cra-w

Walloon Agricultural Research Centre
Scientific excellence and social usefulness

Activity report 2009/2010

Wallonie

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Foreword

CRA-W's new organisation with four scientific departments and one common services department became effective on the 1st of January 2010.

Since 2009 an interdisciplinary research programme has been pursued along the five main lines described in this report. These lines represent the upstream (ecosystems, biological resources and inputs) and downstream (food and health) context in which agricultural production operates, including product processing for food and non-food uses. Providing information to private-sector and political decision-makers is another of our priorities.

CRA-W is committed to a proactive approach to ecologically intensive agriculture. This concept is gaining ground in developed countries and is the only way to make farming sufficiently productive to ensure food security and provide environment-friendly biomaterials or renewable energy.

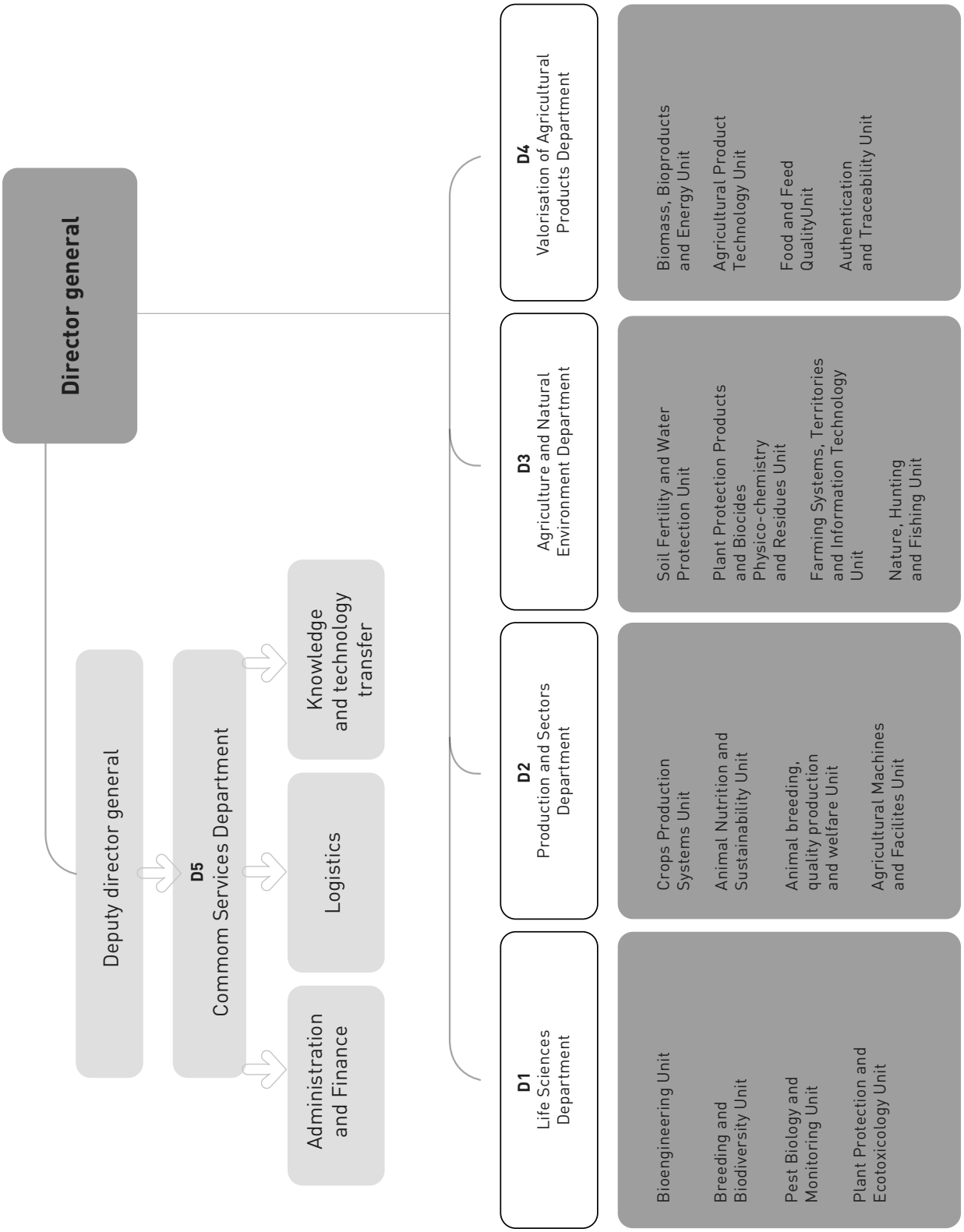
Ecologically intensive agriculture is aimed at optimum use of natural resources and adaptability to changing climate conditions. It follows an approach based on observations and relevant measurements of ecosystem and crop development along with detailed monitoring of livestock farming with the aim of limiting inputs in order to maximise their efficiency.

To achieve that goal CRA-W wants to refine its ability to anticipate and is engaged in developing increasingly efficient decision support systems in line with economic developments.

Mindful of social issues, CRA-W is involved in analysing agricultural systems and current challenges like land management, assessment of natural risks, and animal welfare.

Jean-Pierre Destain
Director general f.f.

Organization Chart



CRA-W's Structure

DEPARTMENT 1

« LIFE SCIENCES DEPARTMENT »

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 (1)

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 (2)

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 (3)

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

Plant Protection and Ecotoxicology Unit (4)

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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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 in an alternative way, by reducing energy intensity, developing resilience and integrating agriculture and ecosystems.
- Producing something different, for instance ecological services and the carbon service.

And, therefore, developing more sustainable crop and animal production systems with a balanced, integrated approach that takes account of economic, agricultural, ecological and social interests.

••• Crop Production Systems Unit (5)

Proposes benchmarks for all of Wallonia's traditional crops and also for special crops, horticultural crops and diversification crops.
Develops decision support tools 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 (6)

Devises animal feeding strategies to meet the animal's nutritional and health needs while at the same time controlling their environmental impact and developing their contribution to the nutritional quality of food for human consumption.

••• Animal Breeding, Quality Production and Welfare Unit (7)

Develops rational, sustainable breeding methods and techniques that contribute to improving the competitiveness of livestock farms and sectors, controlling the quality of animal production processes and products and objectively assessing animal welfare.

••• Agricultural Machines and Facilities Unit (8)

Rationalises the technical and economic resources used in terms of agricultural mechanisation and facilities, having regard to greater environmental protection and technical choices that promote sustainable agriculture.

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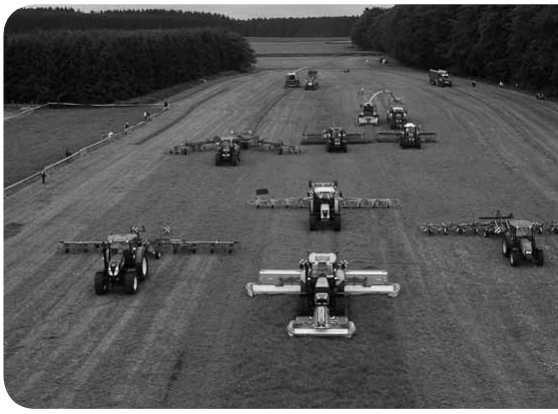

DEPARTMENT 3

« 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 (9)

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 performances and environment preservation.

••• Plant Protection Product and Biocide Physico-Chemistry Residues Unit (10)

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 (11)

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.

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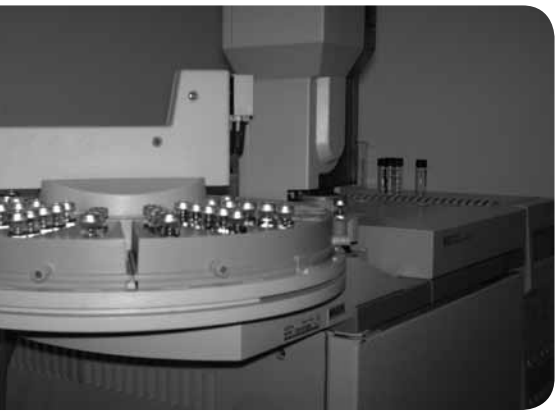

DEPARTMENT 4

« 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 [13]

Contributes to socio-economic development and a more sustainable environment by increasing the efficient use of biomass in energy supply from domestic to industrial applications.

Agricultural Product Technology Unit [14]

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

Food and Feed Quality Unit [15]

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

Authentication and Traceability Unit [16]

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

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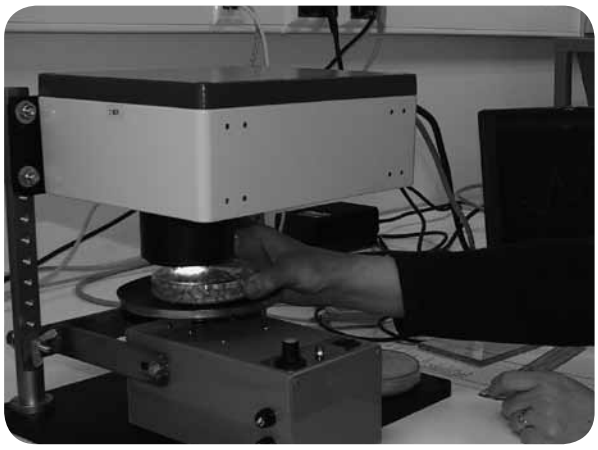

DEPARTMENT 5

« COMMON SERVICES »

As part of CRA-W's restructuring in 2010 the Regional Government decided to set up a dedicated department to provide support for the Centre's other departments and research units. Centralising support in this way is a new step for CRA-W and is aimed at harmonising the Centre's administrative and financial management, providing logistical services to underpin its development, and exploiting research results more effectively. The new department has a team of 50 people and comprises 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. A new hiring and fixed-term staff contract renewal process was finalised and validated.

FINANCIAL MANAGEMENT administers payments to staff, i.e., salaries, bonuses, allowances and travel expenses, as well as sick leave, workplace accidents and business assignments. The appointment of an administrative assistant enabled several organisational improvements to be made in 2010.

ACCOUNTS implemented the new version of the PIA accounting software adapted to CRA-W's new structure. CRA-W's budget also had to be adapted to the new structure. Although this was not an easy task and some subsequent budget adjustments were needed, CRA-W's research work was unaffected.

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, Financial 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

This is a new division within CRA-W. It gradually became operational in 2010 and now comprises two units: Facilities and IT, which gradually got up and running during 2010.

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 will be drawn up for 2011. 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.

INFORMATION TECHNOLOGIES has also taken on more staff in order to provide an efficient on-the-spot service in future. Over the two-year period this unit has put in place processes for harmonising computer hardware and standard software purchasing and is now establishing a schedule aimed at improving and harmonising CRA-W's IT operations.

••• Knowledge and Technology Transfer

This is another new division within CRA-W. This currently comprises the Communications Unit, the Quality Improvement Office and the Procurement Contracts and Agreements Supervisory Unit.
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 Info, our quarterly newsletter. In 2010 the unit was involved in designing CRA-W's new logo and house style book as well as completely revamping our website, which it actively manages.

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 PROCUREMENT CONTRACTS SUPERVISORY UNIT continues its work of assessing and validating all CRA-W's procurement contracts and research agreements/contracts. Its workload increased in 2010 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.

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RESEARCH IN 2009 – 2010 INCLUDED

This part of the Activity Report describes some of the research conducted by CRA-W in the 2009-2010 period. This research has been arranged along the five main lines established in the document entitled 'Walloon Agricultural Research Centre: Scientific Excellence and Social Usefulness'. For more information visit http://www.cra.wallonie.be/index.php?page=2.

The projects described in this part of the Report and other projects are discussed in greater detail on various media. These can be obtained from the Project Manager whose e-mail address is given below each topic, or by visiting our Website http://www.cra.wallonie.be (under 'Research', 'Research Projects', search by key word). You can read about all our research projects and service activities there. We hope you enjoy these various sources of information.

The four research lines

LINE 1

IMPROVING THE LIVING ENVIRONMENT, PROTECTING THE NATURAL ENVIRONMENT AND PRODUCING IN A SUSTAINABLE WAY

Cultivated and natural ecosystems evolve under the combined effects of climate change, new production methods and environmental, social and economic issues. That makes it essential to identify the adaptive strategies and the innovations needed on farms and within the different agricultural sectors.

Our work on this topic aims to explore options for change and the innovations available to the agricultural sector in order to make systems more resilient to face such changes and/or to enable them to adapt in line with the expectations of the sustainable development drives and sectors keen to promote quality-differentiated products, in particular. These adaptations should also help the sector to fulfil the various functions that society expects: producing quality food, maintaining ecosystem services and territorial networking in harmony with rural stakeholders.

OBJECTIVE 1

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

••• No-till crop husbandry and maintaining soil fertility

Long-term tillage trials over the last 20 years show that cropping history can determine the agronomic performance of no-till growing methods. Sugar beet and flax, for example, being susceptible to poor soil structure, both produced lower yields in no-till fields where previous husbandry practices were considered unfavourable to the soil structure: unsuitable crop sequence with, in particular, a potato crop harvested in poor conditions, reduced tillage practices ongoing for several years, etc,.... Although less detrimental, the technique of periodically decompacting the arable layer cannot in itself restore a soil structure comparable to that created by ploughing, as is confirmed by penetrometer measurements to characterise the structural heterogeneity. These measurements also show that, in silty soils, the continuous use of reduced tillage causes a gradual increase in soil resistance accompanied by a decrease in structural porosity, resulting in a decline in soil physical fertility.

► **Christian Roisin, roisin@cra.wallonie.be**

••• Controlling runoff in potatoes to limit water, plant protection product and sediment losses

Growing practices such as ridging, planting in the direction of the slope, late soil cover, etc., make potato crops susceptible to runoff. The result is sediment losses, stagnant water collecting at the foot of the field or in the depressions, increasing the risk of pathogen development, and surface water pollution by leached pesticides.
Tying ridges at regular intervals was tried as a means of encouraging water infiltration. The results of trials in 2009 and 2010 confirm the effectiveness of the technique, confirming the observations made from 2005 to 2007. Runoff volumes dropped by 95% and the quantity of sediment lost was reduced by more than 99%. No crop spray losses were noted whereas, without tied ridges, up to 2% of plant protection products are likely to be lost as runoff. The technical and economic aspects of the method were studied in 2010, namely feasibility of using the technique with existing planters and ridgers, impact of micro-ridges on harvesting and effects on yield and tuber quality. The method was extended in late 2010 via a technical seminar for industry players (growers, agricultural contractors, plant protection product manufacturers and local authorities).

> **runoff volumes dropped by 95% and the quantity of sediment lost was reduced by more than 99%**

► **Jean-Pierre Goffart, goffart@cra.wallonie.be**

••• Developing a system for assessing the risk of diffuse pollution of surface water and groundwater by pesticides: PESTEAUX

To support decisions in connection with implementation of legislation such as the Water Framework Directive it must be possible to assess the risks of diffuse pollution of both groundwater and surface water by pesticides. The PESTEAUX tool has been developed with CRA-W funding to meet this need. The tool, working at agricultural parcel level and covering the whole of Wallonia, estimates the pollution risk according to three main layers of information: the physical characteristics of the parcel (environmental context, topography, soil type, etc.), anthropic pressure (land use, plant protection product applications, etc.) and local weather data (rainfall, evapotranspiration, etc.) It works by assigning each agricultural parcel a risk value based on a decision-making schema that takes account of the key factors of each of the three information layers and their relative significance. On that basis PESTEAUX should identify risk areas for a particular pesticide, target agricultural parcels likely to cause larger-scale pollution (catchment area, regional level, etc.) and, lastly, explain or predict pollution risks.

► **Christian Roisin, roisin@cra.wallonie.be**

••• Improving input application to optimise economic and environmental efficiency

For environmental and economic reasons, inputs have to be applied precisely CRA-W has therefore developed methods for testing and determining fertilizer and pesticide distribution. The alternatives developed and validated for fertilizers involve determining the distribution of the entire spread. On this basis, the standard describing fertilizer spreader test methods has been revised. The data obtained indicate further research into the relationship between fertilizer properties and behaviour. As regards pesticide application the sprayer inspection unit is undergoing ISO 17020 accreditation. Tests have been set up with private firms to analyse the effects of the spraying method (rate, nozzle) on treatment effectiveness. The current tendency is to reduce the volume per hectare in order to increase the work rate and to use anti-drift nozzles for environmental reasons. As the result of tests, in particular by analysing spray nozzle quality parameters and establishing tolerance limits, these new practices can be flagged so that there is no impairment of treatment efficiency. A related study aims to analyse spray nozzle quality parameters and establish tolerance limits. These approaches have been facilitated by modifications to the test bench in cooperation with the University of Lublin (Poland), enabling flow rate measurement and individual nozzle distribution to be combined.
Again with a view to optimising economic and environmental efficiency, CRA-W studies the availability and efficiency, notably in terms of cost/accuracy ratio, of the GPS guiding or navigation systems on the market. Antenna sharing in order to work in differential mode and achieve sufficient accuracy at least cost is one of the avenues explored in this context. Lastly, research is being conducted into low-dose localised placement along the row of the fertilizers needed to start the crop off.

► **Olivier Miserque, miserque@cra.wallonie.be**

... AND ANIMAL PRODUCTION SYSTEMS

••• Estimating methane production by dairy cattle from the milk composition

> accurate methods for estimating methanogenesis in ruminants in order to direct both genetics and practice towards more economically and environmentally efficient animals and systems

Cattle farming accounts for 29% of anthropogenic methane emissions. Not only is this methane environmentally harmful, it also represents a considerable energy loss for the animal. There is a regrettable lack of fast, accurate methods for estimating methanogenesis in ruminants in order to direct both genetics and practice towards more economically and environmentally efficient animals and systems. The METHAMILK project, which is regionally funded and developed with the methodological support of INRA (France), therefore aims to correlate the middle infrared spectrum of milk with methane production. Initial research revealed a significant relationship ($R^2 = 0.72$) between these parameters for nutritionally equivalent rations of very different kinds (grass/pulp as against maize silage/concentrate). This relationship is now being further investigated in a trial comparing the same basic ration with or without additives (yeast, fatty acids) to limit methane production. The database will then be validated against a larger population before embarking on a study of Wallonia's entire dairy stock and, in particular, examining the impact of genetics on these parameters on the basis of the thousands of milk spectra currently available.

▸ **Eric Froidmont, froidmont@cra.wallonie.be**

••• Optimizing the energy efficiency of livestock farms and reducing their greenhouse gas emissions

Like any other sector, agriculture must reduce the pressure it exerts on the environment if it is to survive. That means reducing greenhouse gases (GHG) of agricultural origin, principally by making more efficient use of energy, which represents an increasing share of production costs. This is the main objective of the INTERREG 'OPTENERGES' project, which aims to characterise the systems in situ within the Wallonia – Lorraine – Luxembourg Region from the point of view of energy consumption in order to compare the latter with the farming methods used and identify the alternatives that should be promoted.

> this research has shown up differences in GHG emissions

At the same time, trials funded by the Regional Government have been in progress for the last four years, in cooperation with UCL, to measure the impact of herd feeding and manure management practices, both in experimental cowsheds and in storage, on GHG (CH_4, CO_2 and N_2O) and acidifier (NH_3) emissions. As well as methodological progress this research has shown up differences in GHG emissions according to the type of housing, farmyard manure treatment and feed.

▸ **Robert Oger, oger@cra.wallonie.be**

OBJECTIVE 2
ENHANCING AND PROTECTING BIOLOGICAL RESOURCES AND LAND AND AQUATIC ECOSYSTEMS

••• New plant protection products and selectivity for natural enemies of crop pests

By controlling pests while sparing their natural enemies, selective products establish a balance of power between them which is favourable to the farmer. Natural enemies work in tandem with the selective treatments. This post-treatment action is a useful way of limiting the risk of pest reoccurrence after treatment and also the risk of insecticide-resistant pest populations developing.

Among the latest insecticides, flonicamid and pymetrozine, both of which act by inhibiting aphid food uptake, have proved very selective by sparing aphid enemies like ladybirds, hoverflies, parasitic hymenoptera, carabid beetles and rove beetles. Moreover, these two products are relatively slow-acting on aphids: food uptake and damage are quickly halted, but it takes 3 to 7 days to kill the aphid. That allows the larvae of the natural enemies present at the time of treatment to complete their development cycle and thus, in the long term, to increase their populations in agro-ecosystems. In contrast, pirimicarb, which is selective for ladybirds, causes over 80% ladybird larva mortality simply because they lose their food supply following a treatment.

▸ **Michel De Proft, deproft@cra.wallonie.be**

••• The farmer: a key player in protecting Wallonia's biodiversity

The second pillar of the Common Agricultural Policy (CAP) has equipped the European Union to work towards preserving habitats and endangered species. In that context specific aid linked to 'agro-environmental methods' are providing financial support for farmers who are involved in protecting our natural heritage. As a reminder, farmers manage nearly 50% of Wallonia's total land area. But is the aid granted enough to make up for the loss of income? What are the pros and cons of managing high biological value environments? Does this meet the objectives of the three pillars of sustainable development? The regionally funded ECOGEST project aimed to answer these questions. We looked at the viability of farms that devote a significant part of their activities to maintaining natural sites of biological interest by means of extensive grazing or late cutting. Subsidies, accounting for about 80% of all income, are the main resource associated with this activity. However, the total aid received is not sufficient to reach the annual gross margin for conventional grassland of 1.280 €/ha.

▸ **José Wavreille, wavreille@cra.wallonie.be**

••• Transgenic rape found growing wild in Wallonia!

In a recent study funded by the Regional Government CRA-W found transgenic rape growing wild for four years in succession. The study initially aimed to supply data in connection with possible GMO 'background noise' in fields with a transgenic rape history, as it would have repercussions on the practical steps needed for GMO, conventional and organic rape crops to coexist. The investigation revealed two transgenic rape lines. The first of these could be accounted for by a former experimental site about 4 km away. However, that does not explain the presence of the second line. Other possibilities were examined (transport, bird spread, etc.) but not proved. Further data gathering should shed some light on the possible origins of this contamination and on a rape GMO population's ability to survive in the wild.

▸ **Gilbert Berben, berben@cra.wallonie.be**

OBJECTIVE 3

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

••• Experiments with farrowing and post-weaning pens with heated piglet shelters

A producing and fattening pig farm consumes nearly 1,000 kWh per sow per year, with some systems requiring three times that level. Heating accounts for nearly 50% of the total consumption, over one-third of it in post-weaning and nearly one-quarter in farrowing. In a context of rising energy prices, designing low-energy pig housing is essential.
The DURAPORC study, funded by the Regional Government, tested farrowing and post-weaning pens designed with the emphasis on potential heating savings and animal welfare. The pens had straw litter and an insulated, heated piglet shelter. The ambient temperature was cooler than with conventional systems.
In farrowing pens, energy consumption for heating was cut by 30% with a limited weight and back fat thickness losses in the sows. Sow and piglet behaviour seemed unaffected, but mortality was higher. In post-weaning there were no energy savings. The study also showed the importance of designing the pens to promote cleanliness.

▸ **José Wavreille, wavreille@cra.wallonie.be**

••• Supporting the development of farming systems in line with society's expectations and land use

The changing production context and society's expectations of farming raise a number of issues of values, conflicts of use, interactions between natural and social processes and, lastly, governance and control of systems. Producers therefore need to be equipped with tools for continuous assessment and improvement of their activity sustainability, at both local and global level, in order to get the agricultors and the public talking to one another again. This is the background to the DurAgr'ISO14001 and GeoFairTrade projects, backed by the Region and/or the EU.
The first of these set up a system for continuously improving farm sustainability based on environmental certification. To achieve this aim the certification process has to be adapted to small-scale enterprises by facilitating monitoring of legislation in force and limiting implementation costs through collective approaches.
The second project aims to adapt the concepts of product geographical traceability and sustainable development to various fair trade product chains. The indicators established for assessing the impact and sustainability of strategies followed by producers' associations relate to aspects like environmental protection, health policy, education and training.

▸ **Robert Oger, oger@cra.wallonie.be**

> 1. Alder stock plants as riverside ecotypes established at the CRA-W | > 2. Growth of alder leafy cuttings

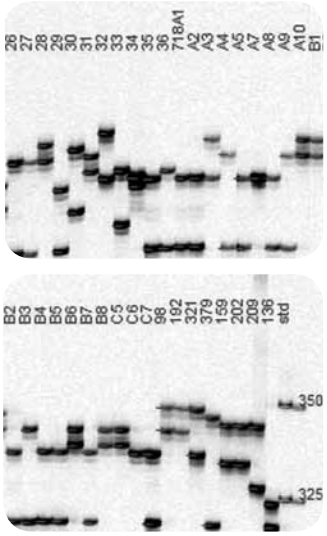
OBJECTIVE 4

HELPING TO DEVELOP AND MANAGE THE COUNTRYSIDE AND FORESTS

••• From the restoration of riparian zones on the river to phytoremediation

Public authorities regard riversides renaturation as a key way of controlling flooding and protecting watercourse fauna and flora. Common alder is one of the woody species chosen, along with willow and ash, for consolidating the banks. However, if they are to survive, alder trees must be sufficiently tolerant to a fungal disease caused by Phytophtora alni which has been spreading through Europe since the early nineteen-nineties. To fight this problem a production line of alder ecotypes was established (INTERREG III ECOLIRI project), spanning the stages from exploring and gathering cuttings through to young plant production. Stock orchards have been established with alders ecotypes collected in Wallonia (356), Lorraine (251) and the Grand Duchy of Luxembourg (116). Replanting projects must, however, take into account local genetic diversity. To characterise this, to assess differences between local and foreign populations and to assess the diversity of the collection: 14 microsatellites molecular markers have been developed for use on the alder and a large number of trees genotyped. These molecular markers are also a collection management tool and will enable the traceability of plants material.
Additionnaly, alder and willow are currently additionnaly being studied for use as pollutant traps on the base of a cadmium tolerance (Interreg IVa ECOLRIMED).

► **Philippe Druart, druart@cra.wallonie.be**



> 3. Genetic diversity of alder: electrophoresis of one microsatellite analysis

OJECTIVE 5

CONTROLLING PRODUCTION AND INVESTIGATING THE FATE OF EFFLUENTS AND RESIDUES

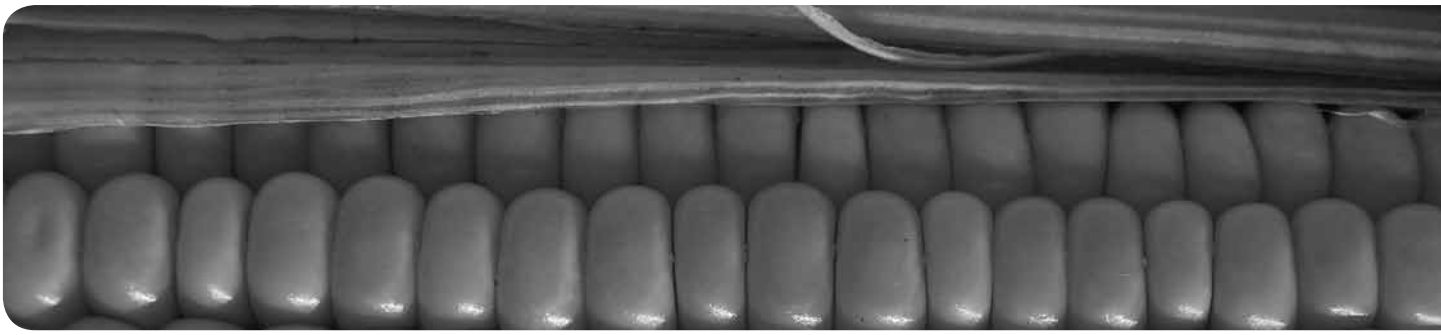
••• Optimising farmyard manure utilisation at farm and field level

Working in close cooperation with the AGRA-OST Agricultural Research and Training Centre and with Regional Government backing, CRA-W has developed VALOR software to determine types of farmyard manure produced (slurry, soft and/or strawy manure, liquid manure), quantities, fertilizer composition and economic value. On that basis the software proposes various types of farmyard manure that can be integrated into fertilizer plans for optimal use, taking all the agricultural, regulatory or environmental constraints into account.

This tool establishes the net requirements of individual crops and meadows. On that basis it will then identify the best application periods in order to optimise the utilisation of farmyard manure at plot and farm level.

Using this software makes people aware of the economic and agricultural value of farmyard manure.
It also removes the chief uncertainty (organic N spread) surrounding the mineral fertilisation advice given by decision support software like AZOBIL.

► **Robert Oger, oger@cra.wallonie.be**



LINE 2

IMPROVING HUMAN NUTRITION, PROTECTING CONSUMER HEALTH AND UNDERSTANDING CONSUMER BEHAVIOUR

Food is a key factor in public well-being and a public health issue. CRA-W's new structure is intended to facilitate more downstream research. Besides primary production, which has been a focus of attention since the very beginning, CRA-W is therefore developing research into product quality in organoleptic and, above all, health terms, so that the industry can supply food suited to people's needs and society's expectations.

As regards chemical and biological food safety, new separation techniques such as HPLC and UPLC are reaching new detection thresholds and are used, in particular, to quantify pesticide residues, an area in which the Centre enjoys international recognition.

Much debate still surrounds GMO and it is important for some sectors to be able to supply guaranteed GMO-free products. CRA-W has a cutting-edge specialist laboratory in this field. This laboratory is also a National Reference Laboratory (NRL) and a member of the relevant European network (ENGL).

CRA-W was also appointed a Community Reference Laboratory for Animal Proteins (CRL-AP) in 2006. In that capacity the Centre provides scientific assistance to member states in connection with MBM detection in animal feed.

OBJECTIVE 1

DETERMINING THE NUTRITIONAL VALUE AND ORGANOLEPTIC QUALITY OF PRODUCTS

••• Technological and sensory properties of lambs from Belgian Dairy Sheep, Ile de France and Vendéen breeds

Dairy sheep farming is relatively marginal in Wallonia. The main breed is the Belgian Dairy Sheep, an endangered local breed. Due to poor conformation the lambs do not find a ready market in conventional distribution channels. The study therefore aims to identify the specific characteristics of Belgian Dairy Sheep meat with a view to promoting it and enhancing its value. The meat was compared with Ile de France and Vendéen lamb fattened in the same environmental conditions (identical housing and feed). Initial results show that the Belgian Dairy Sheep is penalised by its conformation, having a longer body with less fat. Measurements of technological meat quality (colour, loss of liquor in cooking, tenderness of meat and water, protein and fat content), in cooperation with Gembloux Agro-Biotech (ULg), hardly differ from one breed to another. The sensory test data are currently being processed.

► **Eric Froidmont, froidmont@cra.wallonie.be**

> **initial results show that the Belgian Dairy Sheep is penalised by its conformation, having a longer body with less fat**

OBJECTIVE 2
GUARANTEEING THE CHEMICAL AND BIOLOGICAL SAFETY OF FOOD

••• Development and validation of new pesticide analysis methods

With the main aim of protecting consumer health CRA-W has developed and validated some new methods for analysing pesticide residues and their metabolites in food by means of ultra high performance liquid chromatography and gas chromatography coupled with mass spectrometry. The methods developed, optimised and tested in the last two years are aimed at determining residual insecticides / acaricides (pyrethrinoids, neonicotinoids, avermectins, spynosins, etc.), fungicides (anilinopyrimidins, guanidins, thiophanates, benzimidazols, etc.), herbicides (sulfonylureas, aryloxyphenoxypropionates, benzofurans, hydroxybenzonitrils, cyclohexanedione oximes , etc.) and growth regulators in various foodstuffs such as fruit, vegetables and cereals. Determining metabolites of active ingredients was another aspect of the research. These cutting-edge methods were also used to identify and quantify manufacturing impurities in technical compounds and formulations of plant protection products and biocides.

► **Olivier Pigeon, pigeon@cra.wallonie.be**

••• Study of pesticide residues in small-scale crops

For the last 20 years CRA-W has run a major research programme concerned with pesticide residues and their metabolites in small-scale crops. This programme, funded by the Federal Public Service (Public Health, Food Chain Safety and the Environment), supplies the requisite scientific data for European authorisation of plant protection products and for setting maximum residue limits for pesticides in order to check that products are applied correctly, to protect the consumer and to facilitate international trade in food. These tests on market garden crops have extended new product authorisations into crops that are of little value to the agrochemical industry but very important to agriculture and consumers. More than 150 tests involving different insecticides, fungicides and herbicides have been carried out in the last two years on broccoli, celery, cauliflower, kohl-rabi, kale, spinach, fennel, raspberries, turnip, onions, spring onions, peas, broad beans, rhubarb and black salsify. These trials and analyses are conducted in accordance with European and international legislation (Codex/ FAO/WHO) on pesticide residues and according to the OECD principles of Good Laboratory Practice (GLP) (GLP certificate C04).

► **Olivier Pigeon, pigeon@cra.wallonie.be**

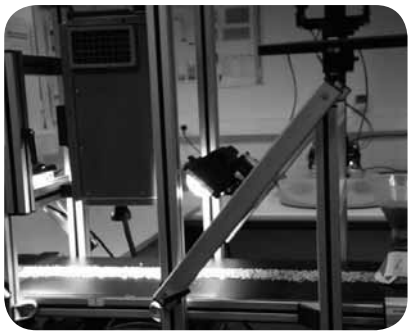
••• Looking for genetically modified organisms

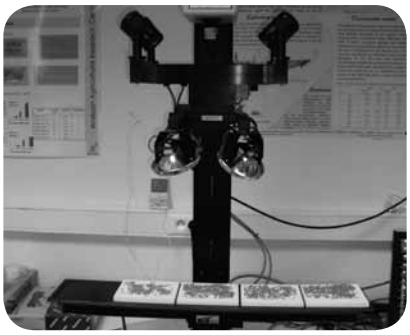
The number of genetically modified organisms (GMO) potentially present in food on the European market is steadily increasing. Some of these GMO are authorised for import by the European Union, whereas others are unauthorised or unknown.

> **“CRA-W is working in partnership with other laboratories on devising new bioinformatic and analytical tools to improve GMO detection”**

Through the GMODetec and GMOseek projects CRA-W is working in partnership with other laboratories on devising new bioinformatic and analytical tools to improve GMO detection at the lowest analysis cost.
CRA-W is involved in building a screening database by developing and distributing methods based on real-time PCR DNA sequence gene amplification, along with practical and theoretical control and validation of the data in the database.

► **Gilbert Berben, berben@cra.wallonie.be**

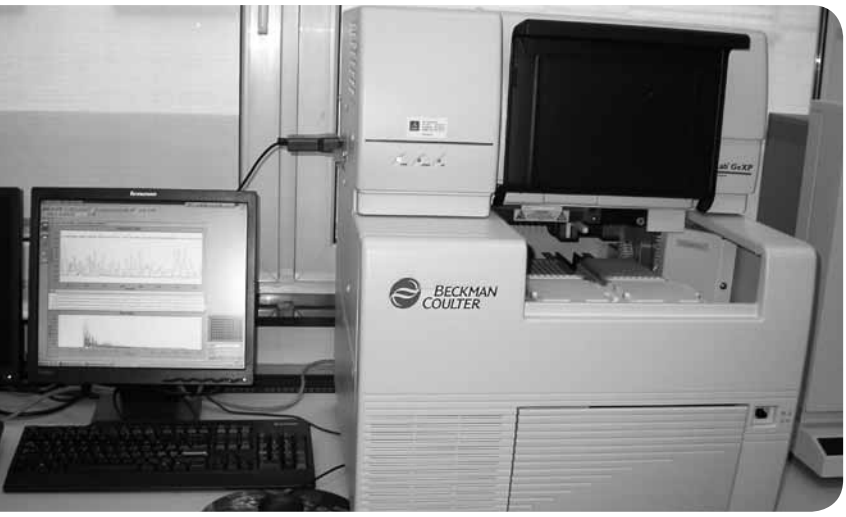




••• CRA-W's expertise in organising ring tests

In the context of its activities as the Community Reference Laboratory for the detection of animal protein (CRL-AP) and the European Safeed-PAP project, CRA-W organised or participated to the organisation of five interlaboratory tests during the 2009-2010 period. Two of these were proficiency tests concerning the reference method in optical microscopy. These proficiency tests were proposed to the 26 reference laboratories in the European Union and to some non-EU countries. The study results highligted the member states' expertise and are visible proof of the added value of the theoretical and practical training provided by CRL-A-P. The other three are ring tests were organised in collaboration with JRC-IRMM and involve two alternative methods (molecular biology – PCR and near infrared microscopy - NIRM) developed by CRA-W to detect and identify animal protein in animal feed. In addition to these five ring tests others are organised annually by CRA-W as part of the REQUASUD project, involving cereals and forage.

▸ **Vincent Baeten, baeten@cra.wallonie.be**



••• Developing NIR imaging (output of European FONIO, SAFEED-PAP and Conffidence projects)

Hyperspectral imaging has gained ground in infrared analysis in recent years. This is a rapid, non-destructive method and the spectral data can be linked to spatial data. This new technology is currently or has been used in framework

> **species-specific animal protein detection in compound feed**

of three European projects: SAFEED-PAP, FONIO and CONffIDENCE. The SAFEED-PAP project aimed to solve the problem of species-specific animal protein detection in compound feed, notably by developing and validating methods applicable to species-specific detection and quantification of animal proteins in order to reconsider the total ban. In this project the NIR microscopy method used for specific animal protein detection has been adapted to NIR hyperspectral imaging. The **FONIO** project developed a methodology based on NIR hyperspectral imaging to distinguish fonio seeds according to production origin and analyse their chemical composition. Finally, the **CONffIDENCE** project aims to develop a NIR imaging based method to detect ergot in cereals.

▸ **Vincent Baeten, baeten@cra.wallonie.be**

LINE 3

DIVERSIFYING PRODUCTS AND THEIR USES AND MAKING PRODUCERS AND ENTERPRISES MORE COMPETITIVE

Over the last two years CRA-W has become a partner on various Marshall Plan projects (Walnut20, Consalim, Wal-Aid). These projects enable the Centre to tackle the new objectives established at the time of restructuring by focussing its researches on processed agricultural products, both food and non-food, while meeting manufacturers' expectations more closely.

On the food side, research has focused on identifying distinguishing characteristics of quality Walloon bread and understanding the mechanism of kefir grain formation, the latter as part of a doctoral thesis. In the context of the former, a new piece of apparatus for assessing the rheological properties of dough has been developed with the private sector.

The main focus of research into the use of agricultural products and by-products for non-food uses is the use of biomass for energy : second generation ethanol production, solid fuel densification, etc. While paying special attention to the sustainability of such uses for agricultural biomass, a more global approach, at regional level, allows the bioenergy chains to be understood in technical, economic and environmental terms.

OBJECTIVE 1

CHARACTERISING AND PREDICTING PRODUCT QUALITY AND SPECIFICITY

••• Developing methods for supporting a Differentiated Quality Walloon Bread sector

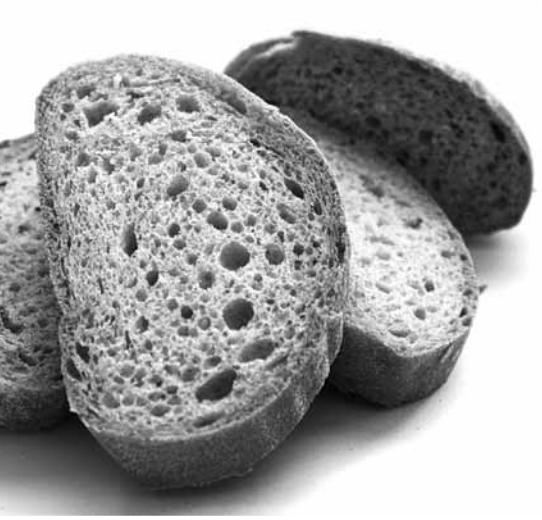
Setting up a Differentiated Quality Walloon Bread sector involves compliance with a specification and ensuring traceability at all levels: farmers, through integrated wheat growing; merchants, by forming differentiated quality batches; millers, by producing distinctive flour; and bakers, by giving the product its specific features. However, having to use breadmaking methods

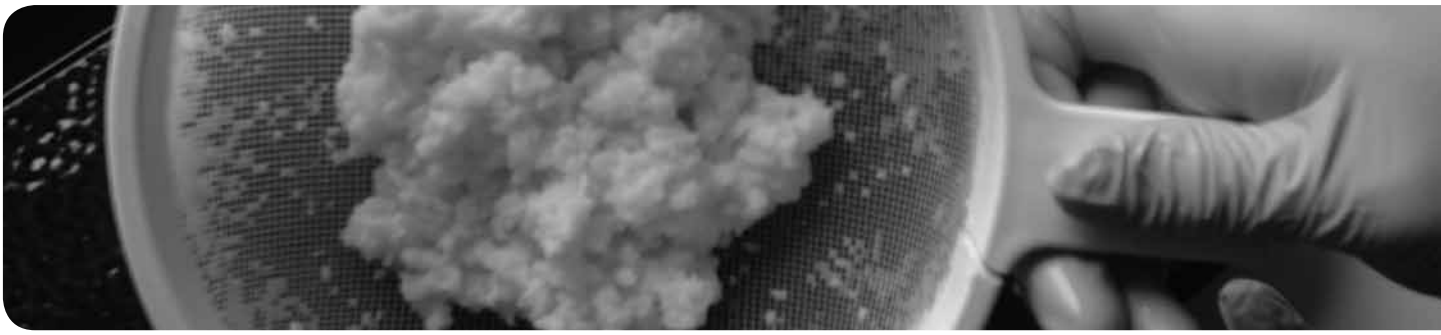
> **CRA-W has developed a series of indicators for controlling industry practices**

that require lengthy fermentation is a major constraint which may prompt bakers to deviate from the pre-established 'baker's charter' in some respects. To avoid any drifts CRA-W, in cooperation with ULg-Agro Bio Tech under a regional convention, has developed a series of indicators for controlling industry practices.

For example, ultra high performance liquid chromatography analysis of the lactic acid content of bread reveals the use of a particular flour, provided it contains a dehydrated lactic leaven. The same analysis applied to glycerol shows whether long fermentation has taken place. This can be confirmed by detecting the increased occurrence of volatile organic compounds from secondary fermentation by gas chromatography. Determining the fat content establishes the authenticity of the flour if it contains the wheat germ. Lastly, analysis of the fatty acid patterns is a means of checking that no extraneous agents such as emulsifiers have been used.

▸ **Georges Sinnaeve, sinnaeve@cra.wallonie.be**





OBJECTIVE 2
PRODUCING FOOD WITH CONTROLLED CHARACTERISTICS

••• The kefir grain under the microscope

The kefir grain is a lactic starter consisting of a complex microflora fixed in the polysaccharide matrix it produces. Creating a kefir grain in the laboratory, from individual microbe strains (in other words, not from an existing grain) indicates that it may be possible to produce a grain with fully controlled health, fermenting and organoleptic properties. Unfortunately, this is not just a matter of combining all the microorganisms in a kefir grain to make a new grain. Observation of very small grains has in fact shown that they dissolve in milk, suggesting they need to reach a critical mass in order to reproduce, that is to say, to grow and multiply in their natural environment. While not forming grains, the kefir microorganisms surprised us by their ability to form structures sometimes resembling biofilms. Are such biofilms, which are quite heavy but softer than grains, the expression of a primary grain structure? Do they develop into a firmer structure ? Finding answers to these questions will be the challenge for the next stage in kefir grain research.

▸ **Georges Sinnaeve, sinnaeve@cra.wallonie.be**

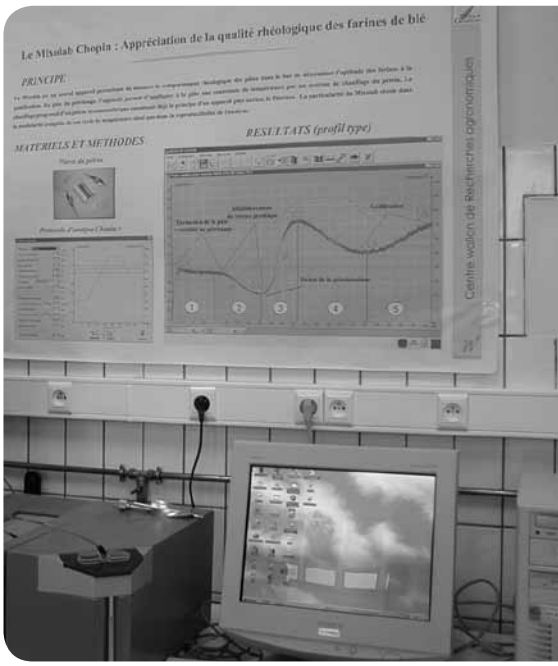
OBJECTIVE 3
CONTROLLING FOOD PROCESSING TECHNOLOGIES

••• Contribution to developing bread dough texture measuring equipment: the CHOPIN MIXOLAB

CRA-W was involved from the beginning in developing the Multigraph, later marketed by Chopin Technologies under the name Mixolab. This tool can replace the set of indirect methods used to determine the rheological properties of dough (farinograph, extensograph, alveograph and/or consistograph). These methods require large quantities of samples (about one kg) that have to be milled beforehand in a test mill.

The Mixolab, on the other hand, works with small samples and can assess the following properties in either white or wholemeal flour: kneading stability, heating stability, water absorption, protein network quality, starch gelatinisation and gelling properties and the effects of amylolytic enzymes. Its properties make the Mixolab a tool of choice for the entire cereal development sector.

▸ **Georges Sinnaeve, sinnaeve@cra.wallonie.be**



OBJECTIVE 4

DEVELOPING INTEGRATED NON-FOOD USE APPLICATIONS, IN PARTICULAR BIOENERGY OR BIO-BASED CHEMISTRY

••• Second generation bioethanol – an opportunity for Wallonia ?

Finding alternatives to using non-renewable energy sources is becoming a priority in order to move towards a more sustainable energy system. Europe aims at meeting 10% of its fuel needs from renewable sources by 2020. Biofuels are currently described in terms of 'generations'. The generations differ in terms of the resources used to produce them.

First generation biofuels processes, available at commercial scale, are based on the sugar-, starch- and oil-rich plant parts. They rise numerous issues, both in energy, economic and environmental terms and from the ethical point of view, given that such biomass could be used for food. An alternative being investigated by CRA-W is to produce second generation biofuels utilising the whole plant and particularly the lignocellulosic fractions (hemicellulose and cellulose).

As part of this research a model has been built to estimate the second generation bioethanol production potential. This model is based on observed yields for different lignocellulosic crops grown at CRA-W under contrasting soil and weather conditions or extrapolated from literature for the other stages in the production process. New crops like Miscanthus and switchgrass have been found to have an estimated ethanol potential of 400 and 370 litres ethanol per tonne dry matter, respectively.

▸ **Jérôme Delcarte, delcarte@cra.wallonie.be**

••• Technical, economic and environmental optimisation of the supply, processing and conversion into energy of solid biofuels

In Europe, bioenergy offers a solution to three current concerns: reducing greenhouse gases, dealing with rising fossil fuel prices and developing 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.

In some parts of Africa charcoal consumption produces large quantities of greenhouse gases and exerts heavy pressure on forests. A charcoal replacement containing agricultural residues has been developed by CRA-W and is currently being produced and sold in Senegal and Rwanda.

▸ **Jérôme Delcarte, delcarte@cra.wallonie.be**

••• Analysis and development of sectors for the use of biomass as energy

The rural sector, both agriculture and forestry, has to face up to some big challenges: maintain or create economic activity; ensure sustainable production and develop new markets; help protecting the environment; fight against climate change, etc. The sectors that use biomass to produce renewable energy or bio-based products are rising to these challenges, but they have to contend with a number of obstacles, whether technological or non technological. In this context

> **environmental and socio-economic impact studies of bioenergy chains and their comparison through analytic methods such as Life Cycle Analyses**

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, environmental and energy challenges and, on the other hand, the stakeholders involved in or concerned with bioenergy, in order to equip them with tools to develop bioenergy projects. In particular decision-making tools integrate environmental and socio-economic impact studies of bioenergy chains and their comparison through analytic methods such as Life Cycle Analyses. Methods for assessing and monitoring biomass resources are also being developed. Bioenergy projects are assessed from a technical, economic and financial point of view. . The factors and mechanisms likely to influence stakeholders involved or concerned are identified and these are informed and advised.

▸ **Jérôme Delcarte, delcarte@cra.wallonie.be**

LINE 4

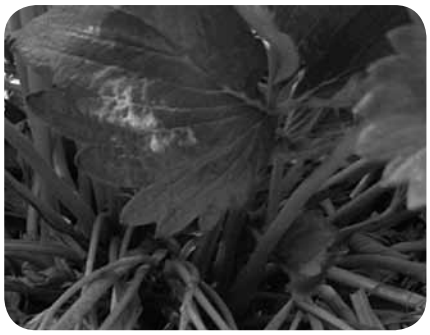
ADAPTING SPECIES, PRACTICES AND PRODUCTION SYSTEMS TO CHANGING CONTEXTS

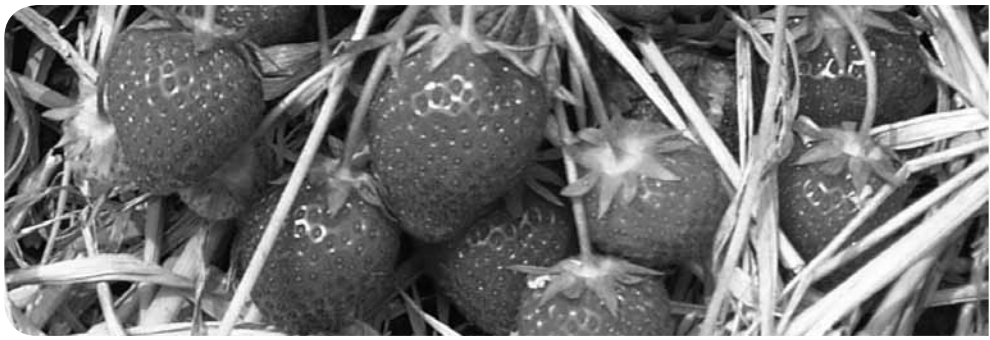
Like any sector of economic activity, Wallonia's agriculture must remain competitive and to do so it has to develop and adapt to changing conditions that are often restrictive and complex. For instance, globalisation and price volatility are drastically altering market access rules and driving producers to cut costs.

Focus on areas, thrifty resource management and maintaining efficient agricultural ecosystems all affect the conditions of agricultural production, with the need, in particular, to limit inputs and diversify production methods and the resulting produce.
Moreover, changes to the type and intensity of bioaggressors as the result of global changes could jeopardise the sustainability of our agriculture.
Against this background the role of research, and hence of CRA-W, which works in tandem with farmers, is to innovate in developing alternative production systems based, in particular, on biological and technological progress.
During the 2009-2010 period our research into reducing inputs was linked to new breeding procedures (minor scab resistance genes in apples, susceptibility to foliar and ear diseases in cereals), new nitrogen fertilisation management tools in potato crops, vegetables and cereals (potential offered by chlorophyll fluorescence) and new livestock rearing and feeding, herd management and grazing methods.
Developments in production and product diversification have resulted from breeding apple, strawberry, cherry and cereal cultivars (spelt, in particular) which are suited to our soil and weather conditions and which have innovative nutritional, taste and health properties that allow them to be differentiated in line with consumer expectations.

In a context of increased biovigilance, our research into methods for monitoring or controlling pathogen populations (or their vectors) complements our work on bioaggressor identification.

Finally, progress in understanding fundamental physiological and molecular mechanisms has led to developments in the use of efficient breeding and propagation tools (somatic embryogenesis in plants).





OBJECTIVE 1

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

••• Research into rapid selection methods for new apple varieties of differentiated quality and optimising the factors that determine a sustainable 'orchard' agro-ecosystem

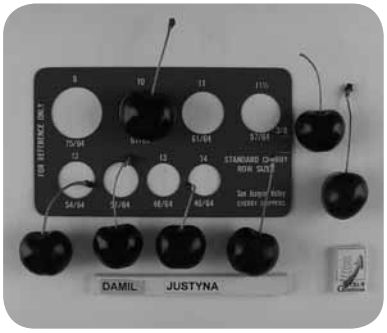
The POMINNO project, backed by CRA-W, aims to develop rapid breeding methods for commercial apple varieties that provide sustainable disease resistance as well as innovative nutritional and health properties.
In this context, among local germplasm CRA-W has characterised minor scab resistance genes by analysing differential gene expression by cDNA-AFLP. Sequencing the expressed fragments and characterising their expression via real-time PCR will be the next step.
Non-destructive methods based on infrared spectrometry have also been developed for measuring internal fruit quality. The fruit sugar content can thus be analysed with the aid of a Phazir portable spectrometer. Robust calibrations have also been developed to analyse acidity and total polyphenols in fruit.
To assess the value of these varieties in integrated orchard management, an experimental orchard run on organic lines with specially increased plant biodiversity (resistant or non-susceptible varieties, plant species that provide shelter for beneficials, etc.) has been designed in order to study the role of the functional biodiversity thus created on controlling various bioaggressors and to optimise plant protection methods and profitable production methods for quality fruit.

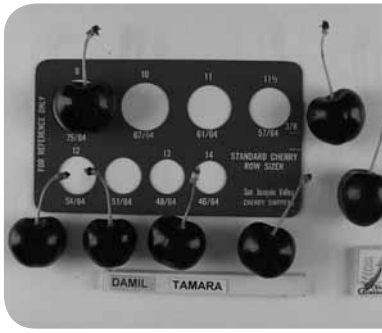
▸ **Jean-Marie Jacquemin, jacquemin@cra.wallonie.be**

••• Assessment and variety resources in fruit crops

The aim of assessing the husbandry and taste characteristics of new varieties of cherries and strawberries is to identify those that are suited to local soil and weather conditions and that meet Belgian commercial requirements.
In this connection 14 new cherry variety data sheets have been added to the published list of 'The Cherry in Intensive Orchards'. This list currently comprises data on more than 160 varieties. These new introductions come from different breeders in Europe (France, Italy, Czech Republic, Hungary) and North America (Canada).
All these varieties are in fact kept in a conservation orchard and included in the European Collection on the initiative of An European Genebank Integrated System (AEGIS), for which CRA-W manages the Pyrus database. This conservation orchard provides a stock of control trees enabeling to check the identity certification scheme by means of morphobiological comparisons and molecular biology markers.
Among the strawberry varieties tested in 2009 and 2010, Darselect Bright appears to offer attractive taste and commercial yield properties. The only downside is that berry size decreases faster than it is the case with the Darselect variety, currently the most widely grown in Wallonia.

▸ **Jean-Marie Jacquemin, jacquemin@cra.wallonie.be**
▸ **Jean-Pierre Goffart, goffart@cra.wallonie.be**





••• Progress in cereal breeding

Wheat Fusarium head blight is a major food safety problem in agriculture. The damage it causes is increasing and the mycotoxins occurring can be harmful to consumer health. With a view to using genetic resistance to the disease in wheat and determining its molecular components we have identified some quantitative genes (QTL) that control this resistance. The results of the expression of several candidate genes from the ABC (ATP Binding Cassettes) carrier family suggest that this molecular efflux pump is associated with the resistance reaction. Separately, spelt varieties have been classified according to their mycotoxin (DON) content, giving us parents with different levels of susceptibility to this problem.
The fibre composition of spelt has been analysed from a nutritional point of view. Whole spelt flour contains fewer insoluble fibres and less cellulose and hemicellulose than wheat. In comparison with wheat, spelt bran is richer in soluble fibres but less rich in hemicellulose and cellulose. Among spelt varieties, Ressac, the reference variety for breadmaking, is the least rich in total fibres and Cosmos is the richest.

▸ **Jean-Marie Jacquemin, jacquemin@cra.wallonie.be**

••• Cereal varieties under the microscope at CRA-W

Official National Catalogue trials have resulted in the accession of 11 varieties of winter wheat, 7 of winter barley and 4 of spelt. The annual trials performed on candidate and reference varieties are the DHS (Distinction – Homogeneity – Stability) and CUV (Cultural and Use Value) trials. Besides productivity, these trials take account of susceptibility to foliar and ear diseases. The trials take place over a 2-year period. The regional post-registration results show big differences between varieties in terms of yield, production security and quality. These differences underscore the value of regional trials to identify the varieties best suited to Wallonia's soil and weather conditions.
More productive new varieties are now available for fodder or breadmaking, confirming rapid variety renewal. The trials conducted also enable the most suitable varieties for organic farming to be identified and recommended.
Lastly, a special showcase on pedigree selection and certified seed production was created at CRA-W in 2010 in cooperation with the Field Crops Promotion Board and APAQ-W. The showcase attracted more than 400 visitors from the industry and agricultural colleges.

▸ **Jean-Pierre Goffart, goffart@cra.wallonie.be**

••• Optical measurements of aerial plant biomass in the field to improve the efficiency of nitrogen fertilisation (transmittance, reflectance and chlorophyll fluorescence)

The potential of chlorophyll fluorescence for determining biomass nitrogen status and managing nitrogen supplementation on that basis is the subject of some doctoral research. Managed splitting of nitrogen fertilisation, based on an assessment of crop needs, in fact increases the efficiency of use of the nitrogen applied. In pursuit of that aim the potential of modern, ergonomic tools for non-destructive measurement of chlorophyll fluorescence was investigated in situ. Dualex and Multiplex (Force-A, Paris, France) were compared with other optical tools studied and developed within decision support systems at CRA-W for potato, vegetable and cereal crops. The other optical tools mobilized are the Hydro N-tester manual chlorophyll meter and the Cropscan portable radiometer, based on foliar transmittance and reflectance on red and near infrared electromagnetic radiation, respectively. In potato and winter wheat crops, the potential offered by spatial remote sensing (visible and infrared reflectance) is currently also being studied as part of the CRA-W-funded MIMOSA project, with promising results as regards distinguishing contrasting nitrogen statuses.

▸ **Jean-Pierre Goffart, goffart@cra.wallonie.be**

OBJECTIVE 2

DEVISING GENETIC AND PRODUCTION STRATEGIES FOR ADAPTING ANIMAL SPECIES TO A RESTRICTIVE ECOLOGICAL AND SOCIOECONOMIC ENVIRONMENT

••• Research into new prospects for using infrared spectrometry in dairy production

Dairy farms are getting bigger all the time throughout the European Union as a result of social, economic, technical and political changes. This development could profoundly alter our farm structures. New tools will be required to enable farmers to more effectively control all the factors relevant to increasing production and to make their work more profitable. The MILKINIR project, funded by the Regional Government of Wallonia and run by CRA-W, aims to develop a measuring system for use in the milking parlour based on infrared spectrometry for instant assessment of a number of milk composition and quality parameters. Taking account of these parameters improves the nutritional quality of the milk as well as herd feeding, genetics, health and fertility. Results to date confirm the value and feasibility of the approach.

> **“improves the nutritional quality of the milk as well as herd feeding, genetics, health and fertility”**

▸ **Georges Sinnaeve, sinnaeve@cra.wallonie.be**

••• Steady dairy heifer growth promotes early calving and good milk production

The growth of more than 700 Holstein heifers from thirty dairy farms was regularly monitored by measuring their thoracic girth between the ages of 3 and 24 months. The project, backed by the Regional Government of Wallonia, showed that the vast majority of milk producers could envisage an early first calving for their heifers, at the age of 24 months, as against an average first calving age of 30 months. It has also shown that more physically developed animals can calve at a younger age with no drop in milk production in the first lactation. Lastly, it confirms the usefulness of measuring thoracic girth as a means of monitoring young dairy cattle. The results are being extended with the aim of giving dairy farmers some technical benchmarks and persuading them to favour early calving at around 24 months in order to keep down the cost of the rearing phase and thus make the sector more profitable. A decision support program called Opticroît has been developed on the basis of the results and will be used by the Walloon Livestock Farming Association (AWE), our partner in the project.

▸ **Eric Froidmont, froidmont@cra.wallonie.be**

••• Near infrared spectrometry (NIRS) applied to faeces to control grazing ruminant feeding a herd management tool

It is not easy to estimate feed intake and digestibility in grazing herds using the methods available. To overcome these problems NIRS, a non-destructive, non-polluting, rapid analysis method widely used at CRA-W, is being developed in new applications on faeces as part of a doctoral thesis. The approaches show the potential of the method for estimating intake, digestibility and, thus the nutritional value of dairy cattle and sheep feed. It is to be noted that the available spectral databases can be used to estimate intake and digestion in all kinds of ruminants across a wide range of feed resources.
Such a tool should allow the availability of fodder resources to be matched to the animals' needs.

▸ **José Wavreille, wavreille@cra.wallonie.be**

••• Replacing soybean meal with protein sources of European origin in dairy cattle feed

The EU imports more than 30 million tonnes of soya each year. Although it is a benchmark for high nutritional value, importing it on such a large scale is not without consequences: nitrogen enrichment of the environment, presence of GMO, economic dependence on external markets, clearing of primary forests. The growth of the biofuel industries opens up new alternatives to food manufacturers such as rapeseed meal or brewer's grains as a soya substitute. The aim of this trial, backed by Dumoulin, was to compare a conventional soybean meal-based protein concentrate with a concentrate containing European protein sources (rapeseed meal, sunflower meal, maize germ meal and brewer's grains). Both production (26 l/animal/day) and the milk butterfat and protein content were found to be equivalent in both systems. As regards cost, the feed price per litre of milk was similar in both cases. The results therefore confirm the production and economic feasibility of replacing soybean meal with European protein sources, assuming soybean meal to cost 300 €/tonne.

► **Eric Froidmont, froidmont@cra.wallonie.be**

OBJECTIVE 3

STUDYING BIOAGGRESSORS, CONTROLLING EPIDEMIC PROCESSES AND MAINTAINING BIOVIGILANCE

••• CRA-W helps to control tropical diseases

Having developed, optimised and validated gas and liquid chromatography analytical methods for determining active ingredients on/in mosquito nets treated with insecticides, CRA-W is contributing to the physico-chemical characterisation of long-lasting insecticide-treated mosquito nets: active ingredient content, thermal stability of products (accelerated storage), homogeneousness of the treatment, surface salting out characteristics of the active ingredient and washing resistance and persistence of the active ingredient. This work is being carried out on behalf of WHOPES (World Health Organization Pesticides Evaluation Scheme), under CRA-W's contract with the World Health Organization (WHO), on behalf of mosquito net manufacturers or for other organisations. In this context CRA-W is cooperating closely with other scientific institutions working in complementary disciplines (biological activity of products, insecticide resistance, etc.).
As a member of the Expert Advisory Panel on Vector Biology and Control CRA-W takes part in WHOPES work on the assessment of pesticides for public health use (biological efficiency and physicochemical properties) for WHO recommendation.

► **Olivier Pigeon, pigeon@cra.wallonie.be**

> Necrosis of the highest part of a sweet cherry tree resulting from *Pseudomonas syringae* attack on the trunk (at the label level)

••• Orange wheat blossom midge, *Sitodiplosis mosellana* (GEHIN), risk analysis and integrated management

When insect flights coincide with the susceptible stage of wheat, the orange wheat blossom midge lays in the spikelets and the larvae develop to the detriment of the grains. The damage may be severe, but it often goes unnoticed.
From work done in the last four years it is now possible to determine when the insect will start to emerge and to establish whether this coincides with the vulnerable stage of the wheat. Pheromone trapping allows the source of insect emergence to be identified. In the course of this work, several varieties of wheat have been found to be spontaneously resistant to *S. mosellana*. In the last two years attention has therefore focused on testing variety resistance under controlled conditions.

▸ **Michel De Proft,**
deproft@cra.wallonie.be

••• Spatiotemporal development of the aerial inoculum of cereal fungal pathogens in relation to climate and impact on disease dynamics

Cereal prophylaxis has hitherto been mainly preventive, based on unmeasured infection risks. This research aims to study aerial inoculum flows of the main fungal pathogens of wheat in order to establish objective risk criteria.
Working in partnership with UCL, a network of 10 fungus spore sensors was established and validated throughout Wallonia. The spores of the different wheat pathogenic fungi thus collected then underwent qualitative and quantitative characterisation using molecular tools.
The data will be linked with local weather conditions to develop understanding of disease development in the field and, ultimately, to refine warning systems.

▸ **Michel De Proft,**
deproft@cra.wallonie.be

> Orange wheat blossom midge: female on ear

••• Improving knowledge of pathogenic orchard bacteria for targeted research into means of control

Pseudomonas syringae van Hall is the commonest pathogenic bacterium causing damage in Wallonia's orchards, but no antibiotics have been approved to control it. That stimulates interest in alternative control methods such as prevention, biological control and variety resistance. However, such methods require a good understanding of the causal pathogens. *P. syringae* comprises more than 50 pathovars, several of which may be responsible for orchard damage. The relative significance and the differences between symptoms of these pathogens therefore needed to be established.

> Symptoms caused by *Chalara fraxinea* on ash (bark necrosis and crown dieback)

Strains collected and isolated from Wallonia's pear, cherry and plum orchards were characterised genetically and in terms of virulence. The *syringae* and *morsprunorum* pathovars and some unclassified strains were found. Different groups in terms of virulence and host specificity were determined within the *syringae* pathovar, whereas two races within the *morsprunorum* pathovar were found to be genetically homogeneous but quite distinct from each other. The strains causing the greatest damage to crops and parts of plants were identified. Identification methods based on genetic fingerprinting, phytotoxins and the pyoverdine and yersiniabactin siderophores (iron chelators) were developed. Research into environmentally friendly control methods will follow on from this work.

▸ **Bernard Watillon, watillon@cra.wallonie.be**

••• Monitoring pospiviroid isolates in horticultural crops: molecular characterisation, status and phytosanitary risk assessment

A case of *Potato spindle tuber viroid* (PSTVd), a quarantine pospiviroid that causes severe losses in tomato and potato crops, was detected and eradicated in tomatoes in Belgium in 2006. Between then and early 2009 it was found on Solanum *jasminoides* Paxton et *Brugmansia* sp., ornamental plants suspected of being an inoculum source as healthy carriers of the disease. Monitoring of these plants led to the discovery of other pospiviroids on ornamental solanaceae in Belgium. These are not covered by the legislation but cause similar damage to the PSTVd, as shown by European focuses in tomatoes. A research project (TOPOVIR), funded by the Federal Public Service, was then launched to investigate the transmission and inactivation mechanisms of PSTVd and other pospiviroids in order to assess the actual risks of spread from ornamentals to potato and tomato plants.

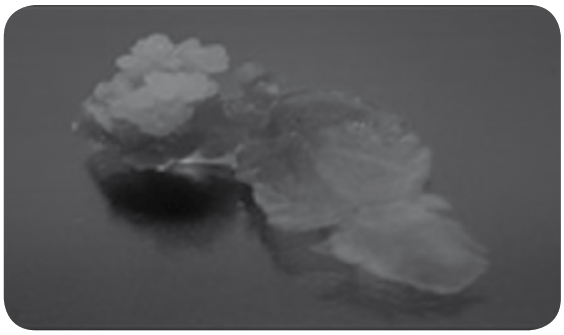
> **monitoring of these plants led to the discovery of other pospiviroids in Belgium**

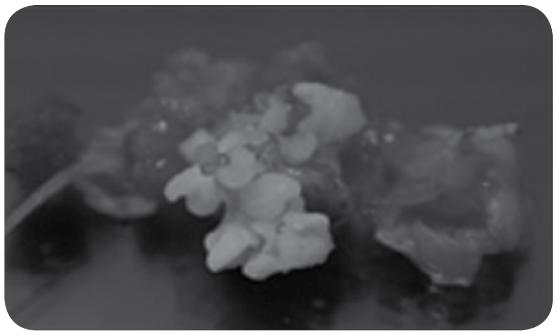
▸ **Bernard Watillon, watillon@cra.wallonie.be**

••• *Chalara fraxinea:* a phytosanitary threat to the common ash

Severe ash *(Fraxinus excelsior)* blight was reported in Poland in 2006. Since then, the fungus *(Chalara fraxinea)* has been identified in several European countries. In view of the dangerousness of this fungus, monitoring of this new disease began in Wallonia in 2009. The sample plots were selected according to various risk factors. A real-time PCR assay to detect the pathogen was developed. The results of monitoring during 2009 did not reveal the fungus. In June 2010 some samples from young ash trees with blight symptoms growing in riparian areas were real-time PCR positive. Further research will be undertaken to assess the extent of the foci of infection and methods of fungus dispersal.

▸ **Bernard Watillon, watillon@cra.wallonie.be**





OBJECTIVE 4

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

••• Knowledge and mangement of somatic embryogenesis in wheat and Nordmann Fir

> **somatic embryogenesis is specially relevant to genetic improvement and vegetative multiplication**

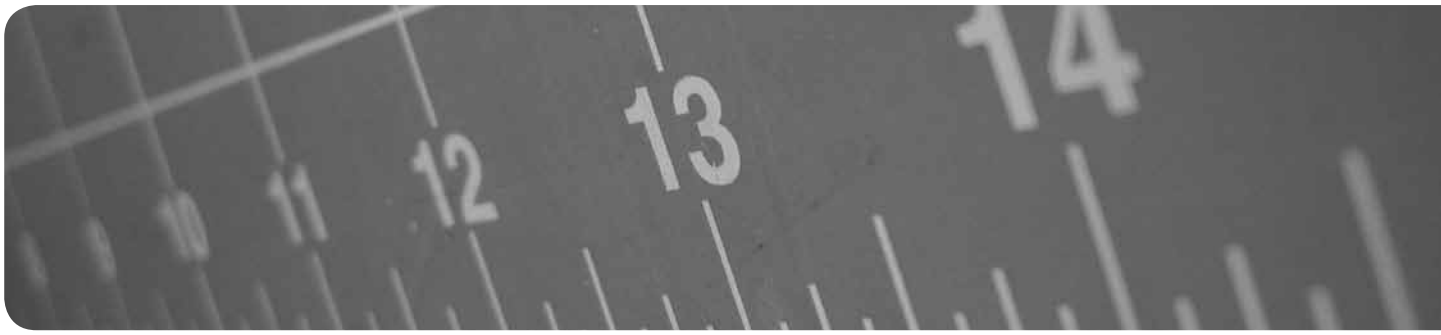
Any plant cell has the capacity for totipotency. Although this was first postulated more than a century ago and has been confirmed in various species, control of whole plant regeneration is still random.
Among regeneration processes, somatic embryogenesis is specially relevant to genetic improvement and vegetative multiplication. Cells of organised tissue successively lose their differentiating traits, acquire totipotency potential and form embryogenic masses or embryos, which further germinate naturally. The expression of this process requires an existing development program in the differentiated plant cell to be released.
Various research works at CRA-W is aimed at understanding the biological, physiological and molecular mechanisms underlying the expression of embryogenetic competence in, for instance, wheat and the Nordmann Fir.
The set of environmental constraints imposed by in vitro growing conditions (injuries, suboptimal nutritional conditions, hormonal imbalances, etc.) creates stress and triggers an adaptive mechanism in the course of which the cell, its physiology and metabolism undergo far-reaching changes. Key genes involved in adaptive response to stress (glutathione S-transferase and oxalate oxidase), cell proliferation (replication factor - Rfc), development control and cell differentiation (Mads-box, oxalate oxidase) have been identified in wheat.
In the Nordmann Fir, compared with 2,3,5-tri-triiodobenzoic acid, a well-known antiauxin compound, 2-(p-chlorophenoxy) 2-methylpropionic and para-hydroxybenzoic acids significantly improve somatic embryo maturation.

▸ **Philippe Druart, druart@cra.wallonie.be**

••• Origin and mangement of somatic embryogenesis in *Prunus* sp.: example of Inmil cherry rootstock

Tests performed on isolated roots of the Inmil cherry rootstock showed that embryogenic competence derives from the parental genotype *P. incisa x serrula* "Inmil" and is transferred by free or controlled pollination of non-embryogenic genotypes like *P. dawyckensis* to their progenies. Also, picloram (4-amino-3,5,6-trichloropicolonic acid), as herbicide with auxinic plant regulation activity, has induced somatic embryogenesis on *P. incisa* leaves. An inverse relationship has been found between the concentration and the induction period in the dark. The blade base of the second subapical leaf contains the most reactive tissues. Lastly, the ortholog-homolog forms (PiABP, Picdc and PiSERK) of three genes potentially involved in induction were identified. These observations should result in better crop conditioning before applying somatic embryogenesis processes.

▸ **Philippe Druart, druart@cra.wallonie.be**

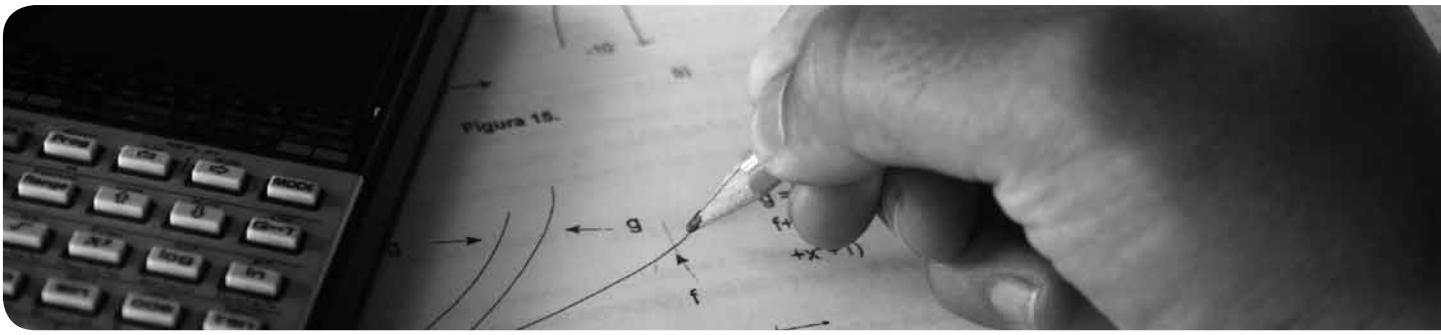


LINE 5

PROVIDING DECISION SUPPORT FOR PUBLIC AND PRIVATE-SECTOR PLAYERS

Establishing production systems that meet the requirements of sustainable development depends heavily on the effective involvement of the socioeconomic players in the decision-making process at both farm and regional level. The issues are all the more important in that they have a global and cross-cutting dimension, that is to say, they concern all the areas within a region and they involve a number of scientific disciplines (life sciences, economics, law, sociology, etc.). The participation of the players in the field is closely linked to the availability of user-friendly tools that meet their expectations and the specific features of the regions or sectors where they are to be used. Another function of these tools is to provide decision support by bringing together knowledge and expertise on the main pillars of sustainable development, adaptation to climate change and environmental protection as material for long-term thinking and discussion on the issues facing tomorrow's agriculture.

This approach requires a forum to be created for dialogue between players with sometimes very different interests (researchers, private and public-sector economic players, citizens, consumers, associations, NGOs, etc.). CRA-W has become involved through a number of research projects, such as long-term analyses of livestock farming systems in Wallonia, the development of decision support systems for multifunctional farm management, performing technico-economic analyses of mechanisation, and support and training for producers in developing countries.



OBJECTIVE 1
IDENTIFYING THE DETERMINANTS OF COMPETITIVENESS

••• Decision support systems and information technologies for multifunctional farm management

The challenges facing agriculture are such as to require the implementation and use of decision support systems (DSS) that allow the complexity of the issues to be taken into account and thus promote the development of integrated crop management at both farm and regional level.
In this context the OptiMAE decision support system, backed by the Regional Government of Wallonia, optimises the systems' economic and environmental performance by promoting agri-environmental measures (AEM). Development continues under the MIMOSA project, financed by CRA-W. The aims of this project are, firstly, to identify the decision rules used in farm management and how these systems link in with their local area and, secondly, to use satellite observations to guide farmers' decisions on both grassland management and crop fertilisation.
On the environmental side, protecting water resources from risks of nitrate or pesticide pollution and protecting the soil have become major issues. This is the background to the REQUACARTO scheme which guides agricultural soil sampling and analysis by the REQUASUD network members in Wallonia. Finally, the ADASCIS DSS is aimed at managing meteorological risks in agriculture more effectively, by setting up crop insurance schemes and helping the authorities to assess the extent of damage at regional level.

► **Robert Oger, oger@cra.wallonie.be**

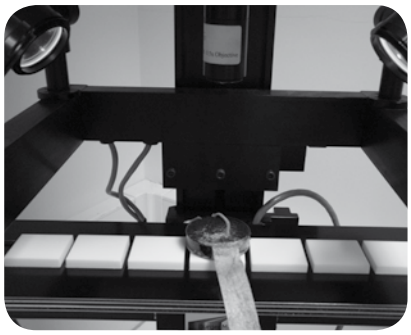
••• Techno-economic analysis of mechanisation

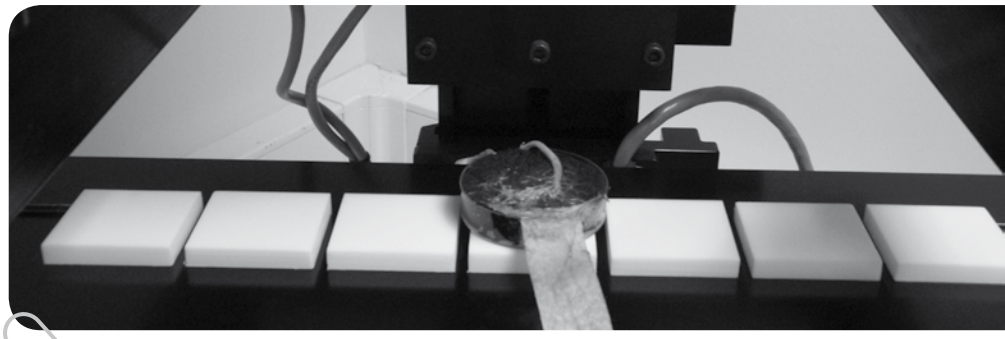
In the constantly changing world of farming with steadily shrinking profit margins, it is important to calculate the return before making an investment decision. The expenses of mechanisation are a major cost price factor for agricultural products. To enable these to be accurately established CRA-W has developed an Internet tool for estimating the cost of use of agricultural machinery.

> **nearly 18,000 calculations had been done by the end of the first year's use**

The Website is called MECACOST (HYPERLINK "http://mecacost.cra.wallonie.be" http://mecacost.cra.wallonie.be). This interface, available in four languages and with free access, can be used to calculate the cost of use of more than 380 tractors and agricultural machines online. Nearly 18,000 calculations had been done by the end of the first year's use. Alongside these economic analyses, new equipment and accessories for use in mechanised agriculture undergo technical testing to assess their efficiency and/or the quality of the results. Equipment testing includes monitoring of GPS systems and, in particular, assessing the accuracy of light bars.

► **Olivier Miserque, miserque@cra.wallonie.be**





OBJECTIVE 2

ANALYSING AND ASSESSING NATIONAL AND INTERNATIONAL PUBLIC POLICIES AND UNDERSTANDING THE ISSUES

••• Energy

The rising costs of oil and energy generally are prompting farmers, like all economic players, to watch their energy consumption more closely. Various initiatives have been undertaken in order, on one hand, to determine consumption data for various agricultural activities and, on the other hand, to explore possible ways of reducing consumption. Test bench measurements of tractor fuel consumption are continuing at the request of users. The method used is subject to continuous improvement, through European project work in particular, in order among other things to take account of more realistic working hours. This work, conducted in cooperation with CEMAGREF and the CUMA networks, should result in an energy classification of tractors in use.
A series of trials has also been carried out with a grain storage company to compare silo ventilation systems. Potential savings have been identified, in particular by installing automatic management systems which do not blow air when the detected temperature is not low enough.

► **Olivier Miserque, miserque@cra.wallonie.be**

••• CAP after 2013

To help public and private-sector players to adapt to the major uncertainties surrounding changing markets and Common Agricultural Policy (CAP) after 2013, we need a better understanding of the micro- and macroeconomic mechanisms involved. Work done by CRA-W, in cooperation with Gembloux Agro-Biotech, focuses on analysing the dairy industry in the context of the post-quota problems (sustainability of Wallonia's production, passing on prices) and the cereals sector (changing world market).
A seminar was also held on the topic of 'European Union Enlargement and Agriculture in Central and Eastern Europe' to describe different countries' situations and agricultural prospects in the context of EU membership.

► **Jean-Pierre Goffart, goffart@cra.wallonie.be**

OBJECTIVE 3

PARTICIPATING IN THE INNOVATION PROCESS AND PROTECTING KNOW-HOW

••• New NIR applications benefiting agriculture

Agricultural and food businesses are increasingly turning to analytical tools to optimise their processes. This applies specifically to near infrared spectroscopy instruments, resulting in rising demand for technical and scientific support in connection with using existing tools or developing new ones. CRA-W's research in this area is focused on portable, on field spectrometers as well as on hyperspectral NIR imaging systems.

For example, within the framework of a joint venture with SESVANDERHAVE NV/SA, new methods using portable spectrometers or hyperspectral NIR imaging instruments have been developed for checking sugar beet seed quality. A tool to assist with nematode-tolerant plantlet selection is also undergoing development. Also, within the framework of projects in partnership with international businesses (such as PROVIMI) and specialist institutes (e.g. AUNIR), CRA-W has successfully developed methods for transferring databases between NIR devices.

► **Vincent Baeten, baeten@cra.wallonie.be**

OBJECTIVE 4
TAKING PART IN DEVELOPMENT PROJECT DESIGN AND EXTENSION

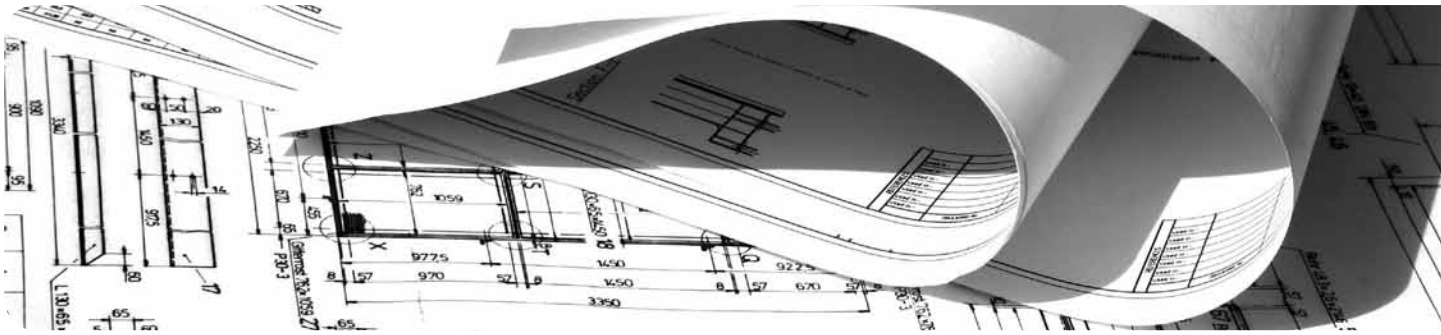
••• CRA-W is involved in extending potato growing in developing countries

Potato growing is developing in the Sahel region as a source of income. Despite the unfavourable climate, the potato has established a niche in the dry season (October to March), when there are low night-time temperatures and day-long sunshine. As in all developing countries, though, the availability of quality plants is a problem. Under the aegis of the CDE (Centre for the Development of Enterprise), CRA-W took part in training civil servants and producers in harmonised control and certification in seven countries: Mali, Niger, Burkina Faso, Senegal, Guinea, Chad and Cameroon.

In Central Africa, in the Democratic Republic of Congo, CRA-W is providing technical support to help develop potato growing. In Katanga an adaptation test identified three varieties that reached good production level in the dry season with irrigation (May to September). In Lower Congo we are advising producers' associations on developing local plant production. Healthy minitubers of five varieties, including a local variety which we regenerated, have been produced and introduced into a multiplication channel.

► Jean-Marie Jacquemin, Jacquemin@cra.wallonie.be

> Potato growing is developing as a source of income



CRA-W and its projects

ANALYSIS OF THE PORTFOLIO OF PROJECTS CONDUCTED BY CRA-W

Our research teams have conducted more than 190 projects in this two-year period.

Over one-third of CRA-W's projects are directly linked to development, service and/or advice activities.

Such activities are necessary for the effective operation of control, monitoring and warning systems put in place to deal proactively with various problems (spread of the muskrat, monitoring of non-endemic pests like the corn root worm, monitoring of zoonoses or emerging diseases, etc.) and to optimise and limit the use of plant protection products (sprayer testing, potato blight and pest warnings, cereal, fruit and nursery crop pest warnings, etc.) or fertilizers (organic fertilizer spreader efficiency study, decision support for crop nitrogen fertilisation, etc.) while ensuring quality product is produced in sufficient quantity,...).

This category also includes testing pesticide formulations and residues and carrying out effectiveness trials of various biocides (fungicides, herbicides, etc.) with a view to authorisation for agricultural use.

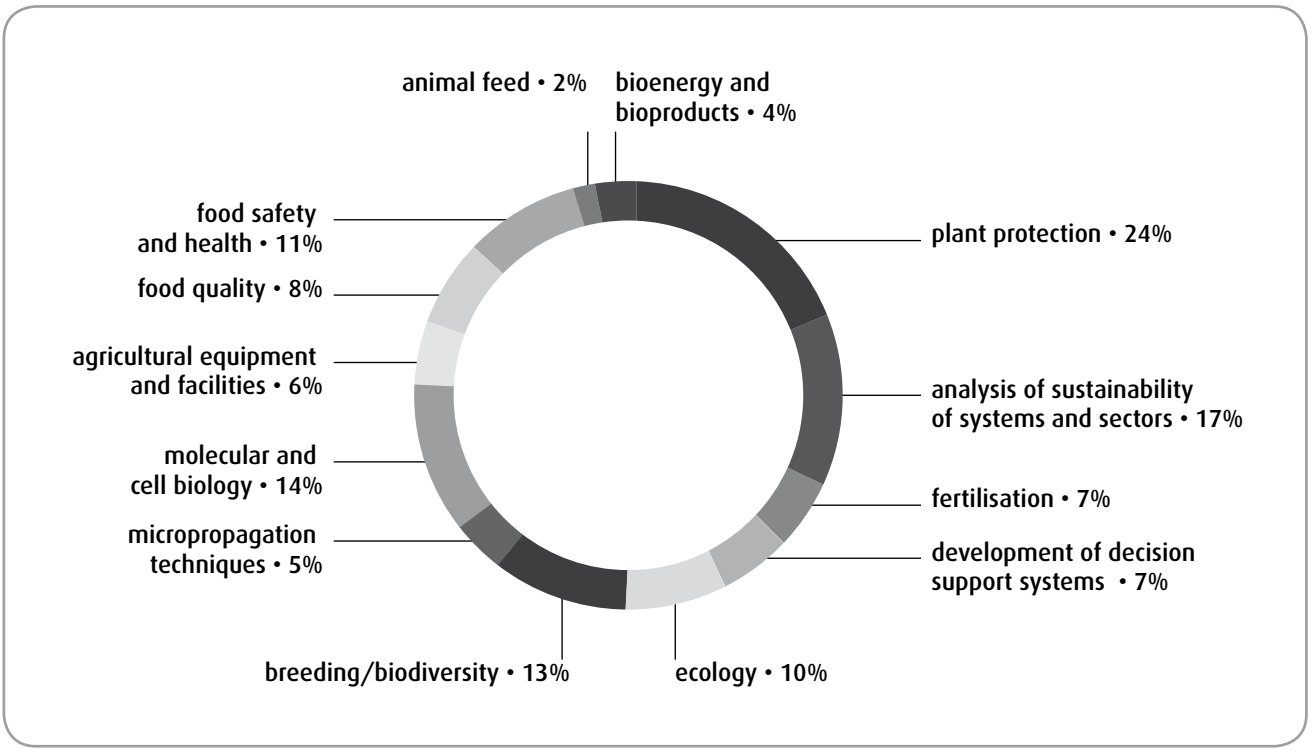
Likewise, to help producers make the best choices CRA-W, in consultation with the relevant pilot centres, oversees a number of variety trials in, for example, potato, cereal, fodder plant and small fruit crops and supplies the different sectors with quality pre-basic material obtained from variety collections maintained in situ or in vitro.

Most of these projects are also directly geared to the sectors' requirements, as shown by the many links between CRA-W and the various sectors. In this regard the reader is referred to the chapter of this report headed **'CRA-W, research to meet the sectors' requirements'**. Similarly, a considerable proportion of the Centre's pig herd is used to assess the performance and determine the production values of Piétrain boars on behalf of the Walloon Pork Breeders' Association (AWEP).

The expertise accumulated by our researchers also covers various services provided to producers, sectors or supervisory and support bodies. Mention may be made here of the work and support provided by the reference laboratories at national (milk, GMO, plant pathogens, etc.) and European level (animal proteins in animal feed), the services provided by the Centre's plant clinic, support for biomass-for-energy development methods and, lastly, calibration of test benches and agricultural machinery.

With regard to the 128 research projects, some of which are discussed under the heading of 'Research in 2009 – 2010 included...', the typology in Figure 1 shows the disciplines within which expertise is developed or the aim of the particular projects. This clearly illustrates the diversity of CRA-W's work.

Nearly 19% of the projects are aimed at improving control of the various health problems that can affect our crops, in both conventional and organic farming, by examining alternatives like using natural defence elicitors or biological control agents. These approaches require in-depth knowledge of the biology of cultivated plants and their aggressors and the interactions between the latter and their environment. They are therefore closely linked to the approaches pursued in ecology, on the one hand, and molecular and cell biology, on the other, which make up 8% and 11% of our research projects, respectively.



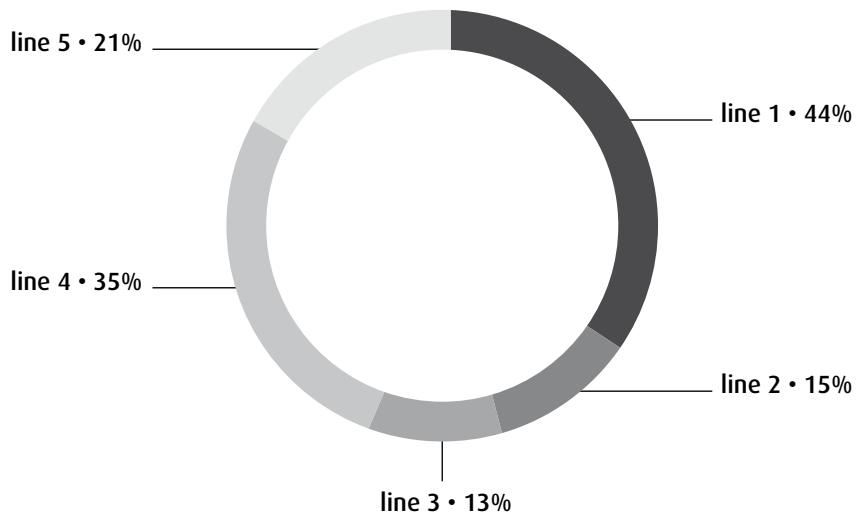
> Figure 1 • Typology of CRA-W Research Projects by Discipline and Aim.

More than 18% of CRA-W's research projects are concerned with the sustainability of crop systems, already covered in the previous type in terms of health management, by determining integrated fertilizer management schemes and also by studying the sustainability of agricultural systems and sectors. The fact is that the choices made by farmers and the various sector players are shaped not only by optimum economic conditions but also by socio-economic interactions. Five per cent of the projects concerning mechanisation and agricultural facilities are also aimed at improving the economic and environmental efficiency of agricultural systems. Here, the aim is to optimise input application and rationalise the use of direct energy. Some of the research produces decision support systems as an end-product. Their development accounts for 5% of CRA-W's projects.

Fourteen per cent of the Centre's projects have to do with breeding new varieties and producing basic and pre-basic material by micropropagation to meet the requirements of the sectors and territories. This line of work, which is crucial for the sector's operation and continual adaptation to society's changing expectations, can draw on the Centre's long-established expertise in particular with respect to potatoes, spelt, fruit crops, Christmas trees, etc.

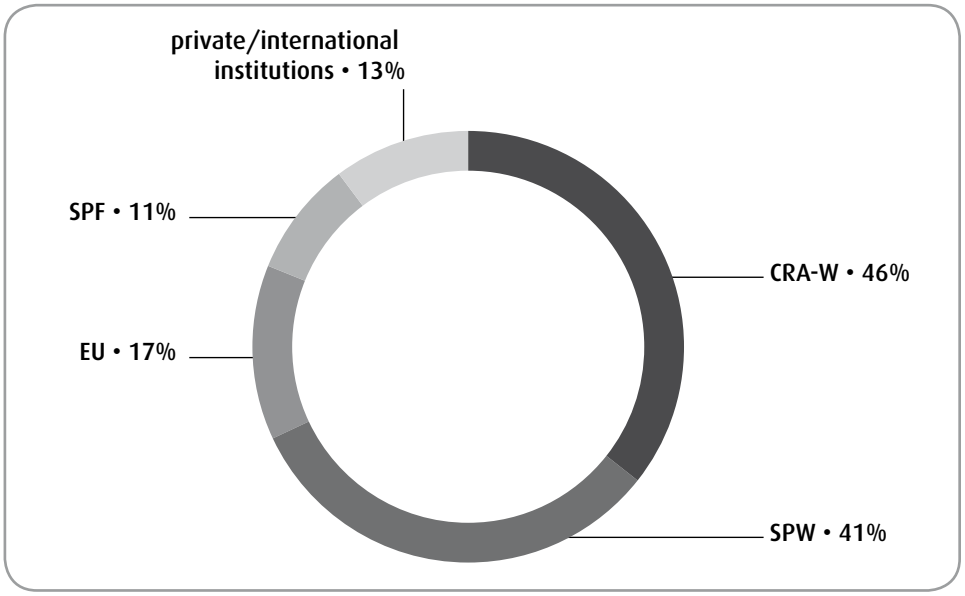
The remaining projects, which account for 20% of our research activities, are aimed at characterising products with a view to their utilisation in sectors such as food, feed or bioenergy.

Breaking down the 128 research projects according to the five main lines of research covered by CRA-W produces the distribution shown in Figure 2. Although this grouping is somewhat arbitrary, as one project often comes under more than one line, it does show the significance of the work done under the headings of 'Improving the living environment, protecting the natural environment and producing sustainably' which accounts for more than one-third of all projects, and 'Adapting species, practices and production systems to changing contexts', comprising more than one-quarter of all the Centre's projects.



> Figure 2 • Breakdown of Research Projects by Underlying Subject Areas.
Line 1 : Improving the living environment, protecting the natural environment and producing sustainably.
Line 2: Improving human nutrition, protecting consumer health and understanding consumer behaviour.
Line 3: Diversifying products and their uses and making producers and enterprises more competitive.
Line 4: Adapting species, practices and production systems to changing contexts. Line 5: Providing decision support for public and private-sector players

Figure 3 shows the breakdown of research projects by sources of funding. Apart from CRA-W, which finances 36% of the projects from its Regional Government grant, the administration (Service Public de Wallonie) is the next-biggest source of support and backing for our work as a means of helping to maintain the dynamism of Wallonia's agriculture.



> Figure 3 • Breakdown of CRA-W Research Projects by Sources of Funding. SPW: Service Public de Wallonie, SPF: Federal Public Service, EU: European Union.

The main government department to finance our research is the Department of Agriculture, Natural Resources and the Environment. The sections specifically involved are Development, European Policy and International Agreements, Soil and Waste and Rural Affairs and Watercourses. However, our work is also supported by the Departments of (1) Economics, Employment and Research, through the FIRST schemes and the Marshall Plan, and (2) Town and Country Planning, Housing, Heritage and Energy. Finally, some projects are also backed in the context of bilateral cooperative programmes promoted by Wallonie-Bruxelles International.

At federal level our sources of funding are the Departments of Public Health, Food Chain Safety and the Environment and Federal Scientific Policy. The EU contributes 13% to funding CRA-W's projects through its Framework Programmes for research (FP6 and FP7), programmes run by the Directorates-General of Energy and Health and Consumers and also the INTERREG programmes. This is closely followed (10% of projects funded) by the private sector (plant protection product manufacturers, food manufacturers, etc.) and the international organisations (WHO, FAO, etc.)

CRA-W, RESEARCH TO MEET THE SECTORS' REQUIREMENTS

By reason of its expertise and know-how acquired over many years in the animal and plant sectors, CRA-W is a partner to several promotion boards and plays an active role in running them.

The primary purpose of these promotion boards is, in consultation with APAQ-W, to contribute to the development, promotion and enhancement of the value of Wallonia's agricultural products, in particular differentiated quality products. The boards are forums for interprofessional consultation. The promotion boards have been formed as non profit organisations. The members represent the various links in the chain from producers to consumers, including the sector's scientific and technical advisors, such as CRA-W.

On the **Wallonia Beef Promotion Board** (FVBW) CRA-W has been involved, through its R&D activities, in

- establishing minimum differentiated quality criteria for beef (positive list of permitted feedstuffs, etc.);
- background planning for seminars on a project aimed at assessing the CO2 impact of meat production and on the use of certain by-products in animal feed; and
- proposing scientific and/or extension articles for the FVBW magazine (Côté Bœuf).

On the **Wallonia Goat and Sheep Promotion Board** (FICOW) the members of CRA-W regularly contribute scientific and/or extension articles to the FICOW magazine (Filière ovine et caprine).

The Production and Sectors Department houses the **Wallonia Pork Promotion Board** (FPW asbl) and deploys its staff, who come under the Animal Breeding, Quality Production and Welfare Unit (Unit 7), on managing, organising, running and chairing the Board's seminars and informative events. Topics covered include a guide to the sector, helping young farmers get started, health management, castrating piglets, rearing pigs outdoors and organic pig farming. Within the framework of its cooperative links with FPW CRA-W has also contributed to:

- Updating and implementing the medium-term development and promotion plan for the sector;
- Analysing farmers' income, quality development and farms' socioeconomic sustainability;
- Organising the Ninth and Tenth Pork and Poultry Products Seminars;
- Organising a quality pork tasting test (Chevetogne, October 2009) and a consumer olfactory sensory test for androstenone and skatole (Libramont Agricultural Fair, July 2010).

The Production and Sectors Department also houses the **Wallonia Milk and Dairy Products Promotion Board** (FLPLW). Specifically, CRA-W and FLPLW are joint promoters of the DURALAIT project, the aim of which is to perform a detailed analysis (economics, animal production, environment and social aspects) of the dairy industry, classifying farms according to their production method. CRA-W has also collaborated with FLPLW on organising annual conferences on current topics and an assessment for the purpose of drawing up specifications for awarding Boulette cheese Protected Geographical Indication (PGI) status.

On the plant side, CRA-W is heavily involved in the **Wallonia Field Crops Promotion Board** (CFGC-W), which has been housed and chaired by the Production and Sectors Department since its foundation in 2003. CRA-W's activities in the CFGC-W context comprise:

- Managing a mycotoxin risk warning network;
- Setting up and managing a Walloon wheat variety testing network;
- Giving an official status to a breadmaking test;
- Participating in initiatives to publicise and promote certified seeds (brochure, platform);
- Investigating scope for promoting Wallonia's brewing industry and ways of increasing the place and occurence of Walloon products on added-value markets (bread, spelt, hops, etc.);
- Contributing to producing the Self-regulation Sector Guide for Primary Crop Production and IQM Standard.

Both the Life Sciences Department and the Production and Sectors Department are members of the **Wallonia Potato Promotion Board** (CFPDT-W). In that context CRA-W permanently contributes to the Terra Nostra technical advisory group (brand created by APAQW in 1998). The Centre also participates in implementing the Strategic Plan for development of the potato sector in Wallonia (Variety Platform project, consultation on future blight warnings in Wallonia, analyse of potato quality evolution in mass distribution sector) and various agricultural fairs including Libramont and INTERPOM at Courtrai.

The Life Sciences Department chairs the **Wallonia Ornamental Horticulture Promotion Board** (CFHO-W). In that capacity CRA-W assists the sector

- in setting up a 'Quality' initiative for Christmas trees, by supplying 'elite' breeding material, and
- in identifying promising new products. CRA-W actively contributes to the conferences and seminars organised by CFHO-W. One notable example is a seminar on vegetative multiplication methods (micropropagation, cuttings of miniaturised vitro plants, micrografting, mini layering, and so forth) held on 26 June 2009.

The Life Sciences Department is a member of the **Wallonia Edible Horticultural Products Promotion Board** (CFWPHC). CRA-W contributes its expertise

- to drawing up specifications for differentiated quality Walloon products;
- researching ways of utilising potato by-products;
- developing sustainable orchards and;
- launching and monitoring projects such as the European 'Fruit School Scheme' aimed at promoting fruit eating in schools.

Finally, CRA-W is an active member of REQUASUD (Réseau Qualité Sud), the quality association formed in 1989. The Association has developed and currently manages a network of laboratories offering a RELIABLE, RAPID AND CUSTOMISED ANALYSIS AND ADVICE SERVICE to meet the needs of players in the agricultural and food sector. Its public-interest brief, defined in a framework agreement with the Regional Government of Wallonia, is to put in place, develop and adapt policies for both product quality and environmental management. As well as chairing the Association, CRA-W also coordinates two analysis chains. Nitrate determination in agricultural soils is handled by the Department of Agriculture and the Natural Environment. Near infrared spectrometry applications including developing prediction models for cereals, fodder, foods, soil, livestock effluent, etc., and the installation and maintenance of the models are the responsibility of the Agricultural Product Valorisation Department.

CRA-W, INTERNATIONAL RECOGNITION FOR THE EXCELLENCE OF THE STAFF AND THEIR WORK

••• Institution and its members honoured by international organisations

- On the occasion of the 50th anniversary of WHOPES (World Health Organization Pesticides Evaluation Scheme) CRA-W was honoured and presented with a commemorative plaque in recognition of its work as a WHO Collaborating Centre for Pesticide Quality Control.
- Dr Olivier Pigeon was appointed by the FAO to the panel of experts for the FAO/WHO Joint Meeting on Pesticides Specifications (JMPS) for the 2008-2011 period.
- Dr Olivier Pigeon was appointed by the WHO to the panel of experts on Vector Biology and Control for the 2008-2011 period.
- Dr Anne Chandelier won the scientific poster prize for her poster entitled "Molecular detection of Chalara fraxinea in ash tree (Fraxinus excelsior L.) using real time PCR" at the 61st annual International Symposium on Crop Protection organised by the University of Ghent.
- Dr Pierre Dardenne was elected President of the International Council for Near Infrared Spectroscopy for the 2010-2013 period. This global organisation was established to encourage the development of technical knowledge and practical applications in near infrared spectroscopy and to disseminate that knowledge and its applications worldwide.
- Dr Ph. Druart was appointed as representative for Europe not including France on the BIOVEG research network committee (Biotechnologies, Plant Breeding and Food Safety) of Agence Universitaire de la Francophonie.
- Dr Eric Froidmont carried off the Best Poster Award from the Management and Health Commission at the 61st EAAP (European Association of Animal Production) annual conference held in Heraklion, Crete from 23 to 27 August 2010.
- Dr Jean-Pierre Goffart was elected President of the European Association for Potato Research (EAPR) for the 2011-2014 period in the run-up to the Association's 19th Triennial Conference to be held in Belgium in 2014.
- Dr Olivier Miserque was appointed President of the Machines and Products Committee at Libramont Agricultural Fair. In that capacity he plays a key role in organising the 'Mecanic Show' and the Grass Day.
- Dr Robert Oger was appointed President of the Specialist Committee of CEMAGREF's Ecotechnologies Department (France).
- Dr Viviane Planchon took the CAMO Best Poster Award at the 11th European Symposium on Statistical Methods for the Food Industry at Benevento (Italy). Her poster aimed at establishing HYPERLINK "http://www.cra.wallonie.be/img/page/poster/CUT_OFF_PHYTOPHTHORA_POSTER_AGROSTAT_2010_BENEVENTO_Planchon.ppt" real-time PCR cycle cut-off for quarantine pathogen detection.
- Dr Vincent Baeten was appointed representative for Wallonia on the Standing Committee of Agricultural Research (SCAR).

••• CRA-W appointed a reference laboratory and reference centre

- CRA-W was appointed by the WHO to carry out final review, editing and formatting of the WHO and WHO/FAO pesticide specifications before publication on the website.
- Community Reference Laboratory for MBM detection in animal feed.
- National Reference Laboratory for GMO detection.
- National Reference Laboratory for analysis of milk and dairy products.
- National Reference Laboratory for plant diseases and potato plant virological status analysis.

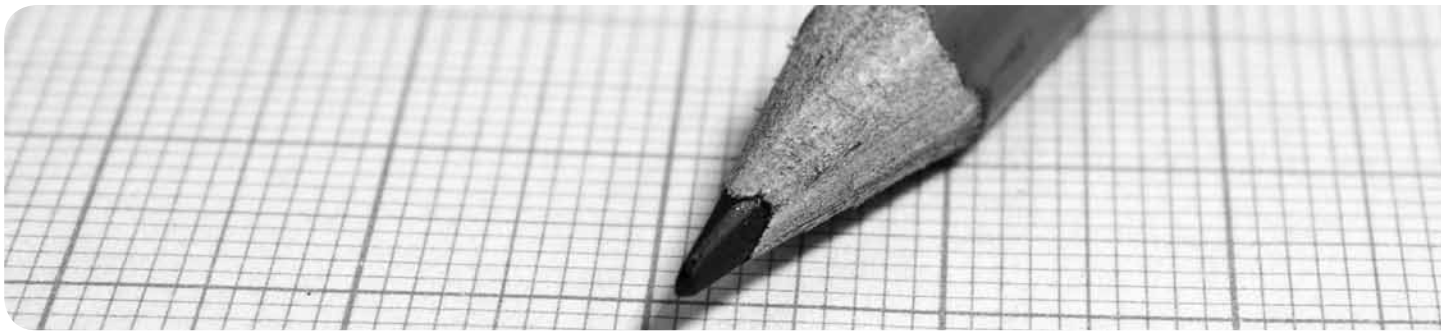
These recognitions often betoken the successful outcome of the hard work by the teams concerned towards obtaining ISO 17025 accreditation, Good Laboratory Practice (GLP) certification, etc., for the services provided. Mention must be made of the achievements of the Quality Improvement Office (BAQ) team and all the staff in the departments involved in harmonising procedures between units and/or frames of reference.

Table : *Accreditations and Certifications Gained or in Progress at CRA-W.*

BUILDING	CERTIFICATE REFERENCE	AREAS OF ACCREDITATION / CERTIFICATION
Carson	**OECD** /Institut Scientifique de Santé publique - Louis Pasteur - C04 **Belac- 189-Test**	**BPL/GLP** > Physico-chemical properties of plant protection products and biocides. > Study of plant protection product residues (including field trials). **ISO 17025** > Pesticide residue determination in fruits, vegetables, cereals and other substrates (e.g. mosquito nets). > Pesticide determination in treated seeds.
Francini	**Belac- 266-Test**	**ISO 17025** > Sprayer trials (transverse distribution and pressure). > Physical and chemical analyses of solid biofuels
Henseval	**Belac- 300-Test**	**ISO 17025** > Microbiological analyses of milk. > Physical (microscopy and spectroscopy) and chemical analyses of dairy products, cereals and animal feed. > Detection and identification of MBM in animal feed > GMO screening in food matrices.
Haute Belgique	**Belac- 333-Test**	**ISO 17025** > Starch and dry matter determination in fodder and crushed cattle feed, cereals and cereal products. > Detection of viruses (PLRV, PVY, PVX, PVS, PVM, PVA) in potato leaves.
Balachowski	**OECD** /Institut Scientifique de Santé publique - Louis Pasteur- C03	**BPL/GLP** > Ecotoxicological studies of plant protection products on terrestrial and aquatic organisms.
Marchal	**Belac- 342-Test**	**ISO 17025** > Deoxynivalenol (screening) in milled wheat grains. > Detection of Phytophtora ramorum in plant tissues. > Detection of Monilia fructicola in plant tissues. > Detection of the Pepino mosaïc virus in tomato leaves or fruit. > Detection of the Tomato spotted wilt virus in chrysanthemum leaves.
Petermann	**CPVO – 1005-01**	**CPVO frame of reference (in accordance with European Regulation No. 2100/94)** > DHS (Distinction-Homogeneity-Stability) testing of winter wheat and barley.

••• Requests for our members expertise

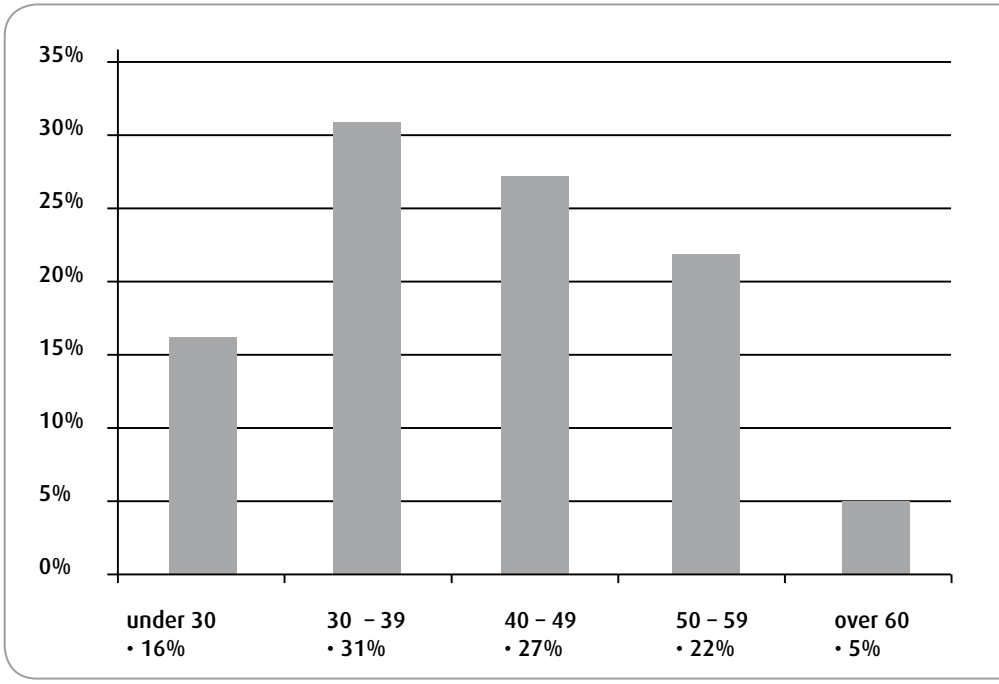
Our members have been asked to review more than 150 contributions to international journals and conferences relating to fields in which they excel and to assist various scientific committees (European Association for Potato Research conference, Rencontres, Recherches, Ruminants, Scientific Symposium on Farm Machinery and Process Management in Sustainable Agriculture, FAO/WHO JMPS, CIPAC, ESPAC, etc.). They have also been esked to assess different projects in several programmes (Mixed Research Unit, CEMAGREF Ecotechnologies Department, FRIA scholarships, ADD and SYSTERRA programmes supported by France's National Research Agency, etc.).



CRA-W, A TEAM SERVING AGRICULTURAL AND AGRO-INDUSTRIAL SECTOR

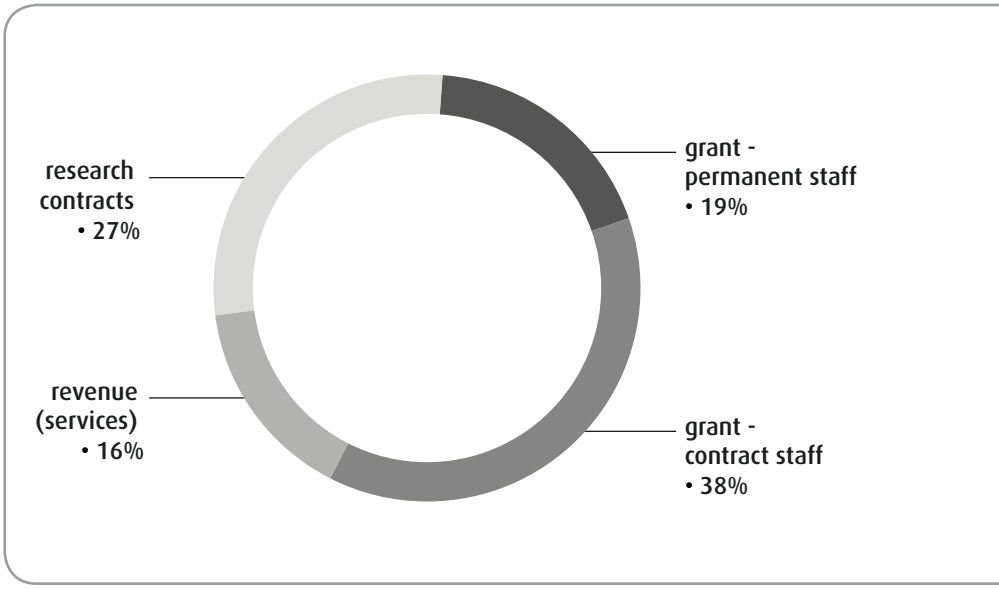
The Walloon Agricultural Research Centre employs a total of 451 people including 105 scientists serving agriculture, the sectors and their territory. The gender balance is almost even at 48% women and the age structure is relatively young.

The personnel breakdown by age bracket can be accounted for by their employment status, with 43% of staff jobs being tied to research agreements or service contracts.



> Figure 4 • CRA-W Staff Breakdown by Age Bracket

These figures testify to the dynamism of our research teams who succeed in winning new research and service contracts by being attentive to the industry's and society's requirements. At the same time, though, the precariousness of employment at the Centre encourages a brain drain, hence the prevailing age bracket distribution.
So, for every job supported by the Regional Government grant, 0.75 jobs are created to deal with the challenges facing agriculture and to meet the demands of the sectors and territories. CRA-W is therefore a significant job provider in Wallonia.



> Figure 5 • CRA-W Staff Breakdown by Sources of Funding

PUBLICATION AND DISTRIBUTION OF RESULTS, ONE OF CRA-W'S

Through its fundamental and applied agricultural research and the parallel development of service activities using the available expertise and equipment, CRA-W seeks to work closely with its partners and the users of the end-results of its work. Our partners include farmers, upstream and downstream enterprises, universities, the general public, the authorities, international organisations, and so on.

Our teams and researchers therefore make every effort to distribute our results via a wide variety of channels (agricultural press, seminars, agricultural fairs, scientific journals, international conferences, etc.) in close cooperation with the Pilot Centres and the Boards set up to promote the sector. In this context CRA-W is a signatory to the Support for Wallonia's Agricultural Sector 2010 charter established by the Department of Agriculture, Natural Resources and the Environment.

Communication tools used to disseminate our research progress include:

- The website 'www.cra.wallonie.be' which gets more than 500 visits per day. The site underwent a major overhaul in 2010;
- Scientific publications and extensions;
- Themed seminars;
- Training for those working in the sector;
- Public events;
- The press, and specifically the specialist agricultural press, along with the local press, etc.

••• CRA-W's Publications

The way this institution is funded, necessitating a constant quest for new research agreements and contracts in order to retain existing staff and hold on to their valuable know-how, is heavily reflected in the nature of our publications (Figure 6), nearly half of which are reports on studies, projects and tests that are either ongoing or have been completed.

Apart from our financial backers to whom the above-mentioned reports are submitted, scientists, technicians and development officials make up 50% of the other recipients of our results, through our staff's contributions to conferences and seminars. Thirty-three per cent of the information is published in the specialist press, made available in the form of decision support systems or disseminated at public events. Beneficiaries therefore include farmers, industry players as well as the general public. The remainder (17% of papers not under contract to our backers) consists of publications in scientific journals referenced in international databases.

The publications in referenced scientific journals are listed below. The average impact factor is 1.64 or 2.16, depending whether referenced journals with no impact factor are taken into account or not.

In short, our hard-working staff produce six documents per scientist per year on average.

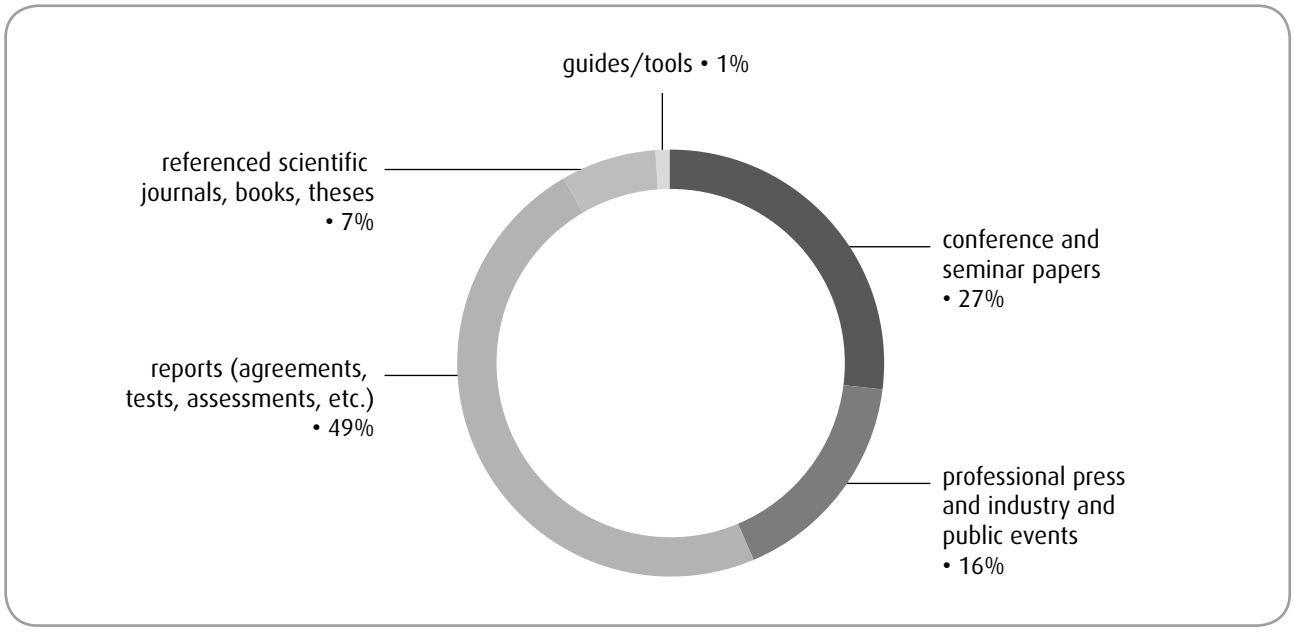


Figure 6 • Typology of CRA-W Publications and Papers in the Period Under Review

••• List of publications referenced in international databases, books, theses defended by our researchers and decision support tools developed

> PUBLICATIONS REFERENCED IN INTERNATIONAL DATABASES

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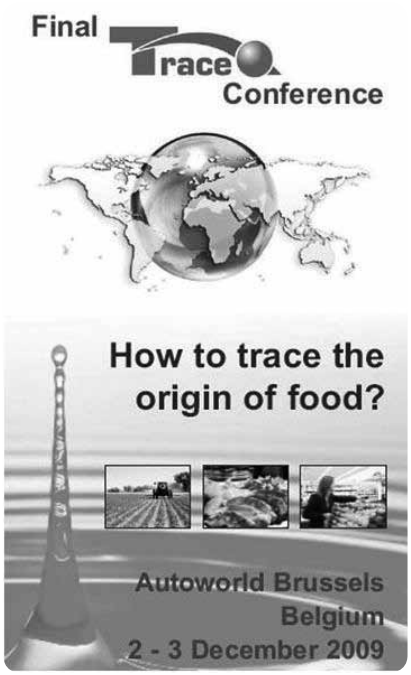


••• International Seminars

During the last two years CRA-W has organised or co-organised 17 international seminars bringing together a total of more than 1,200 participants from the research sphere, industry and the public sector from some twenty countries.

Topics covered include:

- **Spectral and hyperspectral imaging** approaches
- Progress in and new applications for underlying **spectroscopic and chimiometric techniques**
- Methods for **identifying and quantifying animal protein likely to occur in cattle feed** in order to develop tools to ensure food chain safety
- **Development of new tools for food product traceability**
- **Sustainable development of bioenergies** (use of land, greenhouse gases, biofuel quality, etc.) - 5 seminars held
- **Reducing the risks of pesticide use**
- **Phytohormones,** ways of utilising this progress in biotechnology
- The **OMICs technologies'** contribution to the study of system biology
- **Alternatives to genetic transformation in plant breeding**
- The link between **biodiversity and food diversification**
- The value of **biotechnologies in controlling agricultural inputs** in Central Africa
- Drawing up an **energy and greenhouse gas balance** for agricultural systems
- Support for **agricultural systems** to improve efficiency and **sustainability** in Europe and overseas
- Establishing a proactive group approach for **continuous improvement** of the economic, environmental and social **efficiency of agricultural systems**
- **Agriculture and differentiated quality status** in the wake of European Union enlargement

••• National Seminars

As an agricultural research centre CRA-W plays a key role in disseminating progress and innovations to the agricultural sector. In that context the Centre organises numerous seminars at national or regional level. Seventeen seminars involving nearly 1,500 people were held during the period in conjunction with the pilot centres and boards responsible for promoting the sector on the ground. As part of this report is devoted to a description of the links between CRA-W and these pilot centres and boards, we will concentrate below on the events specifically hosted by CRA-W, often jointly with Gembloux AgroBioTech. In total more than 2,000 participants were involved.

Alongside the established seminars such as:

- **Carrefours des productions animales** in February. The topics were 'How can we meet society's changing requirements by developing beef chains that produce more but better?' in 2009 and 'Livestock farming of the future: between scientific progress and human issues' in 2010.
- **Pork and Poultry Products** in October. Topics covered in 2009 and 2010, respectively, were: 'Impact of nutrition on animal health' and 'Our pork and poultry sectors: towards more sustainability'.
- **The White Book,** produced to disseminate innovations and progress in cereal growing. These events take place in February and September each year.

There were also, specifically in the two-year period just ended, seminars on:

- **'Preventive control of scab'** as part of the INTERREG TransBioFruit project;
- **Improving pesticide management** to reconcile technical efficiency with water conservation under the PESTEAUX project;
- **Optimising farm autonomy** either by making better use of fodder resources or by using organic fertilizers (4 seminars);
- 'The image of meat and meat products' co-organised with ULg (BAMST seminar);
- Scientific and technical review of the advantages of tying ridges to **control runoff** in agricultural parcels;
- Biomass for energy production and utilisation (BIOETHA2 and INTERREG IV ENERBIOM projects);
- The role the dairy sector can play in maintaining economic, environmental and regional efficiency (INTERREG IV DAIRYMAN project).

••• Public Events / Field Events

To keep in touch with producers' and consumers' requirements and to optimise dissemination of the information and progress that principally interests them, CRA-W takes part in a number of fairs, farm open days and town farms. Among these, the **Libramont Agricultural Fair** is a major forum for us. CRA-W is a key player at this fair, organising the presentation of technological innovations at the **'Mecanic Show'** and coordinating the demonstrations at the four-yearly **Grass Day**, which took place again in 2010. That year the event was held concurrently with the **International Grassland Days** when CRA-W was in charge of three of the eight themed tents covering harvesting machinery costs, fodder quality and the losses associated with various harvesting machinery/ fodder storage combinations.

CRA-W's expertise in the area of techniques and agricultural mechanisation was also recognised when choosing innovations to showcase at the **Agribex** fair in Brussels and the **International Agricultural Mechanisation Fair** (SIMA) in Villepinte (France).
The Centre was also well represented at the **Battice Fair**, chiefly through the INTERREG IV DAIRYMAN project which aims to optimise the economic and environmental efficiency of dairy farms.

Also in 2010 CRA-W contributed to setting up and presenting the educational exhibition **'Feeding the world sustainably'** in cooperation with Gembloux AgroBioTech.
In November of both 2009 and 2010 CRA-W helped to organise **large-scale events and inter-regional fairs in the area of fruit and market garden crops** under the INTERREG TransBioFruit project.

In the last two years CRA-W has also contributed to the **'Un Chevetogne un peu cochon'** events held to support the pork production sector.

To keep in touch with farmers' requirements and concerns and provide practical answers 50 events comprising tours, tests and advice were organised each year.

For example, more than thirty field visits and conferences were held annually to guide farmers in choosing varieties (**winter wheat, winter barley, rape, cereal-legume combinations**). These events were aimed at both conventional and organic farmers.

Similarly, over the entire two-year period, no fewer than 20 events (training sessions, demonstrations, visits, etc) were organised and/ or co-organised by CRA-W within the framework of the INTERREG TransBioFruit and BIODIMESTICA projects in order to disseminate **new cultural and plant protection techniques in organic farming and to promote old fruit and vegetable varieties.**

Another area where attention must be paid to the requirements of the operators on the ground, in view of the high costs involved, is **agricultural mechanisation**. To guide farmers in building up and managing their fleet of equipment more than twenty presentations on topics varying from selecting sprayer nozzles, the cost of use of equipment (MECACOST), the usefulness of a GPS navigation system, etc. took place over the two-year period in the context of Farmer Technico-Economical Groups meetings, agricultural contractors' meetings, and so forth.

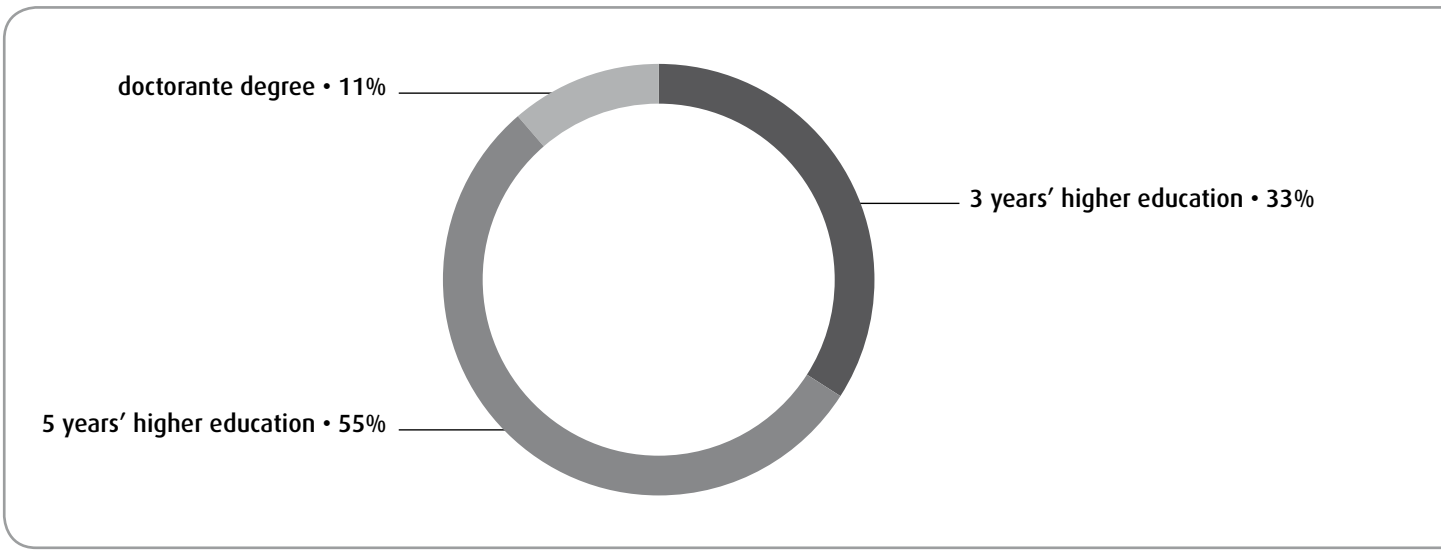
Occasional events were also held with the focus on:

- **Pilot farm** tours, jointly organised by CRA-W, for dairy and pork producers,
- Organising and presenting a **'Strawberries and small fruit'** culture material exhibition
- The role of **agriculture in bioenergy production**, including a tour of some German biomethanisation plants and experimental plants-for-energy crops.

CRA-W, A KEY TRAINING PROVIDER

CRA-W staff is regularly asked by training organisations to contribute to disseminating good practice, the latest progress and innovations in agriculture. Every year our staff provide more than 210 hours' of instruction, spread over 14 courses, to FOREM trainees, farmers, agricultural graduates, bioengineers and researchers. In the two-year period just ended more than 50 students have also been supervised or jointly supervised by CRA-W staff in connection with their dissertations and theses. The breakdown of these students' educational standards is shown below.

Emerging countries also regularly call on the CRA-W members' expertise to help set up analytical laboratories for applications such as certifying potato basic material (Burundi), developing a laboratory wishing to move into GMO detection (Tunisia) and analysing pesticide formulations and residues (Mali, Tanzania, Sudan, Malaysia, Gambia, etc.).



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