA-W has played an active role in the Marshall Plan since 2006. The Centre is a partner on three general projects (WALNUT, CONSALIM and WALAID) and four specialised projects (ALIFERM, CAPPLE, LAITHERBE and POLYOIL) under the Wagralim initiative. Various CRA-W research teams are involved, contributing their know-how for the benefit of agri-food processing enterprises and other relevant players (universities and approved research centres).

The projects on which CRA-W is working are aimed both at creating new products and supporting the emergence of new agricultural and food sectors, making existing Walloon products more competitive and utilising the by-products of our agri-food processing industries. Through its participation in these projects CRA-W networks with more than 30 innovative enterprises in Wallonia and 35 Walloon research teams. CRA-W is also a member of the Wagralim R&I Task Force, which brings together research managers from industry and academia. The Task Force delivers scientific opinions on the merits of proposed projects and contributes its expertise to the operating unit and to project sponsors (<http://www.wagralim.be>).

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## AIM

### TAKING PART IN DEVELOPMENT PROJECT DESIGN AND EXTENSION

#### ► **Detecting contaminants - CAU/CRA-W cooperation**

RA-W is cooperating with China Agricultural University (CAU) in Beijing under Convention WBI/MOST 2010-2011 (Project 6). The aims are to exchange knowledge and develop new technologies for detecting animal protein in animal feed. In the context of this link-up two CAU researchers spent a month at CRA-W and three parties of CRA-W scientists have visited CAU.

The CAU and CRA-W research teams are also partners on the European QSAFFE project (Quality and Safety of Feeds and Food for Europe), which aims to make faster, less expensive methods available for ensuring the quality and safety of animal feed ingredients in Europe. Within the framework of this cooperative link-up CAU organised the Fourth international Feed Safety Conference in Beijing from 11 to 13 September 2012 in partnership with RIKILT (Institute of Food Safety, Wageningen, Netherlands), QUB (Queen's University Belfast, UK) and CRA-W. Previous Feed Safety conferences were held in Namur (2004 and 2007) and Wageningen (2009) (<http://www.feedsafety/.org>).

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#### ► **Investporc, a decision support tool for diversification into organic or outdoor pig farming**

Organic farming is one sector of European agriculture that has enjoyed steady growth in recent years. The organic supply is unable to keep up with the demand for pork products. There is therefore potential for development for Wallonia's farmers. However, a number of regulatory, technical and economic considerations need to be taken into account by anyone switching to organic farming.

To assist farmers keen to do this CRA-W has developed Investporc, a calculation module for working out the investment needed to start out in organic or outdoor pig rearing and estimating the expected return. The Investporc tool was devised from research carried out at CRA-W and data gathered through Reference and Experimental Centres funded by the Department of Agriculture, Natural Resources and the Environment. It is available as a Web interface based on an online simulation performed directly by the Internet user. Calculations are performed according to choices made by the user and default encoded variables which may, or may not, be editable.

By developing the Investporc interface CRA-W has made available a simulation tool for establishing the basics of a proposed move into organic or outdoor pig rearing. The tool is accessible as a beta version to take account of complex, diverse situations. It can be accessed via this link: <http://investporc.cra.wallonie.be>

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### ► Quality control of pesticides used in public health

International organisations such as the WHO, the Global Fund to Fight AIDS, Tuberculosis and Malaria, the UNDP, UNICEF, international agencies supplying goods and services, national authorities and CRA-W have joined forces to increase the quality control of pesticides used in public health, in the context of international public tenders in particular. As a WHO Collaborating Centre for public health pesticide quality control and through its experience in the physical chemistry of pesticides, CRA-W has determined the physico-chemical properties of pesticides used in public health in the context of international public tenders. Since 2008 CRA-W has analysed nearly 1,000 samples of pesticides for public health use in various countries around the world. The analyses were aimed at determining the active ingredient content and relevant contaminants along with the physico-chemical parameters of the products and their stability in storage to establish their compliance with the WHO specifications.

Insecticides are used both to protect our crops from pests and to protect people against insects carrying tropical diseases. WHOPES (World Health Organization Pesticides Evaluation Scheme) publishes recommendations and specifications for the pesticides used in public health (<http://who.int/whopes/quality/en/>). These are mainly pyrethrinoid, organophosphorous and carbamate insecticides and larvicides in various formulations (wetable powders, emulsifiable concentrates, concentrated suspensions, water-soluble pellets, capsule suspensions, pellets, long-lasting insecticide-treated mosquito nets, etc.)

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PART III:

International   
recognition





## CRA-W, a world-wide reference in the physical and chemical analysis of plant protection products and biocides

### ► WHO Collaborating Centre

The Plant Protection Products and Biocides Physico-Chemistry and Residues Unit of CRA-W was designated as a WHO (World Health Organisation) Collaborating Centre for Quality Control of Pesticides in 1998.

The appointment was renewed in 2002, 2004, 2008 and 2012. CRA-W's work in this context involves:

- Developing analytical methods and determining the physico-chemical properties of pesticides used in public health for product quality control according to WHO specifications and the analytical methods recommended in those specifications.
- Performing chemical and physico-chemical analysis of mosquito nets treated with insecticides (long-lasting insecticide-treated mosquito nets) and other treated materials.
- Supporting the work of the WHO in developing, finalising and publishing specifications and assessments of pesticides used in public health.

[http://www.who.int/whopes/en/WHO\\_Collaborating\\_Centre\\_Jan\\_2013.pdf](http://www.who.int/whopes/en/WHO_Collaborating_Centre_Jan_2013.pdf)

### ► Member of the FAO/WHO JMPS

Olivier Pigeon, head of the Plant Protection Products and Biocides Physico-Chemistry and Residues Unit at CRA-W, has been a member of the FAO/WHO JMPS (Joint Meeting on Pesticides Specifications) since 2007. The JMPS is a scientific committee made up of experts from different countries throughout the world and is responsible for evaluating physico-chemical, toxicological and ecotoxicological data put forward by the agrochemical industry, and for proposing specifications which will then be published by the FAO and the WHO. FAO/WHO specifications define the parameters and physico-chemical criteria for technical products and the pesticide formulations. They are used as a basis for the official approval of pesticides used in agriculture and in public health and as a reference to monitor the quality of products placed on the market in order to reduce risks linked to their use.

<http://www.fao.org/agriculture/crops/core-themes/theme/pests/jmps/en/>  
<http://www.who.int/whopes/quality/en/>



### ► Member of the WHOPES working group

Olivier Pigeon has been a member of the panel of experts at WHO for vector biology and control within WHOPES (World Health Organisation Pesticides Evaluation Scheme) since 2008. WHOPES was set up to promote and coordinate testing and evaluation of pesticides used in public health. This operates thanks to the participation of governmental representatives, pesticide and pesticide application equipment manufacturers, WHO collaborating centres and research institutions, as well as other WHO programmes, notably the IPCS (International Programme on Chemical Safety). The WHOPES comprises a testing and evaluation programme in 4 phases examining the security, efficiency, operational acceptability of pesticides used in public health and the development of specifications for quality control and the international trading of pesticides. The WHOPES gathers, consolidates, evaluates and publishes information on the use of pesticides in public health. Its recommendations facilitate the pesticide approval by member states.

<http://www.who.int/whopes/recommendations/en/>

### ► Member of the CIPAC

Olivier Pigeon has been a member of the CIPAC (Collaborative International Pesticides Analytical Council) since 2011. The CIPAC is an international, non-governmental organisation whose aim is to promote the international standardisation of pesticide analytical methods and the evaluation of physico-chemical properties of technical products and pesticide formulations, the organisation of inter-laboratory programmes and symposia to evaluate these testing methods. The methods are proposed by companies and are tested by laboratories all over the world. After evaluation of the results and adoption, the methods are published in the CIPAC Handbooks.

<http://www.cipac.org/index.htm>

Olivier Pigeon and Bernard de Ryckel (study director) are also members of the ESPAC (English Speaking Pesticides Analysis Advisory Committee) which is a preliminary scientific committee for the work of the CIPAC.

### ► Pest Risk Analysis for *Agrilus anxius* EPPO/OEPP 11-16987 (11-16902, 11-16726, 10-16415)

A preliminary draft has been prepared by the EPPO Secretariat. This document has been reviewed by an **Expert Working Group** that met in the EPPO Headquarters in Paris on 2010-09-13/16. This EWG was composed of:

- **Dr Christiane Fassotte - Walloon Agricultural Research Centre - Gembloux (Belgium)**
- Dr Robert Haack - *US Forest Service - Northern research Station - East Lansing, Michigan (USA)*
- Dr Dan Herms - *Ohio State University - Wooster (USA)*
- Dr Daegan Inward - *Centre for Forestry and Climate Change - Forest Research - Farnham (UK)*
- Dr Claire Sansford (Core member) - *Food and Environment Research Agency - York (UK)*

The PRA was reviewed by the core members and the Panel on Quarantine pests for forestry in January-February 2011. The risk management part was reviewed by the Panel on phytosanitary measures on 2011-04-07 and by the Working Party on Phytosanitary Regulations on 2011-06-23.

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Olivier Pigeon, elected member of the CIPAC in 2011.



## CRA-W has formal recognition confirmed by accreditations/certifications in accordance with international standards:

### ► Good Laboratory Practice (GLP)

- D3, U10 (GLP Certificat C 04)  
Study of the chemical and physico-chemical properties of plant protection products and biocides  
Study of pesticide residues in food and in the environment  
Study of pesticide seed treatment quality
- D1, U4 (GLP Certificate C 03)  
Ecotoxicological studies on plant protection products



### ► ISO 17025 for testing laboratories

(14 laboratories in departments D1, D2, D3, and D4)

Grouped together under a single certificate for CRA-W, the accreditation of the testing laboratories relates to the following fields:

- Virology/ mycology/ cultivated and ornamental plants (D1-U2, U3)
- Sprayer tests (D2-U8)
- Analysis of pesticides on mosquito nets and treated substrates (D3-U10)
- Physical and chemical analysis of solid biofuels (D4-U13)
- Physical and chemical analysis of cereals, dairy products and feed (D4-U14)
- Infrared spectrometry and optical microscopy/ feed (D4-U15)
- Microbiology/milk (D4-U16)
- GMO and MBM detection in food and feed matrices (D4-U16)



189-TEST

### ► ISO 17020 for sprayer inspection (SIP, D2-U8)

The SIP (Sprayer inspection unit) is accredited for the compulsory inspection of sprayers (for field crops and arboriculture)



443 INSP

### ► CPVO reference system for the evaluation of cereals (OBEV, D2, U5)



**CPVO · OCVV**

Community Plant Variety Office  
Office Communautaire des Variétés Végétales

The OBEV (the Belgian office for cereal varietal evaluation) is accredited to carry out DUS (distinction-uniformity-stability) tests in the scope of the admission of varieties to the national catalogue of agricultural species.

**Accreditations/certifications obtained and upheld are the result of close collaboration between the scientific units involved and the BAQ (Quality improvement office).**



### ► The Sprayer Inspection Unit (SIP) is accredited to ISO 17020

The Walloon agricultural Research Centre (CRA-W) has been carrying out and organising **obligatory monitoring of agricultural sprayers** in the French-speaking and German-speaking areas in Belgium since 1995. This periodic 'technical' monitoring (every 3 years) has enabled application equipment used for plant protection products to be significantly improved. Every year, two permanent monitoring teams check the functioning of more than 2000 sprayers, in accordance with a method and a protocol developed within CRA-W.

The Sprayers Inspection Service has successfully undergone two new, major stages in its evolution, namely the obtaining of ISO 17020 accreditation and approval by the Ministry of Agriculture from 1 May 2011 to carry out inspection of sprayers in the provinces of Namur, Hainaut, Luxembourg, Walloon Brabant and Liège, pursuant to royal order of 13 March 2011.

Belgium is regarded as one of the forerunners in this area. The Belgian example has been used as a reference at a European level, and by our direct neighbours (Framework Directive on the sustainable use of pesticides, CEN, ISO....)..

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## Events organised (or jointly organised) by CRA-W

Below is a non-exhaustive list of some of the events we have organised with our partners, aimed at a wide range of audiences - farmers, horticulturalists, scientists, businesses, public services, consumers.

CRA-W also participates in numerous events organised by its professional, private and institutional partners.

In addition to these events, we organise a large number of field-based activities aimed at a more specific audience.

For example, over this reporting period, the Soil Fertility and Water Protection Unit has organised information and practice sessions very specifically aimed at farmers:

- **10 talks about soil tillage and soil fertility**
- **4 training seminars in no-till farming practices**
- **10 field trial visits by CRA-W based on the themes - soil testing and crop establishment**
- **3 field trial visits by CRA-W based on the theme - long-term P-K fertilization trials)**
- **3 field corners (notes on crop and penetrometer profiles)**

All CRA-W events are announced in the calendar on the CRA-W internet site. Texts from some conferences are available under the heading 'Documentation' on the site.







► 23 February 2011

**White Book - Cereals - Gembloux**

in cooperation with GBx-AgroBioTech

*Gembloux*

► 28 February - 4 March 2011

**Training in infrared spectroscopy and chemometrics**

*Gembloux*

► 2 March 2011

**16<sup>th</sup> Carrefour des Productions animales**

in cooperation with Gembloux Agro Bio Tech

*Gembloux*

► 4 March 2011

**Soil management for grasslands**

Under the INTERREG VETABIO project, in partnership with the CEB and FOURRAGE-MIEUX

*Libramont*

► 13 March 2011

**Open day at the CRA-W's farm: come and see our animals, find out about our research**

*Gembloux*

► 30 March 2011

**Development of the Walloon dairy sector: what are the arrangements for farms?**

FLPLW annual conference

*Gembloux*

► 14 April 2011

**Forage production, aromatic plants and mineral feed for dairy cattle**

Vetabio project

*Proefcentrum voor Kleinfruit Pamel, Roosdaal*

► 29 April 2011

**CRA-W opens its doors to schools**

Under the Rendez-vous de l'Entreprise, supported by the province of Luxembourg

*Libramont*

► 7 - 8 May 2011

**The strawberry; its strong point - a wonderful taste of home**

Exhibition revealing all the secrets of the strawberry

*Gembloux*

► 25 May 2011

**GPS and precision agriculture - Demonstration**

*Geel*

► 26 May 2011

**The CAP reform beyond 2013: longer term vision**

*Tenneville*

► 9 June 2011

**Farming practices with a high ecological value : dialogue between farmers and researchers**

Under the Interreg DurAgrISO14001 project

*Gembloux*

► 23 June 2011

**Significance of multi-species associations for forage production in organic farming: performance of mixed crops faced with drought**

*Libramont*

► 1 - 3 July 2011

**International grassland days**

*Ettelbruck, Luxembourg*

► 22 - 25 July 2011

**Libramont Agricultural Fair: CRA-W stand, 'Mécanic' show**

*Libramont*

► 23 July 2011

**The farm of the future: the future of agricultural buildings in conjunction with saving energy**

Round table held in the context of the Libramont Agricultural Fair

*Libramont*

► 3 - 4 September 2011

**Battice Agricultural Fair CRA-W stand theme: energy in agriculture and demonstrating fuel economy**

► 7 - 8 September 2011

**PotatoEurope 2011: essential meeting for all the potato sector**

*Kain*

► 8 September 2011

**White Book - Cereals-Gembloux**

Pre-drilling information

*Gembloux*

► 14 September 2011

**New uses for biomass energy**

Biomass energy: valorisation and plant science

*Gembloux*

► 28 September 2011

**Environmental impact of energy plants**

Biomass energy: environmental aspects and crop husbandry

*Libramont*

► 22 - 23 October 2011

**'Chevetogne un peu cochon' event**

Visit the stand of the Walloon Pork Industry Association

*Chevetogne*





- ▶ 26 October 2011  
**8<sup>th</sup> Biomass meeting: Do bio-energies impact upon the soil?**  
ValBiom asbl  
*Gembloux*
- ▶ 28 October 2011  
**INMATEH 2011 - III Agricultural Engineering Soil - Plant - TECHNICAL EQUIPMENT** in the context of Ecological Agriculture and economic efficiency  
*Bucharest, Romania*
- ▶ 8 November 2011  
**Educating in biodiversity through food**  
Workshop with the Benelux Working Group ENE/EDD  
*Gembloux*
- ▶ 17 November 2011  
**Management perspectives for your farm in the face of risks to human and environmental health**  
As part of the DURAGRISO project  
*Ciney*
- ▶ 18 November 2011  
**5<sup>th</sup> symposium of the Belgian Plant Biotech Association in collaboration with UCLouvain**  
Living together :  
Plant Microorganism Biotechnology  
*Melle*
- ▶ 23 - 24 November 2011  
**Farm Machinery and process Management in sustainable Agriculture**  
Conference organised jointly with the University of Lublin  
*Lublin, Pologne*
- ▶ 24 November 2011  
**Pesticide monitoring**  
Seminar organised by CRA-W and ISSeP  
*Gembloux*
- ▶ 30 November 2011  
**11<sup>th</sup> Professional Day for pig and poultry production**  
Latest pork and poultry news: what will tomorrow be made of?  
*Gembloux*
- ▶ 12 December 2011  
**Energy & Farming seminar**  
Feedback on actions carried out in the network for improved energy management in farms  
*Gembloux*
- ▶ 14 December 2011  
**Alternatives to agricultural land in the production of biomass for energy**  
In conjunction with partners from the Ecolirimed and Enerrem projects and the Public Research Centre - Gabriel Lippmann  
*Belvaux - Luxembourg*
- ▶ 3 February 2012  
**Conferences from the provincial association of sheep breeders**  
Viral infections in sheep and new regulations on the Maedi-Visna virus  
*Ath*
- ▶ 27 February - 2 March 2012  
**Infrared Spectroscopy and Chemometrics**  
Training in infrared spectroscopy and chemometrics  
*Gembloux*
- ▶ 29 February 2012  
**White Book on cereals**  
*Gembloux*
- ▶ 1 March 2012  
**Grouping of pregnant sows as at 1 January 2013: to comply with «welfare » standards for pigs**  
organised by FWA and FPW  
*Gembloux*
- ▶ 7 March 2012  
**17<sup>th</sup> Carrefour des Productions Animales**  
From production to the local consumption of animal produce, in conjunction with GBX-Agro Bio Tech  
*Gembloux*
- ▶ 19 - 20 March 2012  
**Sustainable agricultural production of biomass for energy: what alternatives for what sectors?**  
Symposium at the end of the ENERBIOM project  
*Harzé Castle, Harzé*
- ▶ 27-29 March 2012  
**Fourth European Workshop on Standardised Procedure for the Inspection of Sprayer in Europe - SPISE 4**  
*Lana (South Tyrol), Italy*
- ▶ 6 June 2012  
**From field to consumer: some initiatives in Wallonia...**  
organised by the Wallonia Field Crops Promotion Board  
*Chièvre*



► 7 - 27 June 2012

**Visit of field trials (2012) at the Walloon Agricultural Research Centre**

Visit of variety field trials (2012) organised in collaboration with the external extension services of DGARNE (SPW) from Thuin, Ciney, Wavre, and Huy, and local CETAs and agricultural associations *Verlaine, Fraire (Walcourt), Ligney (Geer), Thines (Nivelles), Thynes (Dinant)*

► 12 June 2012

**Meadows and grazing pastures: a resource to be enhanced 'smoothly'**

First event of 'Rallye wallon de L'Herbe'; site visits to the Walloon Agricultural Research Centre *Libramont*

► 27 - 30 July 2012

**Libramont Agricultural Fair 27 July 2012**

**CRA-W round table on the topic of 'The Farm of the Future: The Future of Food'**  
DURAGRISO: official presentation of the ISO14001 certification to farmers *Libramont*

► 31 August - 2 September 2012

**Battice Agricultural Fair**

CRA-W stand: theme: grass-milk project

► 11 - 13 September 2012

**4<sup>th</sup> International FEED SAFETY Conference**

*Beijing, Chine*

► 14 September 2012.

**Manuring demonstration and manure composting**

*Baugnies,*

► 14 September 2012

**Optimising energy consumption and greenhouse gas emissions in breeding**

**Symposium at the end of the OPTENERGES project**  
*Arlon*

► 15-16 September 2012

**Agricultural demonstration Demonstration - reducing fuel consumption, influence of tyres on soil compaction**

*Waremmé*

► 23 September 2012

**Cross-border day to investigate heritage fruit and vegetable varieties which are ORGANICALLY cultivated**

*Gembloux*

► 3 October 2012

**Pasture management: the issue of the sustainability of dairy farming operations**  
Training seminar held in the framework of the Interreg **DAIRYMAN** project

*Gembloux*

► 14 November 2012

**9<sup>th</sup> Biomass meeting**  
organised by Valbiom *Gembloux*

► 21 November 2012

**Gathering information and developing systems for decision-making aids, supporting an agriculture which is constantly evolving**

*Gembloux*

► 28 November 2012

**12<sup>th</sup> Pig and Poultry Products Conference**  
Animal and farmer welfare and sustainable production

*Gembloux*





## Awards won by CRA-W

### 2011

#### ► The Phytofar 2011 Award: DurAgr'ISO farmers are honoured

The Phytofar Institute provides support for research and development in sustainable agriculture. This year, its Scientific Committee has rewarded Terr'Avenir Wallonie and Beloftevol Boeren, the Walloon and Flemish farmers' associations respectively, that are involved in the DurAgr'ISO project, for their collective efforts to reduce the environmental impact of their farms by implementing an ISO 14001-compliant environmental management system.



#### ► Recognition for CRA-W at the NIR 2011 (Cape Town, South Africa)

The research conducted by CRA-W won it recognition at the NIR 2011 Conference. Two of them received an award. Firstly, Vincent Baeten, coordinator of the Food and Feed Quality Unit, received the 'Q-Interline Sampling Award' for the best verbal presentation, entitled 'Right sampling strategies make NIRS and NIR imaging techniques the tool for safety control of food and feed products'. Secondly, the poster titled 'Near-infrared spectroscopy with fiber optic probe for determination of fatty acid profile in raw milk', won Second Prize among the posters. It was presented by Hoang Nam Nguyen, Mohamed Hammida and Frédéric Dehareng of the Agricultural Product Technology Unit and Andreas Niemöller of Bruker Optics.

### 2012

#### ► Province of Namur SUSTAINABLE DEVELOPMENT PRIZE for DurAgr'ISO farmers (Interreg project)

The Province of Namur, in cooperation with Fondation pour les Générations Futures, is supporting sustainable development through the Sustainable Development Prize.

#### ► DURAGRISO: The ISO in agriculture! 27 July, Libramont Agricultural Fair

For the first time in Belgium, ISO14001 certificates have been presented to 18 farmers who have set up a voluntary environmental management system within their farms. Recognition from this internationally renowned ISO standard is the cherry on top of the cake, arriving on the back of an intense 2 year accompanying programme, the aim of which was improved control of management of the farms monitored, and improvement in their sustainability (Interreg DurAgr'ISO14001 project).

#### ► The «Green Biotechnology Awards» awarded to Bruno Godin

Research carried out at CRA-W in the biomass-energy sector was awarded at the Ghent Bio-Economy Summer School 2012. Bruno Godin received the 'Green Biotechnology Award' award for his scientific poster entitled 'Chemical composition and biofuels potentials of various vegetal biomasses' (Project Loi Moerman BIOETHA II).

► **The CERTIFRUIT project winner of the innovation prize for 2012**

Awarded on 2 September 2012 at the Battice fair

Certifruit: Quality charter for ‘artisan grafters’: future biodiversity through the safeguarding of heritage varieties.

The project was borne of an initiative of CRA-W, the plant breeders ‘RGF-GBX’, the agricultural promotion board, the FWH and CEHW.

► **DurAgr’ISO chosen as Interreg ambassador!**

On 14 November 2012 the Interreg DurAgr’ISO project, coordinated by CRA-W, was rewarded for its work and results by the ‘Strategic Project 2012’ label under the Interreg IV France-Wallonia-Flanders programme.

► **DAIRYMAN: a project modelled on the European Commission**

During the conference on the ‘European Innovation Partnership for the agricultural productivity and sustainability – priorities and application mechanisms’ which took place in Brussels on 19 November 2012, the Dairyman project was presented as a model project.

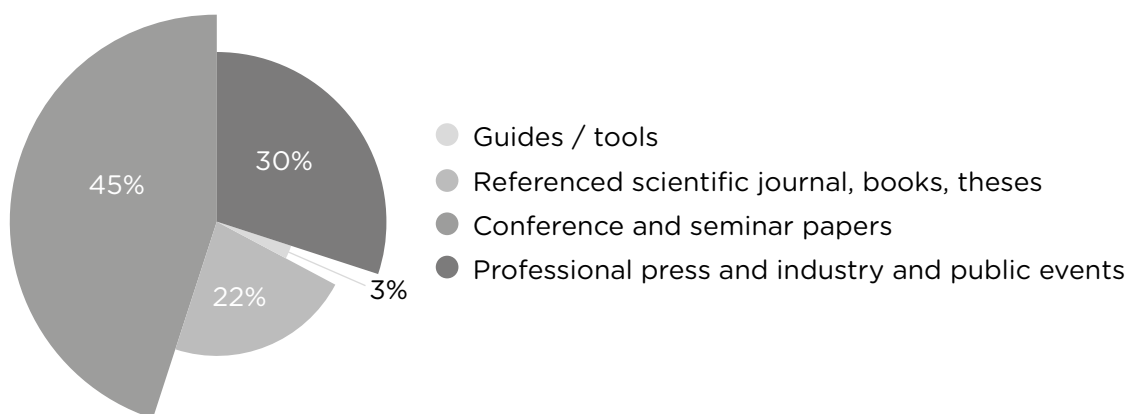




## CRA-W's Publications

In the course of 2011-2012, CRA-W produced more than 800 publications integrating scientific and extension publications made accessible for use by the general public, technical notes (guides/tools) for the benefit of professionals, papers presented at symposia, study days, demonstrations, training activities, ....

Distribution of CRA-W publications



To these publications ought to be added the reports (agreements, testing, assessments, ....), totalling 1,652, for all the units combined.

CRA-W also publishes its own quarterly newsletter, 'CRA-W info', which provides concise, relevant information with regard to research projects and services offered by CRA-W. It has been a great success among its readers and is widely distributed among a list of subscribers in French and in English. It is also published on the internet.



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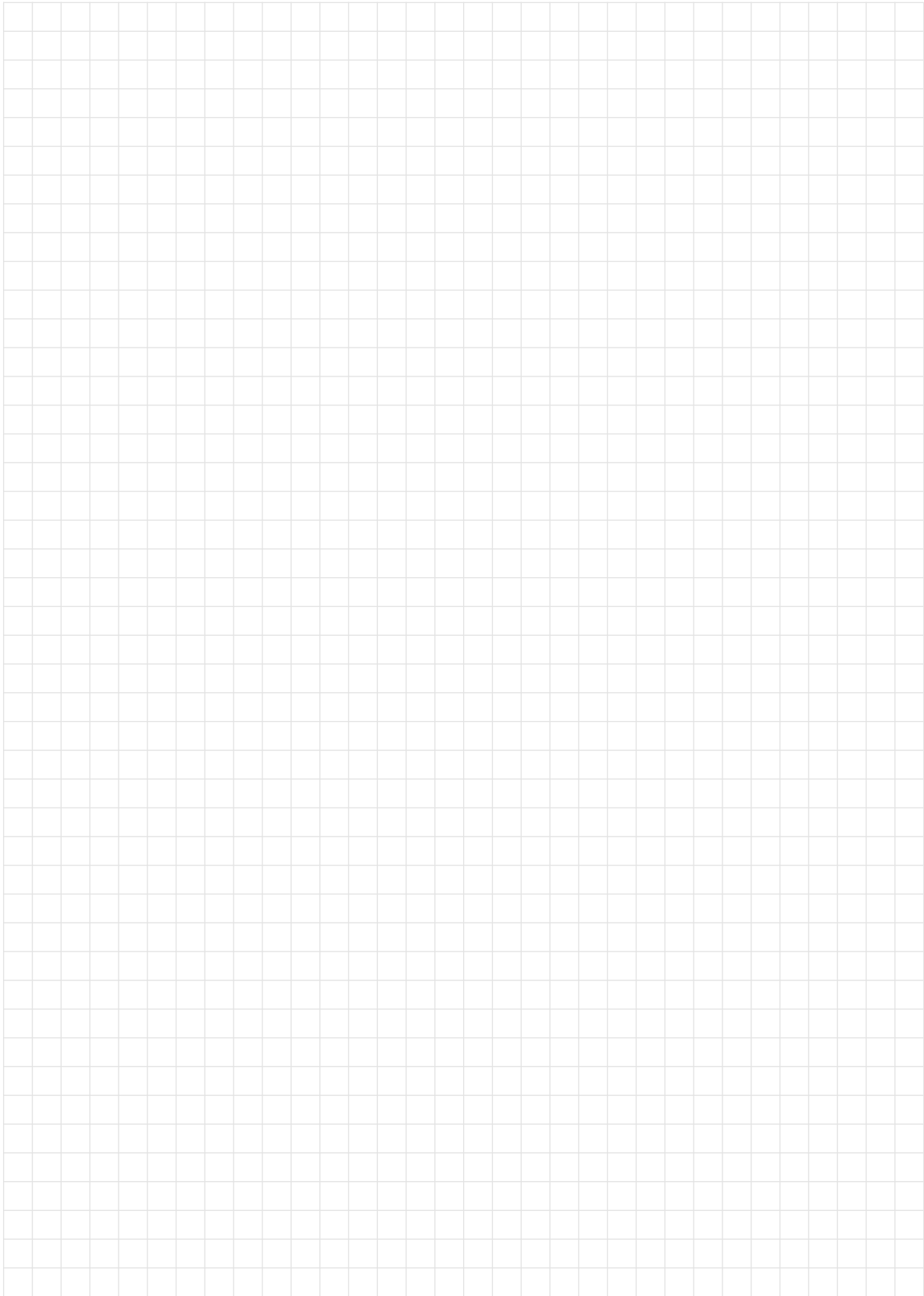
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Edited and distributed by :

Walloon Agricultural Research Center  
Building Lacroix  
Rue de Liroux, 9  
B-5030 Gembloux

ISSN 0770-8343  
Dépôt légal D/2013/1463/3





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