Annual Report 2008

ILVO

Institute for Agricultural and Fisheries Research

Flemish Government

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Dear reader,

The ILVO staff is proud to present this 2008 annual report. 2008 was the first year in our new organisational structure, where the new board of directors took on their agreed-upon tasks. The last phase in the implementation of our 'Better Management Policy' (BBB) ended with a photo finish: the members of the Advisory Board were appointed in mid-December.

The last year was future-oriented. We laid the foundation for the ILVO 2020 programme using bottom-up working groups; we outlined the organisational management and risk analysis; and we introduced Balanced Score Cards. Internal working groups examined both organisational- and research-related horizontal themes. We actualised our strategic goals and concretised our mission. The core activities remain (1) production of high-quality, high-level research and service provision for policymakers and the sector; (2) exploitation of research results and stimulation of innovation; and (3) dissemination of our research results. ILVO, being a centre of scientific knowledge, shall use objective, complete and independent research to contribute to the future of Flemish agriculture, fisheries and our stakeholders.

We cannot forget the essential role agriculture and fisheries play in feeding the inhabitants of a turbulent, dynamic and globalised world. Research is a crucial underpinning of the development of competitive agriculture, both in policymaking and in practice. ILVO strives to be both a beacon and an anchor to help create a sustainable agricultural sector and society. The programmes introduced in 'ILVO 2020' are clustered into 9 hereby-related themes:

- sustainable plant production
- innovative agriculture, fisheries and product processing
- quality animal husbandry
- sustainable exploitation of marine resources
- agriculture and fisheries in a changing climate
- agriculture and the natural surroundings
- agriculture and fisheries for safe and high-quality food
- dynamic rural areas
- competitive agricultural systems

Agriculture in Europe faces enormous challenges after 2013. Our programme themes respond to these challenges, and our official 2009-2010 research programme takes the first steps toward solutions.

ILVO researchers were successful in competitive research and have made a significant effort to attract external funding. We further structured and expanded our service provision within accreditation requirements. Several of our laboratories are even recognized as reference laboratories. The continuation of our smooth cooperation with Agriculture and Fisheries and with the Agency for Facilities Management will keep our research infrastructure up to the mark and ensure renewal where necessary.

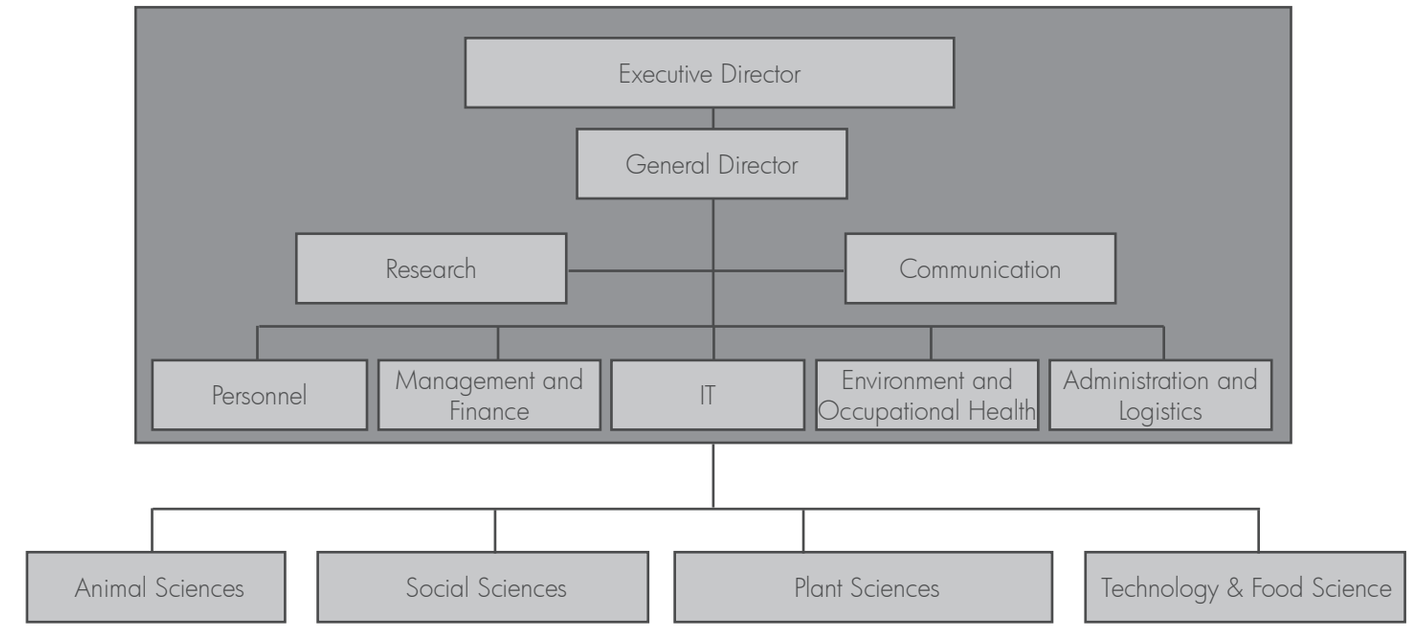
ILVO also received great interest in our research activities and results this year, as measured by the number of visitors to the website and readership of the 'ILVO Nieuwsgolf,' theme issues, and articles in professional journals. Minister-President Kris Peeters and Minister Patricia Ceyssens visited the ILVO campus, and our researchers presented their research to Queen Paola, Prime Minister Yves Leterme and delegates from the Federal, Flemish and Walloon governments at the Libramont agricultural fair.

We created new partnerships and strengthened or expanded others. We joined forces with AZANOVA cvba to create new azalea cultivars, took a big step toward creation of a modern pilot factory with IWT and Flanders Food, and bestowed several 'sandwich' doctoral grants in partnership with universities and research institutions.

This annual report gives a birds-eye view of our organisation's scientific activities, service provision and output. It shines a spotlight on our research results, particularly those which emphasise innovation and competitiveness in the sector. The results of our integrity survey and the survey from 'The Scientist' indicate that ILVO is an enjoyable place to work. ILVO met all performance indicators as set forth in the Management Agreement, and organised or co-organised several successful conferences, symposiums, and demonstration events. I thus want to sincerely thank all of my colleagues and those who make our work possible through their direct or indirect effort and support. Many thanks also go to those who trust and rely on our work, as well as the agencies for control, management and advice.

Enjoy our report,

Erik Van Bockstaele,
General Director



Research groups

Functional Animal Nutrition
Animal Husbandry and Animal Health
Fisheries

Research groups

Integration
Open space
Transition

Research groups

Growth and Development
Applied Genetics and Breeding
Crop and Environment
Crop Protection

Research groups

Agricultural Engineering
Food Safety
Product Quality and Innovation

Own Capital (OC) Management Council

Members from ILVO:

- Prof. dr. ir. Erik Van Bockstaele, executive director, Chair
- dr. ir. Kristiaan Van Laecke, head of the Unit
- Prof. dr. ir. Daniël De Brabander, scientific director
- dr. Lieve Herman, head of the Unit
- ir. Dirk Van Lierde, scientific director

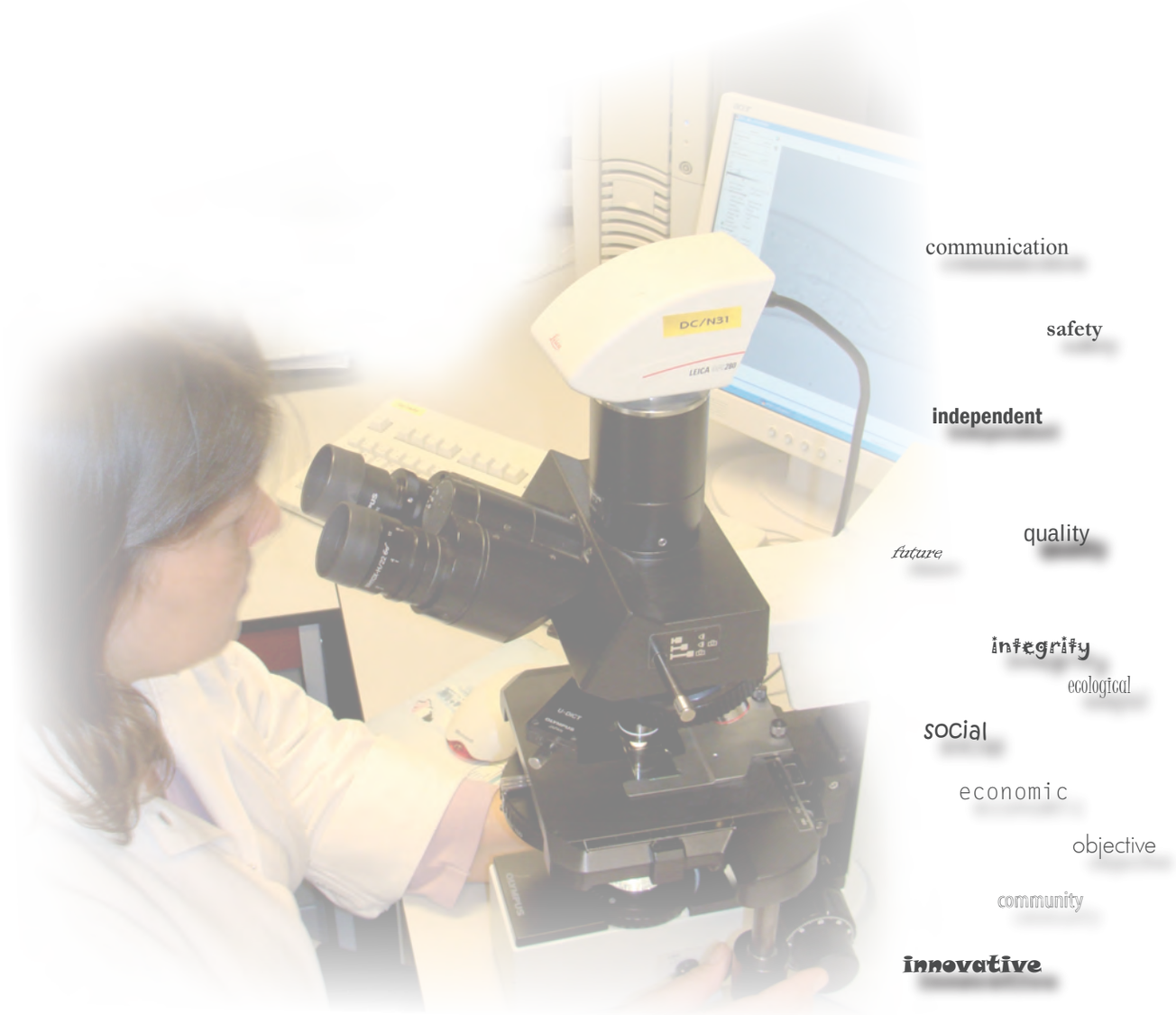
Leading representative from the Department of Agriculture and Fisheries, secretary general:
Mr. Jules Van Liefferinge, secretary general

Representative of the Flemish minister of Science and Technology:
dr. Kathleen D'Hondt

Representative of the Flemish council for Agriculture and Horticulture:
Mr. Georges Van Keerberghen

Representative of finance inspection:
Mr. Kurt De Bruyne, inspector general

Expert from the Agriculture and Fisheries policy area (upon invitation):
ir. Hector Willocx, ALV project leader



ILVO's Mission

ILVO's mission is to perform and coordinate scientific research which supports policymaking and to provide related services with an eye toward economically, ecologically and socially sustainable agriculture and fisheries.

Based on scientific discipline, ILVO will build the necessary knowledge for improving products and production methods, for monitoring the quality and safety of end products, and for improving policy instruments as a basis for the development of the sector and rural policy. ILVO will communicate with the authorities, the various sectors and society at regular intervals.

1. Management

ILVO - Management

- Prof. dr. ir. Erik Van Bockstaele, administrator-general
- Prof. dr. ir. Maurice Moens, research director
- Prof. dr. ir. Johan Van Waes, communication director
- ir. Frank Lagaisse, prevention, safety, environment and welfare
- dr. ir. Koen Grijspeerdt, IT
- ing. Ellen Claeys, IT
- ing. Steven Cools, IT
- ing. Jurgen Desamblanx, IT
- ing. Sabine Nelis, IT
- lic. Catherine Blancquaert, organisational control
- lic. Katrien De Bruyn, financial coordination

1.1 Communication

In 2008, the communication group determined ILVO's internal and external communication needs, primarily through a SWOT analysis, and wrote a communication plan for 2008. The communication group meets on a monthly basis and adjusts the communication plan as necessary.

We facilitated internal communication through various channels this year. Regular and extensive updates to the intranet provide staff with accurate information, including reports of the meetings of the Executive Board, the decision-making body of ILVO. We also publish a staff magazine called 'OVLI' every four months, oversee afternoon information sessions for each personnel group, and send a bi-monthly 'Newsflash.'

External communication:
- Published bi-monthly Newsflash plus two special issues ('Crop Protection' and 'Service Provision')
- Organised a Social Sciences theme day for the Agriculture and Fisheries policy area and a contact day for new colleagues
- Participated in conferences, demonstration days, and trade shows
- Redesigned the ILVO website, brochures, and PowerPoint presentations
- Wrote communication guidelines in consultation with the policy area spokesperson
- Organised press conferences

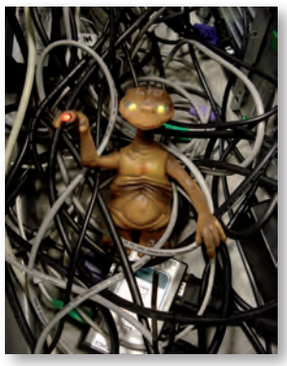
Balanced Scorecard Process Initiated
All the entities initiated the Balanced Score Card (BSC) process in 2008. The first phase involved all ILVO colleagues, then small workgroups furthered the process. After six months the management evaluated the BSC and adjusted the Critical Performance Indicators (CPI) for different Critical Success Factors (CSF). The aim is to create a consolidated strategy map in 2009.

Strategic seminar
The division managers and the scientific directors held a strategic seminar, organised by Delta-I consulting, during October 22-24, 2008. The directors presented activity reports, then set strategic objectives and operational goals for the management and units in 2009.

Satisfaction survey
In accordance with ILVO's management agreement, we performed a satisfaction survey with ILVO's main stakeholders. We worked with the Significant Gfk office and the Agency for Government Personnel to create the questionnaire and survey over 600 ILVO 'customers' (public services, scientific institutions, research stations and third parties) in early November. The results will be processed by April 2009.

1.2 IT

The 5-person IT office manages the IT infrastructure and networks in all seven ILVO sites and supports 500 staff members. In addition, it develops customised applications to support the various ILVO activities and works with the communication group to maintain the ILVO website and intranet.



IT's most important projects in 2008 were:

- Centralising purchase and software and hardware management
- Implementing an electronic helpdesk system
- Extending and uniformising storage capacity by adding a number of iSCSI storage servers to the network
- Developing and implementing a reliable backup policy
- Initiating server virtualisation to optimise use of the available hardware

1.3 Environment and Occupational Health

Environment and occupational health are essential parts of ILVO's operational management, investment policy, and monitoring requirements.

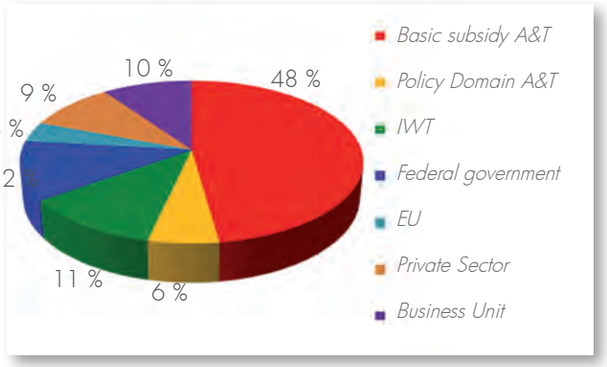
We invested this year in a filling and washing station at the Plant Unit site to ensure the filling and washing of cars and farm vehicles in a safe manner and with minimal environmental risk.

Our five-year plan includes the installation of a new sewer system which separates domestic and industrial wastewater. ILVO produces very little wastewater – ILVO's seven sites produce barely more wastewater in a year than a medium-sized company does in a week. We are thus more concerned about the wastewater composition, in particular from the laboratories. ILVO has had several decades of successful biological wastewater treatment in the Technology & Food Science site, and we now plan to improve wastewater treatment in the other sites.

The new, separated sewer system will bring the wastewater from one end of our campus (the Animal Sciences Unit site on Van Gansberghelaan) to the other end (the Plant Sciences Unit site on Caritasstraat) where it will be discharged into a collector to be installed by Aquafin.

Our next investment will be a thermal decontamination unit to treat water contaminated with quarantine and pathogenic organisms. This wastewater originates primarily from the new laboratory for quarantine organisms housed in the diagnostic centre.

Filling with minimal environmental risk



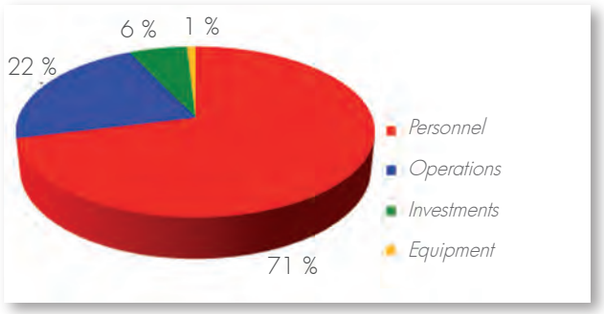
Income sources 2007-2008

1.4 Management Control and Finance

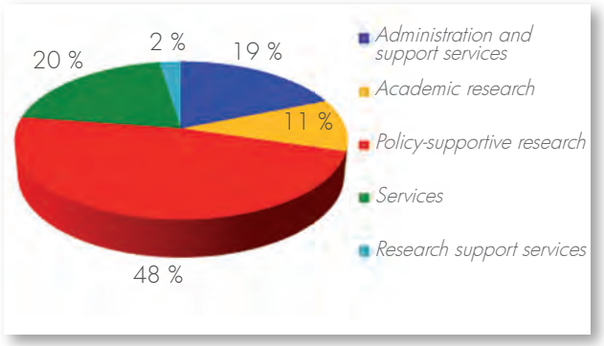
ILVO has two accounting systems: one for the annual allocation from the Flemish government, and one for revenues from project research and the Business Unit. The Flemish government's basic subsidy covers certain operational and personnel costs. Revenues and costs of project research are managed by Own Capital (OC or *Eigen Vermogen*). We combine both accounting systems once per year.

Own Capital continued to use an ESR budget and financial balance monitoring. As of January 1, 2008, Own Capital uses a new accounting system called Expert/M Plus. We also actualised the entire chart of accounts. Costs and revenues are now assigned to the specific research projects and to the ESR-operational budget.

The department of Management Control and Finance focused more this year on internal control and organisation management. We used the guide "Internal Control/ Organisation Management" to do a self-evaluation. We also performed a SWOT and a risk analysis.



Expenses 2007-2008



FTE's by function

1.5 Research

Research planning was ILVO's special focus this year. During 45 meetings, approximately 50 researchers from the four units met to discuss these nine research programmes:

- Sustainable plant production
- Innovative agriculture, fisheries, and product processing
- Quality animal husbandry
- Sustainable exploitation of marine resources
- Agriculture and fisheries in a changing climate
- Agriculture and the natural surroundings
- Agriculture and fisheries for safe and high-quality food
- Dynamic rural areas
- Competitive agricultural systems

The researchers described the justification and research strategy for each of these programmes, and placed them in the current ILVO research framework. They then added overarching research themes, applicable to both conventional and organic farming, to the programme descriptions. The overarching themes will maximise research efficiency. ILVO's stakeholders will be informed of these developments through the document titled 'ILVO 2020.' On June 24, 2008, we presented the programmes and heard commentary from members of the Agriculture and Fisheries sector and policy area. Each of the programmes has been assigned a coordinator who will lead the discussion within the programme in the coming years. Colleagues from the Agriculture and Fisheries policy domain will also be involved in this discussion process.

The 2009-2010 research plan is also framed within the nine aforementioned programmes. Each of these programmes has a foreword by the programme coordinator. The programmes were developed in the fall, then given to the administration in December for further input.

In 2008, ILVO awarded 9 doctoral scholarships to young researchers. ILVO will use these to respond to several interdisciplinary research challenges, thereby also increasing our competence and creating openings for new agreements with stakeholders.

In 2008, ILVO signed two Memorandums of Understanding: one with the Flemish Institute for Biotechnology (on March 10th) and one with the Scottish Crop Research Institute (SCRI) in Dundee, UK (on May 29th). ILVO hopes to use both agreements to increase our own level of competence as well as access complementary expertise.

We completed preliminary talks on the Protocol of Cooperation between the Minister of Agriculture, Nature, and Food Quality of the Kingdom of the Netherlands, the Minister of Agriculture, Sea Fisheries, and Rural Policy of the Flemish Community, and the Minister of Nature and the Environment of the Flemish Community (on November 20th, 2006). We agreed to begin with two projects in crop protection.

Researchers from ILVO and the Department of Bio-Engineering of Katholieke Universiteit Leuven explored cooperation between both institutions (on February 5th).

Discussions between ILVO, the Agriculture and Fisheries administration, policymakers (on June 16th) and the research stations (on September 16th) continued this year. The discussion partners all wish to intensify the interaction between ILVO and its partners.

Erik Van Bockstaele (ILVO) and Peter Gregory (SCRI)

1.6 ILVO Personnel Department

Service provision to staff and managers continues to be the main task of ILVO's personnel department. We seek to achieve maximum customer satisfaction whilst taking budget and regulations into account.

Attention went primarily to basic services and personnel administration for all staff members, plus the wage administration for staff paid by Own Capital (OC). We created a new personnel database in 2008 and disseminated it to the division heads and personnel officers of the various Flemish government bodies.

In 2008, we began implementation of a VTO (training) policy. Our first clients were the ILVO managers. After two preparatory workshops we set up an information pathway, in cooperation with the Agency for Government Personnel, for competency development, management, and evaluation.

We also informed staff members of the level C and D government testing and assisted staff with test preparation.

As of January 1, 2008, new staff members are now paired with a mentor.

We also introduced staff regulations in the personnel department for staff paid by Own Capital, which are separate from the existing work regulations for the staff members of the Flemish administration. This was approved during the meeting of April 22, 2008 of the Entity Consultation Committee.

An increasing amount of information reached staff through ILVO's intranet in 2008. Registration for the preventive health examination and the aforementioned information pathway for managers now occur electronically via the intranet.

2. Internal Communication – Lecture Sessions

Within an institute as large as ILVO, it is not always easy to stay informed about what one's colleagues are doing. An internal lecture series provides a forum for understanding and communication within and between the units. During the lectures, a researcher introduces his or her work to the (sub)unit. This can be advanced research, where results are already available, or starting research. Ample time is dedicated to discussion after the lecture, as it can be very enriching to look at a research topic from (sometimes very) different perspectives or backgrounds. To provide as much cross-pollination as possible, the lecture sessions of the Social Sciences Unit are also open to colleagues from other units. Within the Animal Sciences Unit - Fisheries, these Monday noon sessions got the nickname 'Saint Mondays,' because during the 17-19th century the cantina was not used for lunch on Mondays due to most employees taking a day off (usually the consequence of a hangover after the weekend). Other Animal Sciences Unit research groups also hold similar lectures.

Plant@3 is the name of a monthly seminar series within the Plant Unit. The "@3" refers to the start time of 3 p.m. Each Plant@3 seminar is comprised of two scientific presentations, each lasting about 30 minutes, followed by time for questions. The presentations are mainly given by the doctoral students from the Plant Sciences Unit, for whom participation is required. Each student normally gives two presentations during his or her doctoral research: once about halfway through their research, and once at the end. The main goal of Plant@3 is to raise the general knowledge base of the unit. It also presents an opportunity to receive feedback, and plays a role in staff training and development.

ILVO staff composition as of 12/31/08

	male/FTE	female/FTE	total/FTE	percent OC (%)
A-level	110.0	96.9	206.9	56.5
B-level	39.2	44.4	83.6	47.2
C/D-level	112.6	70.1	182.7	37.9
Total	261.9	211.4	473.2	48.5

3. ILVO's Internal Working Groups

3.1 General

ILVO has approximately 10 internal working groups to examine both research-related and organisational concerns.

3.2 Organic Farming

The working group on organic farming exchanges information between units about organic food and farming research. Each unit of ILVO has one or more representatives in the working group.

The objectives of the working group are: exchanging information about organic food and farming; development of new research opportunities for organic farming; and coordinating research activities for the organic food and farming sector within ILVO.

We began by developing a vision for research on organic food and farming at ILVO. We gave a description of this vision, together with an overview of ILVO's research activities for the organic food and farming sector, to the Minister of Agriculture and Fisheries. The working group reconfirmed that ILVO will carry out research with results applicable to both organic and conventional agriculture, and that the knowledge obtained will be valuable to the practice of organic farming.

The working group contributed actively to the development of the Flemish Department of Agriculture and Fisheries' research agenda for the organic food and farming sector. ILVO's working group on organic farming will continue to provide input as the Flemish government sets research priorities for 2009-2010.

3.3 Energy

The working group on energy, comprised of representatives from ILVO's four research units and administration, addresses energy and climate change as related to Flemish agriculture and horticulture. ILVO responds to this need by researching the following: socio-economic aspects of energy and climate change; sustainable and profitable production of biomass for bio-energy production; the use of by-products of bio-energy as animal feed; and ways to reduce energy demand in greenhouses and animal husbandry.

The working group facilitates communication and identifies possible synergy between different research units at ILVO. The group meets at least twice per year. The group discusses energy-related initiatives and research results at ILVO.

The Energy working group also identifies new project ideas and possible collaborations with the private sector. The working group represents ILVO in different organisations concerning sustainable energy use (ODE, VALBIOM, GBEV, etc.). The working group also serves as a line of communication through the different units and circulates information such as position papers, conference information, et cetera.

The group met several times in 2008 to work on grant proposals involving more than one research unit. We also met with private partners to identify possible research collaborations.

3.4 IT & Statistics

This working group, already active for many years, is comprised of one IT representative from each site.

We discuss general IT strategy and guidelines, as well as more practical, specific items. The working group is an ideal forum for the IT team to learn what is important to our internal customers. The group is also involved in the testing of new systems and software. The group meets annually, in addition to ad hoc contacts between the central IT team and the local IT representative throughout the year. We discussed the general IT-strategy during our annual meeting.

The working group unites all ILVO researchers with an above-average interest in statistics. Our goal is to unify the statistical expertise and resources available at ILVO. We are making an inventory of the available resources and contacting other research institutes to see how they organise statistical guidance. We then spread knowledge through training, seminars, and the like. We also advocate our vision for ILVO's statistics to the management.

We developed an interactive website and made contacts with Ghent University and INBO.

3.5 Nutrient Flows

The nutrient flows working group works with all units to optimise research on farm gate nutrient flows, emphasising nitrogen (N) and carbon (C).

The aim of the working group is to fill the knowledge gaps on farm gate nutrient flows. The short-term objective of the working group is to exchange information on equipment, expertise, projects and project proposals between the units, which catalyses optimal research cooperation between the units. Opportunities for cooperation thus become clear, and methods and equipment become available for other units, which optimises equipment use and enables staff members to function more efficiently.

The long-term objectives of the working group are (1) development of integrating models on nutrient flow at farm level and (2) start-up of a long-term monitoring of the animal – plant – soil system.

3.6 Organisational Control

Article 33 of the Flemish Parliament Act on administrative policy stipulates that all departments, IAAs and EAAs must be in charge of the management control of their business processes and activities. In order to achieve this, IAVA (Internal Audit of the Flemish Administration) has formulated objectives to be met. ILVO established the Organisational Control working group to meet these objectives.

The aim of this working group is threefold:

- First, to make an objective self-assessment of the ILVO processes. To this end, the processes are subdivided into 10 compulsory themes, namely: objectives; process and risk management; stakeholder management; monitoring; organisational structure; HRM; organisational culture; information and communication; financial management; and ICT. We then check the processes against the objectives set by IAVA.

- Second, to define the priorities and then create action plans per theme. We then further develop the processes which do not yet meet the imposed requirements relevant to ILVO.

- Third, to implement these actions and regularly monitor and update the working group's progress. We will then adjust our activity as needed. The final goal is to achieve a Plan-Do-Check-Act cycle in which all ILVO processes are in compliance with the key goals of effectiveness, efficiency, quality, and integrity.

In 2008, the working group drew up a self-assessment schedule and filled it in. During the strategic seminar (22-24 October), we established priorities based on this schedule, then devised an action plan for 2009-2010. We have already taken the first actions set forth in the action plan.

3.7 Accreditation

The Accreditation working group is based on the former IKM-CLO working group, but has a different approach. The former working group existed primarily to introduce ISO 17025 accreditation of analyses in the non-accredited departments. Now that all ILVO units are accredited, the Accreditation working group exchanges knowledge and information about accreditation, provides mutual support, discusses problems concerning accreditation, and harmonises efforts wherever possible.

The kickoff meeting took place on May 21, 2008. During this meeting, we outlined the different goals of the working group and drafted measurable goals for 2008. Those goals were: 1) list all accredited activities at ILVO, 2) draft and approve the shared parts of the quality manual, 3) perform internal audits across the different ILVO locations and 4) brainstorm on the possibility of introducing the same LIMS system for all ILVO units. During our second meeting on October 2, 2008, we discussed evolution in the measurable goals, webpage services to third parties, and the BELAC reports of the external audits.

Two demonstration sessions also took place in 2008. The first session concerned the use of the document management system 'Vivaldi QMS' and the use of Labcollector software to collect lab information. The second session demonstrated the calibration of glassware.

Kick-off meeting ILVO Accreditation working group

3.8 Sustainability

Sustainability is a very broad concept, which calls for environmental, economic, and social action. A realistic approach requires focusing on a specific area of the subject, where priority is given to linking economic feasibility to the legislation in force.

Through systematic environmental audits, we draw up an inventory of environmental red flags. That is why we focus on very specific and well-defined themes within the subject. The first theme-based working group deals with all the environmental aspects of hazardous substances.

This working group brings together the persons responsible for laboratories at each site who, in addition to their affinity with environmental concerns, also embody excellent laboratory practices. This working group aims to develop a procedure across the borders of the different sites, in order to achieve the following:

- uniform management of hazardous substances (purchase, storage, etc.)
- uniformity in the sorting and disposal of laboratory waste

Since 2008, ILVO has been working with a single recognised waste collection company, resulting in a reduction in collection and processing costs of more than 25% compared to previous years. These savings were only made possible by the cooperation of our colleagues in the laboratory who ensure efficient sorting of the different waste streams.

3.9 GMOs (Genetically Modified Organisms)

The multidisciplinary composition of this working group best addresses the complexity of GMOs. It has representatives from units were GMOs are used as tools in research; where GMOs are developed, evaluated and monitored (the Plant Sciences Unit and the Technology & Food Science Unit); and researchers from other ILVO units (the Social Sciences Unit, the Animal Sciences Unit, and a delegate from the administration).

The principal aim of the working group is to provide answers to the Agriculture and Fisheries policy domain on GM matters. We also intend to exchange knowledge and information about GMOs across ILVO units and to identify and further develop new GMO research possibilities. Furthermore, this group aims to contribute to clear, fact-based communication about GMOs using only proven and well-established scientific arguments.

The working group initiated a discussion about ILVO's vision on GMOs and outlined a strategic research agenda. In addition, ILVO researchers contributed to the successful COST project on Molecular Farming (see also 'In the Spotlight'). Molecular Farming, or the use of transgenic plants for the production of valuable proteins, is a GMO application resulting in the so-called third generation of GM crops. Participation in this COST Action will allow ILVO to further extend its network and keep up with the latest developments in the GM field.

3.10 Equal Opportunities and Diversity

At the end of 2006, the working group on equal opportunities and diversity was set up with these goals in mind:

- to raise consciousness about the existence of minority groups in order to create a basis for discussion of this issue within the various ILVO sites and units;
- to support the annual revision of the equal opportunities and diversity plan of the Agriculture and Fisheries policy domain;
- to work on achievement of the formulated objectives (from the Agriculture and Fisheries diversity plan) within the given term.

The creation of this working group meets the request of the Equal Opportunities Commission to assist in creating and supporting the vision of the policy domains and the larger entities of the Flemish government wherever possible.

The Flemish government wishes to mirror society's composition, and thus strives to have a proportional representation of each minority group in the personnel roster. It thus splits the equal opportunity and diversity policy into the following five groups:

- Women (for middle management and higher functions);
- People of foreign origin;
- People with a handicap;
- People with little schooling;
- Experienced employees (+45 years old)

Our working group meets once per year with representatives from each of the various ILVO sites and units.

It is the equal opportunity representative's task to communicate information about the specific situation facing minorities working in a scientific environment to the Agriculture and Fisheries Department's working group on diversity and the Equal Opportunities Commission (CE) of the Flemish community.

4. Animal Sciences

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dr. Nico Peiren
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Scientific director
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Researchers

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ir. Stephanie Buijs
lic. Karen Bekaert
ing. Marc De Paepe
ing. Robin De Sutter
dr. ir. Leo Fiems
dr. Nicoline Geverink (until 30/09/08)
ing. Sofie Isebaert
ir. Karolien Langendries (since 01/09/08)
ir. Luc Maertens
ir. Margot Sprenger (until 30/11/08)
dr. Frank Tuyttens
ir. Roselien Vanderhasselt (since 24/11/08)
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4.1 Functional Animal Nutrition

In the area of Functional Animal Nutrition, applied scientific research on animal production aims to match the supply of nutrients with the requirements of cattle, pigs, and poultry, taking into account the production of milk, meat, and eggs with a high nutritional and health value as well as a minimum output of minerals into the environment.

Research into nutrition physiology through digestion and balance trials results in a more correct feed evaluation and contributes to an improved nutrient provision for the different animal species, and hence better nutrient efficacy and lower environmental pollution. In this respect, our reference laboratory plays an important role in the ISO 17025 guarantee for quality analyses on both animal feeds and animal products.

Research topics on dairy cattle are the use of grains as concentrate replacement, the incorporation of leguminosae in the ration and the use of by-products from biofuel production. In addition, an ongoing project investigates if and how the rumen-degradable protein balance of dairy cattle rations can be lowered to reduce N-excretion. The research concerning milk urea as an indicator of N-excretion is also ongoing.

With meat pigs, the effect of lower protein levels on nitrogen excretion and meat percentage is studied, with the goal being optimal economy as well as ecology. Further, possibilities to improve intestinal health of pigs through the composition and structure of the feed are examined.

Due to the ban on feed antibiotics, there is a continuous need for an objective evaluation of alternatives, e.g. probiotics, prebiotics, enzymes, acids, yeasts, etheric oils, and anticoccidials. Both intestinal health and nutrient efficacy are important because of their impact on the zootechnical performances and nutrient excretion. Additionally, there is a search for new dietary strategies to improve N- and P-utilisation and reduce N- and P-excretion in poultry.

Main research topics in 2008 were:

- Feed evaluation for cattle, pigs and poultry
- Use of cereals, leguminosae and by-products originating from biofuel production in dairy cattle nutrition
- Reduction of the N-excretion and the import of protein through feeding measures in dairy cattle
- Indicators of N-excretion by dairy cattle
- Pig nutrition aimed at reduced N-excretion
- Functional nutrition of pigs to improve intestinal health
- Feeding strategies to improve N- and P-utilisation and to reduce N- en P-excretion in poultry

Services

- Reference laboratory for feed research and nutritional value of animal products

4.2 Animal Husbandry and Welfare

This research group focuses on key aspects of cattle, pig, and poultry husbandry, as well as on animal welfare. Although the research topics are often related to animal nutrition, they relate to the livestock production in general.

In suckler cow husbandry, attention is mainly paid to the most efficient uses of grassland. The nitrogen and phosphorus excretion in double-muscled grass-fed heifers is also determined. Moreover, strategies for optimum development of double-muscled heifers are studied with the assumption of first calving at the age of 24 months. The research with piglets focuses on the most critical period, i.e. the first weeks after weaning. By managing the weaning process, we try to increase feed intake, and consequently also the post-weaning growth rate and health of the piglets.

With regard to legislation stipulating that by 2013 pregnant sows must be housed in groups, a case study on 40 sow units was carried out. This should help the pig farmer choose a group housing system best suited to the farm conditions and management.

Another important subject in pig husbandry is the surgical castration of male piglets, which comprises a great part of our research. The key points here are measures to reduce boar taint without castration and methods to rapidly detect boar taint. In addition, the production and marketing of entire males is considered.

The continuously increasing growth rate of broiler chickens also implies some unfavourable selection responses, such as an increased fat deposition, a higher incidence of leg problems and a greater susceptibility to metabolic diseases. In order to decrease these problems, several growth manipulation possibilities are examined.

Animal welfare research focuses on the development of objective, valid and innovative indicators. In this respect an on-farm and at-slaughter indicator of thirst in broiler chickens was developed. These indicators are subsequently integrated into a protocol for evaluating the general state of welfare. In that respect, the Animal Sciences Unit works on the "Welfare Quality" EU-project to develop an EU standard for evaluating the welfare of farm animals. Another research project aims to derive an optimal stocking density as a compromise between profitability and animal welfare. Moreover, we explore Flemish public opinion about this topic.

Main research topics in 2008 were:

Cattle husbandry
- Optimal milk regimes for double-muscled calves
- Efficient use of grass with attention to the mineral efficiency and excretion in double-muscled cows and heifers
- Optimum growth rate of double-muscled heifers

Pig husbandry
- Castration and boar taint in entire males
- Managing the weaning process to improve growth and health of pigs

Poultry
- Modulation of growth of commercial broiler breeds to improve sustainability of broiler husbandry

Animal welfare
- Development and validation of innovative indicators of animal welfare, such as fluctuating asymmetry
- Development, validation and application of EU-standards for evaluating the welfare of farm animals
- Determination of the optimum stocking density of group housed livestock
- Group housing of pregnant sows

Services
- Contract trials for product support: mainly testing feed additives for poultry, pigs and dairy cattle

4.3 Fisheries

The mission of the Fisheries research group (D-VI) is to provide research and advice in the fields of fisheries biology and management; aquaculture at sea and on land; technical fisheries; quality of the marine habitat and its resources; and technological aspects of fisheries and aquaculture products. These core tasks provide a scientifically sound basis for policy as requested by national and international governmental bodies and professionals.

2008 was a disaster for the fisheries sector. Profits were down due to a combination of falling market prices and extremely high diesel prices. One positive element was the European Council's approval of scientifically-based higher quotas. D-VI was urged to develop alternative fishery production methods in order to cope with the devastating economic circumstances.

D-VI shares most aspects of the vision of the national Strategic Plan on Fisheries. The main goal of D-VI is to reform the Belgian fleet in accordance with a rational and sustainable exploitation model in a social context. This process is ongoing and was accelerated by the economic crisis.

The European Common Fisheries Policy is being reformed because the current indicators (population dynamics, stock size, discards and exploitation of commercial fish and crustaceans) have not sufficiently protected fish stocks, and new needs have arisen. The policy needs to be reshaped within the perspective of ecosystems and their functioning.

Technical fisheries research is the key to developing alternatives to the current fishery practices in order to preserve the ecosystems and meet social need. The key elements are research on modified trawling and other fishing techniques such as passive fisheries and selective electrical pulse fisheries. Last March, field experiments on selective electrical shrimp fishery have started and seem promising.

D-VI is convinced that there is a future for aquaculture in Flanders. We hope that the European Fisheries Fund will provide us the means to further aquaculture in Flanders. One hindrance remains the current lack of legislation on implementation of land-based fish culture facilities. However, D-VI's opinion is that fish culture, as part of hydroculture, is perfectly justifiable in agricultural areas.

The studies on the quality of the marine environment and its resources have also focused on primary production and population genetics. The coupling between the bentho-pelagic systems and the plankton is threatened by climate changes and pollutants. Each loss of suitable habitat can induce changes in the diversity and density of the food chain and lead to less-exploitable stocks. These long-term programmes mainly focus on all anthropogenic activities in the Belgian part of the North Sea.

The quality of fishery products is important to both producers and consumers. The Quality Index Method (QIM-Score) is a refined technique and has been adopted in fish auctions. Fishermen and crew have also become familiar with the technique. Flyers have been developed to accompany the products to inform consumers on the sustainability of the fishing technique used, the origin and authenticity of the products, status of the stock, etc.

5. Social Sciences

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The Social Sciences Unit has been part of ILVO since the end of 2006. The unit's mission is *to present and clarify, on a scientific basis, the social choices concerning sustainable and competitive Flemish agriculture and fisheries.*

The unit started from the idea that the agricultural and horticultural sector can contribute to the Flemish economy and welfare, but needs to develop toward a sustainable and competitive system within the bounds of social, ecological and economic conditions. The unit's activities support three 'clients': policymakers, research within the other ILVO units, and the agricultural sector in general.

Research activities within Social Sciences are clustered in three groups: integration, transition and open space. Our research activities are supported by data management and sector and farm models. The three research groups and the projects running during 2008 are introduced below.

5.1 Integration

Sustainability of Flemish agriculture and horticulture is the core research element in the Integration research. Economic, ecological, and social aspects of sustainability are integrated in the research. Methods are developed to evaluate sustainability on the farm, region, chain or sector level, and to guide both management or policy-making toward better sustainability.

- Indicator development for sustainability assessment
- Validation and application of MOTIFS, the Monitoring Tool for Integrated Farm Sustainability
- Evaluation of methods for measuring sustainability at a supra-farm level
- Management of greenhouse holdings
- Evaluation of new technologies to improve the economic and ecological performance of animal production farms
- Sustainable value analysis of policy and performance in the agricultural sector
- Price-setting and allocation of transferable permits in agriculture and horticulture
- Definition of technology groups within animal husbandry in function of sector modelling
- Environmental scenarios for greenhouse horticulture by 2030

5.2 Transition

This research studies transition processes and their management in Flemish agriculture and horticulture. A transition process is the structural change of a complex system to a new system over a long period of time. Understanding these processes helps to support actual 'change processes' become more sustainable.

- The future of Flemish fruit and vegetables
- Study of a transition process: the case of the azalea sector
- Multifunctionality and local identity as paradigms for a sustainable and competitive agriculture
- The role of agriculture in the development of more sustainable energy and material flows
- Background study on subsidies for organic agriculture and horticulture in Flanders
- Greenhouse firms in industrial ecological clusters: towards sustainability and collaboration in Flanders

5.3 Open Space

Open space in Flanders is scarce, which makes it imperative that it be used in an efficient and qualitative way. We study agricultural use of open space, but agriculture is not the only user of this open space. The relationship of agriculture to the other stakeholders such as inhabitants, industry, recreation, nature is also taken into consideration.

- Integration of large-scale greenhouses into the landscape
- Decision-support framework for planning and management of agricultural areas
- Alternative agricultural use of open space
- Rural development indicators
- New functional use in the countryside: the impact of functional changes

5.4 Service Provision

Services provided by the Social Sciences Unit include:

- Coordination of the Network for Organic Farming and Food Research
- Spin-off of the indicator research on monitoring, such as contributions to the annual State of the Environment Report
- Advice to farm consultancy or accountancy agencies, extension agents and public authorities on the implementation of MOTIFS, the Monitoring Tool for Integrated Farm Sustainability
- Advice on policy issues, participation in various stakeholder- and feedback groups and referee work for policy-preparation documents
- Organisation of activities to stimulate the exchange of knowledge, such as international conferences on Farming for Health and agricultural economics

6. Plant Sciences

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6.1 Applied Genetics and Breeding

The core of this research focuses on the generation of new knowledge and policy-supporting research in the field of plant genetics and breeding. This requires a multi-disciplinary approach and integration of knowledge from different research areas.

The breeding activities focus on the creation of pre-breeding material and on the development of new varieties of forage and lawn grasses, clover, vegetables (leek, celery, and parsley), green manure crops (radish and yellow mustard), industrial chicory, and vegetatively propagated ornamental plants (azalea, rose, and ornamental shrubs). Development of resistant varieties is a key element of sustainable agriculture. The selection for disease- and pest resistance is accomplished by thorough knowledge of the pathogen, the interaction between pathogen and the crop, and the availability of effective screening techniques. This is the basis for the development of a DNA marker-assisted selection strategy.

Better nitrogen utilisation and quality are important issues to consider while creating new varieties of fodder crops (grass and clover). A better nitrogen-use efficiency of the grass and a higher content of water-soluble carbohydrates lead to lower nitrogen losses. Clover is an alternative source of nitrogen for pasture, replacing mineral nitrogen. In addition, clover has a positive effect on the nutritive value of ensiled forage, increases the levels of unsaturated fatty acids, and thereby improves milk quality.

In ornamentals, the demand for innovations with a clear aesthetic value is enormous. In order to maintain the international position of the Flemish ornamental sector, technological innovations that accelerate or improve the breeding process are extremely important. Thus novel techniques (e.g. embryo rescue, meiotic polyploidisation, and asymmetric protoplast fusion) are applied to enable interspecific crosses and/or circumvent crossing barriers. The influence of variations in genome size on crossing incompatibility, as well as the possibilities to use cytogenetic techniques and new flow cytometric applications for plant breeding and related research fields, are examined.

The azalea research focuses on developing a "toolbox" for applied genetic research. cDNA banks of flower and leaf were made, several markers have been developed and used for the construction of a genetic map, and (candidate) genes were characterised. A protocol for gene studies will be developed.

Maintaining genetic heritage is important in light of international agreements. For this purpose, gene banks were created for important Flemish agricultural and horticultural crops with the aim of maintaining genetic

biodiversity on the one hand, and for the exploitation of useful characteristics in the development of sustainable agriculture and horticulture on the other hand.

Close cooperation with other national and international institutes, as well as the Flemish agriculture and horticulture sectors, ensure optimal results.

Main research topics in 2008 were:

- Development and application of DNA markers and gene expression in plants
- Alternative induction of polyploid ornamental plants and their usefulness
- *In vitro* breeding techniques and interspecific hybridisation
- Breeding of agricultural and horticultural crops
- Improving disease and pest resistance in plants and evaluation of strategies for pathogen control
- Development and use of cytometric and cytogenetic techniques
- Regulation of flowering and flower quality in azalea: interaction between genetic, physiological, and cultural factors
- Improving the quality of grass/clover mixtures for fodder production
- Growing and processing flax as the basis for a bio-based economy in Flanders
- Collection and preservation of the genetic patrimony of fodder crops, vegetables and ornamental plants

6.2 Crop Protection

In 2008, this research group started several new projects concerning plant diseases and pests having an important impact on agriculture and horticulture in Flanders. Most of the projects are carried out in collaboration with other research institutes and research stations. We have new programs on *Globodera* and *Erwinia* rot in potato and production of seed potato and on the problem of *Xanthomonas* in strawberry. More fundamental research on virulence, epidemiology, and new alternative control strategies are developed through doctoral research and are supervised within the group. 2008 has also been a year of brainstorming about innovative research, which resulted in the approval of several project proposals which will begin in early 2009. Notable projects are: active participation in the European QBOL project on the bar-coding of quarantine diseases and pests of plants; a project on the behavior of zoonotic pathogens on leafy vegetables; and research on soil management for plant health purposes.

Since 2007, we have provided services to Belgium's national plant-protection organisation (FAVV) as a National Reference Laboratory for bacteriology, mycology, entomology, and nematology. This service demands a lot of dedication and organisation, and creates new perspectives in European networking and collaboration.

PRA or 'Pest Risk Analysis' has become an important theme within Europe. It explores the possible introduction, installation, and spread of harmful organisms that are still absent or have a restricted spread as a result of officially taken measures, and the economic/ecologic impact of those organisms. Plant cultures, production techniques, and climate and economic conditions are very diverse within Europe. However, a national PRA can provide standard guidelines, which are also in the sector's interest. PRA information compiled from the different member states supports decision-making on phytosanitary status and control measures. In 2008, ILVO's Plant - Crop Protection research group was involved in producing PRAs and PRA training.

The Diagnostic Centre for Plants can be regarded as an extension of our diagnostic expertise, and this service centre is well-known among professionals and the wider public. Here, the quality and reliability of analyses and reporting are essential. We worked in 2008 to preserve our ISO17025 accreditation, and also to enlarge the accreditation to include some other specific analyses.

Main research topics in 2008:

Quarantine diseases and pests:
- *Phytophthora ramorum* on *rhododendron* and in the natural environment
- *Puccinia horiana* on *Chrysanthemum*
- *Xanthomonas fragariae* on strawberry plants
- Ring rot and brown rot on potato
- *Meloidogyne chitwoodi* en *M. fallax* in vegetables in the open field
- *Globodera* cyst nematodes in potato production
- The wheat bug *Nysius huttoni* as an alert organism for Belgium

The biotic environment in relation to plant growth and plant health:
- Current virological problems in agriculture and horticulture
- Inventory of plant parasitic nematodes in vegetables in the field
- Losses in vegetable production caused by the lesion nematode *Pratylenchus penetrans*
- *Colletotrichum acutatum* on strawberry
- *Erwinia* rot in potato and production of seed potato
- Bacterial diseases of leafy vegetables, with a focus on lettuce midrib rot
- Registration of spider mites and their natural enemies in tree nurseries
- Bleeding of *Aesculus*

Methods for diagnosis and detection of plant pathogens:
- development of PCR-based detection technology
- profiling microbial communities in association with plants

Control of diseases and pests:
- artificial inoculation methods for screening of plant resistance and evaluation of control methods
- control of insect pests with entomopathogenic nematodes
- Biological control of *Collembolae, Sciara*, and *Scatella* in lettuce

Pest risk analysis (PRA) for organisms harmful to plants

6.3 Crop Husbandry and Environment

The mission of this research group is to explore research activities which support sustainable agriculture and horticulture production, specifically the impact of agricultural activities on yield and quality and on the environment.

The applied basic research in crop husbandry gives special attention to the investigation of the C storage capacity of grasslands and urban ecosystems, the influence of tillage activities on erosion, nitrate leaching, the use of farm-made compost, and the influence of lowered input of external production means on yield and quality of agricultural products and their environment. Further development of organic farming and the co-existence with classic and GMO farming is also under investigation. The seed production technology of grasses, clovers and yellow mustard has also been incorporated into this research area.

Good communication with the government, the sector, and the consumer remains a priority. To this end, we publish an annual update of the descriptive and recommended list for agricultural species. We cooperate intensively with the Agricultural Centre for Forage Crops, including offering advice and support.

Extensive networking on the national and international level is integral to our research and includes different EU actions, COST activities, federal and Flemish cooperation programs with countries in central and eastern Europe, etc.

Quality assurance remains a priority. In 2008, we added several chemical analyses to our ISO 17052:2005 accreditation - the NIR analyses for moisture, crude ash, crude protein, crude fiber and starch.

Main research topics in 2008:

- Grass/clover: production and feeding value
- N-efficiency of forage crops
- Seed production and seed technology of grass and clover species
- Organic farming (crop cultivation systems and coexistence)
- Minimum tillage, soil food web and use of compost
- Carbon sequestration and nitrate-related problems on grassland and arable land
- Optimisation of the use of compost in growing mediums
- Redaction of new criteria for the evaluation of plant species and varieties in the framework of changed legislation
- Varieties for organic farming
- Research on chemical, physical and physio-chemical and non-destructive analysis techniques for the evaluation of plant material, soil, substrate, compost, manure and water
- Cooperation between Flanders and central and eastern Europe
- Damage to pastures and arable land by wintering geese

6.4 Growth and Development

In the context of sustainability and growing concern for the negative impact of human activities on the environment, future crop plants will become more heavily exploited for more food and feed, renewable energy, pharmaceuticals, and other commodities. A thorough understanding of the functioning of plant genomes and their interactions with environmental factors is essential for the creation of improved cultivars that can fulfill these expectations. The Growth and Development research group unravels the molecular mechanisms and the physiological processes that lay at the basis of growth, development and interaction of crop plants with their environment. To achieve this aim, we explore knowledge generated in model plants through a 'translational' approach. Results of fundamental research are translated into practical applications in crops, and agronomic and horticultural knowledge is used to define the focus of fundamental research. This strategy contributes to the integration of research in the lab and in the field, and has the potential to result in innovative practical applications and novel cultivars.

This strategy is currently being applied to understand and improve seed yield in oilseed rape. Higher seed yield would make the crop more profitable for the Flemish farmer than crops such as wheat. Similarly, the allelic diversity of branching genes identified in model plants is explored in perennial ryegrass and red clover. The identification of alleles associated with improved plant architecture can be exploited to increase yield and persistence in these two crops.

To meet the energy needs of the future, new methods and sources have to be explored. Currently, the Growth and Development research group is evaluating the potential of temperate grass species as feedstock for bio-ethanol production, in comparison to species such as *Miscanthus*, reed canary grass, switchgrass and willow. The annual yield and saccharification potential of these different crops is evaluated and compared. Cell-wall composition is a major intrinsic determinant of the potential of grasses as second-generation energy crops. Therefore, new insights into the genetics of cell-wall biosynthesis in grass species are generated through studies in the model species *Brachypodium distachyon* and may provide new targets for crop improvement.

Advanced ecophysiological and phenotyping approaches are being used to follow plant responses to the environment, and to abiotic stresses in particular. Among others, parameters based on photosynthesis and chlorophyll fluorescence measurements are studied to understand the response of industrial chicory to cold stress and of azalea to heat stress. Besides the identification of genotypes able to cope with these stress conditions, this research will translate into efficient screening techniques for the evaluation of large numbers of plants.

Main research topics in 2008:

- Morphological and molecular characterisation of architectural characteristics in perennial ryegrass and red clover
- Genetic control of reproductive characteristics in crops
- Development of a cruciferous oil crop for the production of biodiesel through implementation of knowledge generated in the model species *Arabidopsis*
- Seed production in *Lolium*
- Cell wall composition of grasses
- *Brachypodium* as model for the *Poaceae*
- Evaluation and genetic improvement of fast-growing grasses as source of biomass for the production of bio-ethanol in Flanders
- Development of screening methods for the evaluation of stress tolerance based on physiological processes
- Cold stress tolerance and yield stability in industrial chicory
- Physiological response of azalea to heat stress
- High-throughput phenotyping and genotyping
- Detection of Italian ryegrass in seed lots of perennial ryegrass
- Distinction of grains of different cereal species
- Development of a protocol based on the use of SSR markers to be used in disputes of essential derivation in *Lolium perenne* L
- Secondary metabolism in hop
- Silencing of isoflavone synthase in red clover
- Identification of DNA-markers linked with disease resistance in diverse crops
- Population genetics research of wild plant species and of wild crop relatives

6.5 Business Unit and Services

One of the goals of the Business Unit is to transfer research to the concerned sector. Our results are widely disseminated by issuing publications, organising demonstrations, and giving lectures nationally and internationally.

ILVO's multidisciplinary and creative approach to breeding contributes to high-quality seed and starting material for small and alternative crops in Flanders. The benefits of research and selection are also distributed internationally. More than one hundred cultivars have plant breeder rights or appear on at least one variety list. Seed merchants carry out the production of certified seed and the final commercialisation. Cuttings of ornamentals are produced and sold through external companies in collaboration with private growers.

In addition to the research activities on product improvement and innovation, we manage several services for the government and the professional sector. Under EU Regulation 53/2003, the VCU trials of all agricultural species and the DUS tests of some species for the composition of the national and European variety catalogue for agricultural crops are carried out as a mandated activity for the Administration for Agriculture and Fisheries. Based on the research, essential expertise is developed for the genetic identification of varieties by using molecular markers. These techniques are applied to determine purity, homogeneity and whether the cultivar is true to type. Our laboratory is equipped with a flow cytometer to do ploidy analysis specifically adapted to the requirements of third parties (research institutes, universities, and companies). The reference lab for Plant and Soil offers analyses to determine the quality of plants, forages, substrates, and compost. It also performs analyses of mineral soils. Some of these analyses are accredited according to ISO/IEC 17025.

Quality has become a prerequisite for a competitive agriculture and horticulture in Flanders. Consequently, production and trade are increasingly being challenged by the demand for assurance of plant health. Reliable and early diagnosis of pests and diseases is therefore indispensable.

The Diagnostic Centre for Plants (DCP) is the prominent plant health laboratory in Flanders. Safeguarding and improving the health and quality of commercially-produced plants and plant products implies a significant support for the policy of sustainable agriculture and horticulture. Quality and reliability of analyses and reports are essential. The offered services are accessible for growers, consultants, private customers, research facilities, and government extension services. In 2008, we aimed for new accreditation and extension of the ISO 17025 accreditation for specific analyses.

Close contact with different sectors gives valuable feedback about our research, helping to guarantee success for the agriculture and horticulture sectors.

Services:

- Technological advice on applied biotechnology for the ornamental sector (SIETINET)
- Collection and maintenance of the genetic patrimony of fodder crops, open field vegetables, and horticultural crops
- Development of cultivars, production and delivery of starting material
- Genetic characterisation of plant material and plant varieties by means of ploidy analysis and molecular markers
- Characterisation of shape and color of plant material by means of image analysis
- The Diagnostic Centre for Plants (DCP)
- National reference laboratory for plant diseases
- Quality and composition of plants and soil
- Variety testing; seed testing; descriptive and recommended variety lists

7. Technology & Food Science

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7.1 Product Quality and Innovation

Research at T&V-PI focuses on improving the functional quality of food products as well as the control of their authenticity, with the aim being better protection of the consumer and improvement of the market position of the Flemish producer, while taking sustainable production and processing methods into account.

Fraud-control techniques are being tested to determine species and treatment authenticity, and extensive research is being done on the development of strategies for characterisation and detection of genetically modified organisms (GMOs). This also includes research in function of the EU-required coexistence of GMO and non-GMO agricultural systems.

Physio-chemical and technological research develops innovative functional food and quality improvements regarding stability, composition, taste, processing and shelf life of dairy products. Another important research area is product development for the dairy farmers and small and medium-sized enterprises (SMEs) in the dairy industry.

Further, an integrated approach is being developed to control the problem of allergens in the Belgian food and catering industries.

A project on the diversification of vegetables will increase knowledge of new tendencies in the areas of marketing and new consumption patterns.

A renewable materials study investigates the use of a plant-based platform for the production of high-quality proteins.

Main research topics in 2008:

Authenticity and product quality:
- Development methodology for stability, shelf life and taste of dairy products
- Development methodology for authenticity of product composition and treatment
- Stability of dairy products with a long shelf life
- Characterisation of psychrotolerant *Pseudomonas* and their heat-resistant enzymes in raw and heat-processed milk
- Integrated strategies for screening, identification and quantification of GMOs
- Detection methods for the food allergens hazelnut and soy
- Development of knowledge and strategies in function of implementation of the coexistence legislation in Flanders

Product development:
- Processing and quality of milk with a modified milk fat composition (functional food)
- Development of drinks with health-promoting properties
- Development of dairy products for dairy farm producers and SMEs in the dairy industry
- Sugar reduction and/or replacement in dairy drinks and ice cream
- Research for diversification in leek
- Development of a plant-based production platform for the production of high-quality proteins

7.2 Food Safety

T&V-VV performs research for the improvement of the microbiological and chemical safety of food products of animal and vegetable origin to both protect the consumer and improve the market position of the Flemish producer, all within the framework of sustainable production and processing methods.

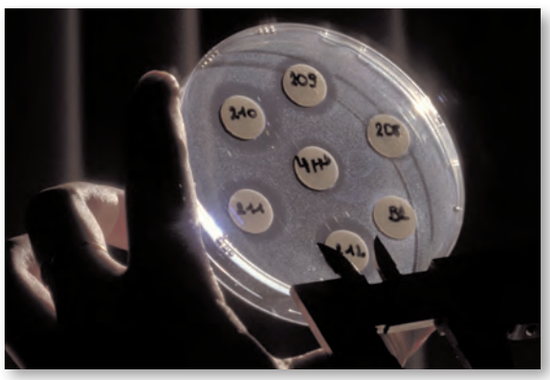
Food safety is very important for the producer and the consumer, with a consequent amount of research dedicated to microbiological safety. In this research, molecular detection, identification, typing, and gene expression techniques applied on pathogenic and spoilage micro-organisms play an important role. Animal experiments are replaced to the extent possible by *in vitro* techniques. We investigate contamination sources, behaviour of zoonotic microorganisms in the food production chain, virulence for humans and animals, and farm management adaptations for the reduction of pathogens and harmful bacteria. The effect of these different measures is then quantified by risk assessment.

Chemical food safety is another important research area. Detection methods for tracing contaminants and residues of veterinary drugs are being developed. New screening methods are tested, and chromatographic methods are developed for confirmation. The latter will assist in tracing the contamination source and remediation suggestions will be formulated. A multiresidue method is being developed for the detection of mycotoxins in silage. A new research theme has recently been introduced: the development of a model for the determination of transfer factors of residues in poultry.

Main research topics in 2008:

Microbiological safety of food:
- Detection, identification and typing of new microbiological risks, such as *Mycobacterium avium* subsp. *paratuberculosis*, pathogenic viruses (e.g. noroviruses) and shigatoxin-producing *Escherichia coli* (STEC), *Yersinia enterocolitica*, *Bacillus cereus* and moulds
- *In vitro* techniques (cell cultures, fermentation) for the study of the interaction of the pathogen-host relationship
- Molecular identification and detection of patulin-producing moulds and the influence of conservation circumstances of apples on the expression of patulin-producing genes
- Research on MRSA at pig farms
- Unwanted moulds in silage
- Microbiological quality of fish and fish products
- Development of risk models for *Salmonella* and *Campylobacter* in pig and broiler sectors
- Transfer of antimicrobial resistance genes from the intestinal microbiota in broilers to humans
- Influence of feed additives on the reduction of *Salmonella* in pigs
- Prevention of the transfer of EHEC from cattle to humans
- Scientific support of the *Salmonella Enteritidis* monitoring on laying hen farms
- Improvement of udder health and milk quality by research towards coagulase-negative staphylococci

Chemical safety of food:
- Sample preparation based on new technology, e.g. "Molecular Imprinted Polymers"
- Evaluation of new screening methods for antibiotics
- Reduction problems with animal drug residues and migration of antibiotic residues in honey
- Secondary metabolites produced by moulds (e.g. mycotoxins) in silage
- Development of confirmation methods for residues of animal drugs in diverse biological matrices
- Determination of transfer factors of residues in poultry



7.3 Agricultural Engineering

The Agricultural Engineering research group focuses on innovative farming systems which respect the environment, promote animal welfare, and give an added value for agriculture and society. The core of this research is the development and evaluation of new and existing techniques, as well as their integration into innovative production systems within the context of sustainable agriculture and horticulture. In addition to the more traditional technical skills (strength studies of materials, (electro)mechanics, pneumatics, hydraulics, control and measurement techniques, sensor technology, etc.), this research also uses modern mathematical and IT-based methods such as image processing, data-based modelling, mechanistic modelling (e.g. CFD), CAD, etc. This research area is also equipped with a workshop for the construction of newly developed experimental installations and constructions.

Main research topics for 2008:

Livestock technology
- Development of a method to determine the average nipple size from a dairy herd
- Continuous monitoring of milking systems for sustainable milk production
- Development of an automatic detection system for cattle lameness
- The influence factors of mastitis in dairy cattle
- Sustainable materials for agricultural structures and animal housing
- Development of a measurement technique to determine the soiling degree, body size and shape of farm animals
- Development of an observation system for the group density of broilers and rabbits

Environmental technology
- Development of measurement techniques and research regarding the impact of farming on the environment
- Evaluation of environmentally friendly production systems (low-emission barns, manure injection, etc.)
- Development of measurement techniques for ammonia emissions from agricultural buildings with mechanical or natural ventilation
- Research into the state of affairs of fine dust in Flemish pig husbandry with respect to occupational safety, animal health, and environmental hygiene
- Modeling N-flows for the agricultural emission inventory
- Efficient energy use in the exploitation of agricultural buildings with an emphasis on the ventilation process

Mechanisation
- Research on the importance of spray drift and reduction measures for environmental protection in Flanders
- Optimisation of application techniques for pesticides in horticulture
- Optimisation and development of application techniques for biological crop agents
- Measurement of the characteristics of spraying patterns and spray nozzles using PDPA laser techniques, image processing, test banks, etc.

Harvest and post-harvest technology
- Adjustment of potato harvesters to maximise potato quality
- Optimisation of chicory harvesters to reduce root fracture
- Prediction of fertiliser application distribution using imaging techniques and ballistic models
- Development of robust image-processing algorithms for use in agriculture (sorting techniques, handling precision of crop products, etc.)
- Collection of 3D information by applying high-speed images and stereo vision techniques
- Development of prototypes of harvesters for new crops

7.4 Business Unit (BU) and Services

The most important activities of T&V-BU comprise reference working and science-based consultancy (for laboratories, small- and medium-sized enterprises, farmers, etc.), ring trials (for the dairy sector, spray nozzle manufacturers, etc.), consultancy for the government, and technological advice through our Technological Advisory Services (TAD).

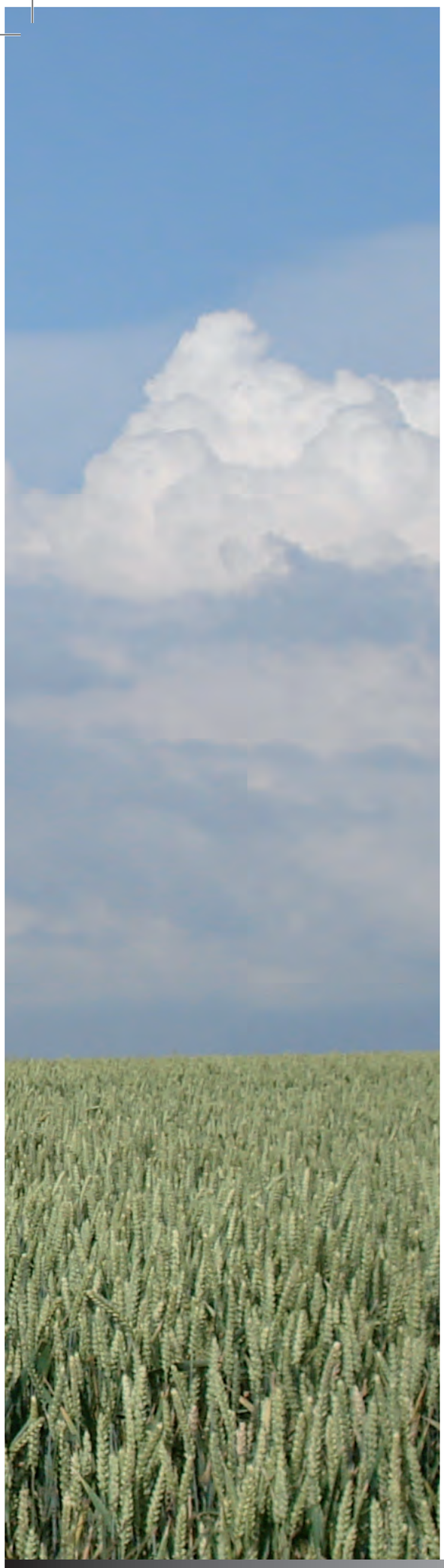
T&V-BU is equipped with accredited laboratories, an accredited service for the inspection of spray nozzle apparatus and laboratory spray techniques, test halls, a renovated workshop, and a pilot dairy plant. This pilot plant, large enough to operate on a semi-industrial scale, contains equipment for the production of cheese, extrusion products, milk powder, drinks, desserts, and ice cream. This equipment is used for technological research projects and in private research for the food industry. T&V-BU is also equipped with test halls (milking measuring apparatus, house floors, etc.), a small concrete lab, a test milking machine, a scale model for gas emission measurements, and others. These assemblies can be used for technological research on agricultural engineering. The machine shop is equipped to construct different experimental assemblies.

Reference working and consultancy:

- Reference working on analyses for food authenticity and food safety (including GMO detection and platform for food safety and GMOs)
- Reference working concerning National Reference Laboratory (NRL) for GMOs, for milk and milk products, and for moisture content in poultry meat
- Reference working for the "Milk Control Centre of Flanders" (MCC)
- Consultancy for government agencies on authenticity (including GMOs), food safety, and food quality
- Flemish authorisation for evaluation of food quality regulations
- Spray techniques: accredited inspection of sprayers and accredited laboratory for spray technology
- TAD Dairy: new practices and technologies on dairy farms, dairy farm producers, and small- and medium-sized enterprises
- TAD Agriconstruct: construction and renovation of buildings and materials in agriculture and horticulture

Services for the public:

- Laboratory analyses of food authenticity and food safety (including GMO analyses)
- Technological trials for feed and food transformation
- Experiments on agricultural technology
- Inspection: monitoring of certified dairy technicians



8. Main Research Results

8.1 Reducing nitrogen excretion in dairy cattle

Agriculture plays a predominant role in the nitrogen (N) pollution of the environment. It is thus of great importance to reduce the N losses from animal husbandry. In dairy cattle husbandry, nutrition is the main source of nitrogen losses. However, due to fear of production losses, dairy farmers usually feed a large N surplus, in particular an OEB (degraded protein balance) of 250 g per day and even higher, whereas theoretically 0 g OEB would suffice. This 'safety' margin is taken to avoid any ammonia (NH_3) shortage in the rumen during some part of the day, which could depress microbial protein synthesis, and to account for inadequacies from using tabular or estimated OEB values of the feedstuffs. Diets with these OEB values induce peak NH_3 concentrations in the rumen at about 1 to 2 h after feeding (figure 1: black curve). The large surplus of ammonia in the rumen is not used at that time and leads to N losses, while at other times of the day, NH_3 concentration is close to the minimum value for microbial protein synthesis.

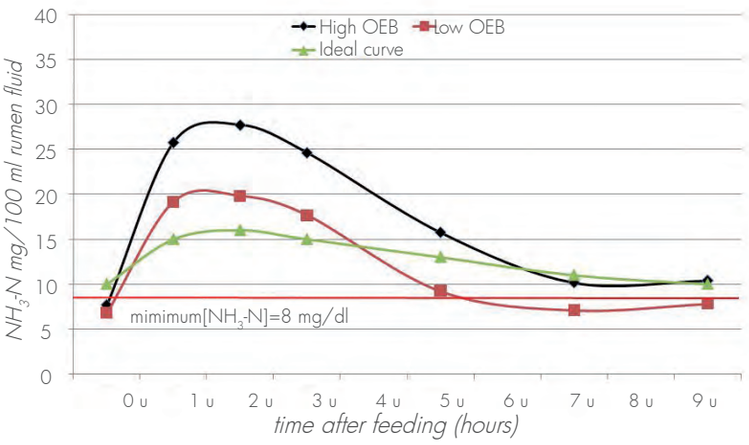


Figure 1: Course of the rumen ammonia concentration after feeding

Feed technical measures, that decrease the OEB of the diet, were investigated in an attempt to flatten the rumen NH_3 concentration curve as much as possible and obtain a sufficient and stable NH_3 availability throughout the day (Fig 1: green curve). Two measures were studied: feeding strategies (total mixed ration (TMR), meal frequency, etc.), and protected protein sources.

The first step taken was screening for several measures in 6 rumen-cannulated cows. Decreasing the OEB of the diets reduced the peak ammonia concentration, while feeding strategy appeared not very effective in flattening the NH_3 curve, resulting in concentrations beneath the minimum value (figure 1: red curve). N excretion per kg milk was lower when concentrate feeding was spread and when fast carbohydrates were added. More frequent concentrate meals seemed to result in a lower NH_3 peak, a higher microbial protein synthesis, and a higher N efficiency, than protected protein meals. From the latter, protected soybean meal showed a clearly flatter NH_3 profile than the mixture of protected soybean/rapeseed meal.

The second step was to evaluate the most promising measures of the screening trials by performing three feeding trials. The results of the first trial showed that if concentrates were fed 6 times daily (instead of twice for the control treatment), as a compensation for the reduction of the OEB from 280 g to 160 and 40 g per day, milk production and composition results were not affected. However, the amount of N excreted per kg FPCM (fat and protein corrected milk) decreased from 10.5 to 9.9 and 9.5 g respectively, a reduction of 6 and 9%.

In the second trial, a control treatment (with unprotected soybean meal) with an OEB of 160 g/d was compared to 2 treatments with an OEB of -40 (with protected soybean meal) and -55 g/d (with protected soybean/ rapeseed meal). Both treatments with the negative OEB resulted in a lower N excretion per kg FPCM (on average 9.7 vs. 10.3 g), but also in a reduced milk production (on average 2 kg lower), partly caused by a reduction in the total dry matter intake. A third trial was carried out to test if the lower production was due to the negative OEB or to the protein protection. In addition to a similar control treatment as in trial 2 (OEB 150 g/d), the third trial compared two rations with a negative OEB, one with unprotected soybean meal (OEB -60 g/d) and the other with protected soybean meal (OEB -105 g/d). Again, both treatments with negative OEB showed a lower excretion of N per kg FPCM (on average 10.4 vs. 11.2 g), but in both treatments milk production was also reduced (on average 1 kg). One may

conclude that decreasing dietary OEB clearly reduces the N-excretion per kg FPCM. Reducing OEB from 280 g to 40 g/d does not hamper production results, but it should be stressed that the low-OEB diet concentrates were fed in 5 meals. However, at negative OEB values, even when some feed technical measures (protected protein sources) are taken, the risk of loss in production is real.

8.2 Feeding value of grass/clover silage

Through the subsidisation of home-grown protein crops since 2004 as well as manure regulation, clover and grass/clover has gained importance in traditional dairy husbandry. Clover has already been used for a long time by organic animal husbandry because of the fixation of nitrogen out of the air. The advantages of a mixed crop grass/clover increase with decreasing fertiliser rate. White clover is not suited to grow alone, whereas pure red clover is difficult to ensile in a proper manner. A mixed crop of grass/white clover is mainly destined for grazing, while a mixture of grass and red clover is particularly suited for mowing. The latter combination may not only give high yields at a low nitrogen input, but also fits well in crop rotation systems. In order to use grass/clover more efficiently in practice, additional information about the feeding value is needed.

In collaboration with the Agricultural Centre for Feeding Crops (LCV) and with some Dutch institutes, ILVO Animal Sciences determined the botanical and chemical composition, energy, and protein value of 7 grass/white clover silages (GWC) and 8 grass/red clover silages (GRC). Five batches of GWC and 6 batches of GRC originated from the Netherlands and were all harvested in 2007; 2 batches of both GWC and GRC were grown at ILVO and harvested in the autumn of 2004 and 2005. The clover percentage of GWC varied between 28 and 64% with a mean of 43%, whereas for GRC the minimum, maximum and mean percentage amounted to 46, 96 and 71%, respectively. All batches were pre-wilted. The mixture of grass and clover seemed to ensile fairly well. The ammonia fraction amounted on average to 8.1 and maximum 12.8% for GWC and 8.7 and 11.8% respectively for GRC. Only one silage contained a noticeable butyric acid content (16 g/kg DM). The nutritive value of GWC was not only compared with that of GRC but also with that of an average grass silage (G) as reported by the private laboratory for soil and crop research at Oosterbeek (BLLG, the Netherlands) (table 1). The mean crude protein content of the grass/clover silages was somewhat lower than that of G, which is probably due to the lower N-fertilisation rate and the somewhat later growth stage of the former. The crude fibre content was on average somewhat higher for grass/clover than for grass silage. On the other hand, the total cell wall content was clearly lower for GWC or GRC than for G; this is explained by the lower hemicellulose content, whereas the cellulose content is comparable. Typical for GRC was its higher lignin content in comparison with GWC and G. Clovers contain few sugars in contrast with grass, which was reflected in the contents of mixed silages. The digestibility of GWC was on average higher than that of GRC, although clearly lower than that of G. A comparable ranking order not only appeared in the net energy value, expressed in VEM (feeding unit milk) but also in the DVE-value (protein digestible in the intestines). The mean OEB-value hardly differed among the three groups of silages .

Further, three rations based on either GWC, GRC or G were compared in a feeding trial with dairy cows. The GRC-ration resulted in a clearly higher roughage intake than the GWC-ration and also in more milk (28.5 vs. 27.4 kg milk). The milk fat content was identical (4.68%), whereas milk protein content was somewhat lower for GRC (3.24 vs. 3.32%). The better results for GRC may for a large part be explained by the higher percentage clover compared with GWC (72 vs. 21%). The production performances with the grass ration were less favourable than those with the grass/clover rations because of the lower nutritive value of the grass and the lower DVE-supply. Finally, milk fat on the GRC-ration

Mixed crop grass/clover

Table 1: Mean composition and nutritive value of grass/clover silage and grass silage

	Grass/white clover silage	Grass/red clover silage	Grass silage
Dry matter (g/kg)	481	396	473
Crude protein (g/kg DM)	160	167	180
Crude fiber (g/kg DMS)	268	281	261
NDF (g/kg DMS)	453	434	504
Hemicellulose (g/kg DM)	169	128	215
Cellulose (g/kg DM)	252	253	263
Lignin (g/kg DM)	32	53	25
Sugar (g/kg DM)	49	25	86
Digestibility OM (%)	72.1	67.1	76.3
VEM (per kg DM)	796	732	880
DVE (g/kg DM)	55	50	65
OEB (g/kg DM)	40	48	47

contained somewhat higher amounts of unsaturated fatty acids than that on the GWC- or G-ration.

One can conclude that in general a mixed grass/red clover silage has a lower energy and protein value than a mixed grass/white clover silage and the latter in its turn lower than grass silage, but may for a great part be compensated by the better intake capacity.

8.3 Optimal protein/amino acid levels for pigs

An efficient livestock production that takes the environment into account requires optimised nutrition. In the past, research at ILVO was performed to determine nutrient requirements for growing/finishing pigs of a typical Belgian breed. Protein/amino acid concentrations that lead to optimal performance were determined for barrows and sows from 20 to 40 kg, from 40 to 70 kg and from 70 to 110 kg. The question rises whether these optimums for performance also lead to the highest profitability and the lowest impact on the environment.

Therefore, an experiment was performed where the effects of suboptimal ideal protein levels were evaluated on performance, feed cost price and nitrogen excretion. Sixteen pens of 6 pigs were divided over 4 treatments: the control diet with the optimum ideal dietary protein level for different feeding phases as observed in previous experiments with pigs of the same genetic background (100%), and 3 diets with 10%, 20% and 30% lower protein level, respectively (90%, 80% and 70%). Maximal performance was already reached on the 90% feed. The 80% feed only showed in the first phase a significantly worse feed conversion ratio and a slightly lower (not significant) performance overall. The 70% feed led to significantly poorer results (table 2). Carcass quality did not differ but protein content of the carcass was lower on the 70% feed. Efficiency of crude protein utilisation increased, and consequently nitrogen excretion was reduced with decreasing protein concentrations up to the 80% group. Simulated feed cost price per kg carcass gain was lowest on the 80% and 90% feed. If protein was formulated towards a fixed value, the lowest nitrogen excretion was noticed on the 90% feed. If protein varied together with the essential amino acids, the lowest excretion was noticed on the 80% feed.

If protein varies together with digestible amino acid content, the 80% feed may be the best choice when taking environment and profitability into account. If protein content stays at a fixed level, nitrogen excretion no longer differs between the 90% and the 80% feed, thus the amino acid concentrations of the 90% feed might be the safest choice.

Meat pigs

Table 2: Performance results using the feeds from 100% to 70% of the theoretically optimal ideal protein concentration

weight evolution		100 %	90 %	80 %	70 %	P-value
20-40 kg	Daily feed intake (kg/d)	1.14±0.13	1.20±0.10	1.05±0.06	1.15±0.19	0.472
	Daily gain (g/d)	546±52	566±53	463±29	465±61	0.024
	Feed conversion ratio (g/g)	2.09^{a}±0.08	2.11^{a}±0.06	2.28^{b}±0.08	2.47^{c}±0.09	<0.001
40-70 kg	Daily feed intake (kg/d)	1.72±0.09	1.77±0.11	1.65±0.08	1.64±0.14	0.296
	Daily gain (g/d)	679^{a}±17	733^{a}±19	654^{ab}±71	575^{b}±81	0.012
	Feed conversion ratio (g/g)	2.53^{a}±0.10	2.42^{a}±0.12	2.49^{a}±0.13	2.79^{b}±0.12	0.004
70-105 kg	Daily feed intake (kg/d)	2.57±0.06	2.49±0.20	2.52±0.15	2.34±0.13	0.197
	Daily gain (g/d)	842^{a}±24	796^{ab}±77	833^{a}±66	708^{b}±46	0.022
	Feed conversion ratio (g/g)	3.05^{a}±0.10	3.13^{ab}±0.10	3.03^{a}±0.09	3.32^{b}±0.08	0.004
20-105 kg	Daily feed intake (kg/d)	1.82±0.05	1.83±0.08	1.71±0.07	1.73±0.18	0.323
	Daily gain (g/d)	692^{a}±21	706^{a}±22	639^{ab}±46	596^{b}±40	0.002
	Feed conversion ratio (g/g)	2.64^{a}±0.08	2.61^{a}±0.05	2.66^{a}±0.04	2.93^{b}±0.07	0.001

8.4 Optimum growth rate of Belgian Blue double-muscled heifers

The effect of body weight (BW) prior to the first calving (BW_{BC}) at an age of two years in the beef strain of the Belgian Blue breed was investigated using 341 double-muscled (BBDM) heifers. Although many calves are not suckled by BBDM dams, females with a heavier BW after calving (X, kg) give more milk (Y, kg/d) when measured through the milk intake of the offspring: $Y = -1.200 + 0.014\ X$; $R^2 = 0.320$; $P < 0.001$. This is important because milk intake by the calf during the first 20 weeks of life explains 65% of the growth rate. BWBC has no clear effect on the length of the interval between the first and the second calving. Calf birth weight is reduced when BW_{BC} was lower than 600 kg. Increasing BW_{BC} above 600 kg did not further enhance calf birth weight. Primiparous cows have a lower body condition than multiparous cows. Previous research revealed that a lower body condition score resulted in more calf losses during the first months of life. This is not desirable because the income of the beef farmer depends on calf survival. Heifers with a lower BW_{BC} partly compensate their lower BW between the first and the third parturition, but there is a tendency that the interval from the first to the third parturition is increased.

We also found that the BW_{BC} of less than 600 kg is partly due to a lower birth weight of the heifer, but it is also provoked by a growth rate below 600 g daily during the first four months of life. This means that this lower weight gain is not fully compensated afterwards, and that the first months of life are critical with regard to the further development of the female.

Based on the positive effect of BW_{BC} on calf birth weight, milk production and calf survival, a BW_{BC} of 600 kg is desirable. Taking into account that the mean birth weight of heifers averages 48 kg and that BW at mating should amount to 55-60% of the mature BW (±710 kg), we deduce the following growth pattern and BW evolution:

suckler cows in grass

Table 3 Growth rate and evolution of Belgian Blue double-muscled heifers

Period	Age (d)	Weight (kg)	Gain (g/d)	
Birth	0	48	750	
End of rearing	150	160	765 - 880	
Start gestation	450	390 - 425	450 - 630	625 - 750
3 months before calving	640	510		
calving	730	600 (BW_{BC})		
		510 (BW_{AC})		
Birth till				
1st calving		600 (BW_{BC})	760	
		510 (BW_{AC})	630	
21 months		510 (BW_{AC})	720	

Most often, growth rate is reduced during the last part of the gestation as a result of a lower feed intake because of the compression of the rumen by the growing uterus. This situation is further exacerbated due to the lower intake capacity of BBDM animals. Lighter females lose more weight towards the end of the gestation. BW gain during the last trimester of the gestation was significantly lower in grazing heifers than in confined heifers. This could be explained by the lower dry matter content of grass compared to the diet fed during the winter period, and the fact of a substitution of the dry matter by the water content of the forages. As a consequence of the levelling-off of the BW during the last part of the gestation, it may be taken into account that the BW at calving is already reached at 21 months of age. This development of BBDM heifers requires an intensive approach.

8.5 Growth manipulation of broiler chickens by means of feeding strategies

Genetic selection has resulted in broilers that reach the target slaughter weight in a ever-shorter period of time (figure 2). However, the very high growth rate and the low feed conversion ratio are accompanied by some unfavourable selection responses. The modern meat-type broilers show an increased fat deposition, a higher

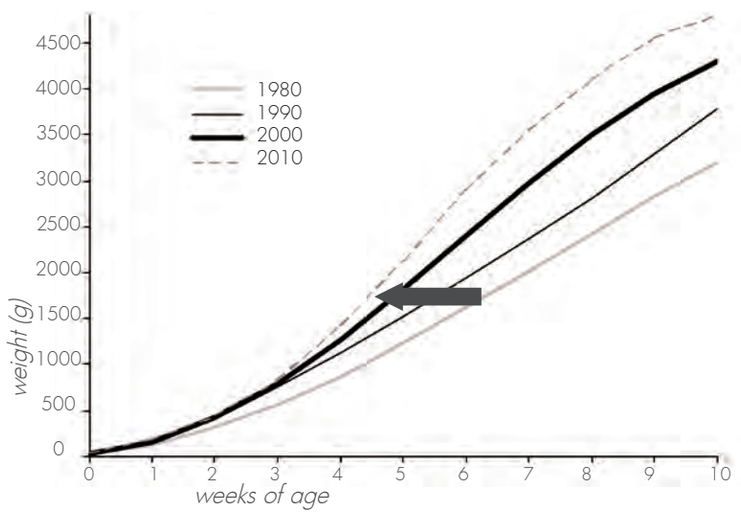


Figure 2 : Growth pattern in function of age of Ross broilers for the years 1980, 1990, 2000 (based on data of Ross Breeders Ltd.) and as expected in the year 2010 (extrapolation). Indication of the age reaching 2 kg of body weight

incidence of leg problems and a greater susceptibility to metabolic diseases such as 'sudden death syndrome' and ascites. These negative aspects of selection are of major concern for the farmer and processor, because they cause important economic losses.

It is possible to control growth of the chickens, e.g. by adaptation of the feeding strategy. By restricting growth of broilers in the early phase of life, the vital organs and the skeleton may develop more optimally. Reliance on the phenomenon of compensatory growth can achieve equal final body weights. In addition, better feed utilisation and lower carcass fat contents are expected. To limit growth, feed intake can be restricted either quantitatively or qualitatively. With a quantitative restriction, the quantity of feed is restricted to a certain level during a short period of time early in life. With a qualitative restriction, birds are able to keep on eating *ad libitum* but temporarily receive feed with a lower nutritional value.

A number of trials were performed to determine the optimum feeding strategy to control the growth pattern of the broilers. In a first set of experiments, different quantitative and qualitative restriction programmes were evaluated on a Ross 508 and a Hybro G strain. The two qualitative feed restrictions, a low-energy diet on the one hand and a NaCl-deficient diet on the other, seemed to be good methods to induce compensatory growth. Indeed, final body weights of the chickens showed no significant differences with the control birds. The quantitative birds were restricted to 80% or 90% of *ad libitum* intake (of the previous 24 h of the control group) for 4 d or to 80% for 8 d. All restrictions started on day 4. Results indicated that a restriction program should not last more than 4 days, in order to give the birds the opportunity to recover completely. There was no indication in these trials that changes in growth trajectory (growth retardation-compensatory growth) induced by quantitative or qualitative feed restriction had a negative effect on slaughter yield nor meat quality once compensatory growth was complete. It was concluded that a quantitative feed restriction to 80% of the *ad libitum* intake or a qualitative feed restriction (as used in the current work), may be practical tools to reduce losses due to metabolic diseases without deteriorating performance, carcass or meat quality. During compensatory growth some (not significant) improvement in N retention was induced, which is favourable for the environment.

These results confirm the findings in the literature that the effect of an early feed restriction can be rather variable. Indeed, several factors such as timing, severity and duration of the restriction, strain type and gender are of influence when considering this kind of growth manipulation. However, even when these factors are taken into account, results remain rather unpredictable. In other words, these parameters are not sufficient to explain all the variation

broiler chickens in a test facility

found. Additional factors of possible influence are chick quality and feed structure (mash vs. pellets). Still, in any given situation, it seems impossible to predict the final results of a given feed restriction programme. Thus it is very difficult for the farmer to decide whether or not to choose for a feed restriction programme with the arrival of the chickens. It might be advisable to control growth continuously in time by adjusting feed intake from day to day rather than using an *a priori* determined feed restriction in all circumstances.

A first way is to offer broilers 2 diets (e.g. low- and high-protein diet) and to let them choose between both in function of their age. Our results indicated that broilers were able to make a choice between two diets differing in protein/amino acid contents starting as early as day 1, but feed structure interfered with their choices. However, neither performance nor N-retention could be improved by this feeding strategy. A second method used to control growth was a multiphase feeding strategy with continuously (every other day) adjusted diet composition by blending 2 diets (high and low amino acid levels). The more optimised mixture schedules of the precision feeding resulted in better performance and improved N-retention compared to the conventional 3-phase feeding schedule.

These trials indicate the possibility of growth control. However, many factors interfere. More research is needed to reduce the negative aspects of selection responses as requirements change with time due to continuing genetic selection.

8.6 Development of an on-farm and at-slaughter tool to assess thirst in broiler chickens

Animal welfare is a very important aspect of modern animal husbandry. To improve welfare of animals, one must first be able to correctly assess welfare. "Freedom from thirst" is considered to be of paramount importance for animal welfare, but an animal-based indicator to assess thirst that can be used for monitoring on-farm or at-slaughter animal welfare is not available. At ILVO Animal Sciences, innovative behavioural and physiological parameters for assessing thirst in broiler chickens are being developed and validated under experimental conditions.

To develop a simple behavioural indicator for application on living animals on-farm, small groups of chickens were subjected to different periods of water deprivation (0, 6, 12 or 24 h). After deprivation, water was offered in a test drinking fountain and spontaneous water consumption was measured during two hours. The results showed that water consumption increased in proportion to the period of water deprivation. There was also an effect of familiarity with the test drinking fountain. If chickens were used to drinking from it, water consumption was higher and drinking seemed to start earlier than for chickens that were not used to the fountain. Only after 24 hours of deprivation did familiarity with the test drinking fountain not affect water consumption. At this time, the behaviour of the chickens during the test is being scored and analysed. It is expected that duration of drinking will increase with deprivation length and that latency to drink will decrease. It is also being studied whether group activity depends on deprivation time.

To develop a physiological indicator to assess thirst (mainly for application at the slaughter line), chickens were deprived for 0, 6, 12, 24 or 48 hours. After deprivation, several blood parameters were measured, as well as dry matter content of the excreta. Plasma osmolality, plasma sodium and plasma chloride concentrations significantly increased after 24 hours of deprivation.

These results illustrate the potential of very simple animal-based measures such as water consumption over time to assess thirst in chickens. For on-farm application, the influence of familiarity with the test drinking fountain ought to be taken into account and further validation and on-farm application tests are warranted. To assess serious dehydration, for example in severely sick animals, physiological measures such as plasma osmolality or plasma sodium concentrations can be used.

Chicken at a drinking fountain

8.7 Links between the detoxification system EROD and environmental and physiological parameters

Risk assessments of biological effects of contaminants in the marine environment through biomarkers and the development of assessment criteria are often compromised by complex interactions in the field. E.g. The biomarker ethoxyresorufin O-deethylase or EROD, represents the catalytic activity of the Cytochrome P450 1A1-detoxification system. This biomarker is recommended, although not readily interpretable. In order to develop a more precise assessment of impact, ILVO Animal Sciences - Fisheries set up a new approach based the seasonal patterns of environmental and physiological parameters and the relationships to climate changes. The study is being performed in dab (*Limanda limanda*) liver tissue from the Belgian continental shelf (BCS) and the determinants covered are the fat contents and persistent organic pollutants (POPs) concentrations in this tissue (6 dioxins (PPCDs), 7 dibenzofurans (PCDFs), polyaromatic hydrocarbons (PAHs) and biphenyls (PCBs), including the planars, mono-orthos and 10 of the 'traditionally measured PCBs,' and EROD activities. The most important abiotic parameter was the bottom water temperature. All measured POPs have similar hydrophobic and persistency properties, accumulate in fatty tissue and most of them are well known inducers of EROD.

The outcome of this approach is remarkable in that all parameters, liver fat contents and POPs show identical seasonal patterns that are fully in accordance to the changing bottom water temperature. The latter seems to have a profound impact on the liver fat content but seemingly also on its POPs, with highest differences of approx. 2.5-fold between the lowest measured levels in

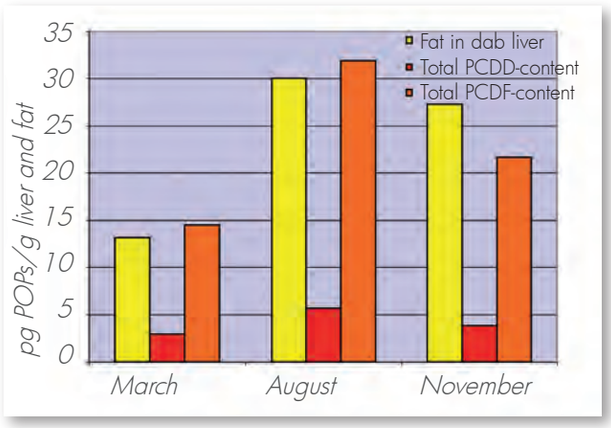


Figure 3: Fat, PCDD and PCDF-content in dab liver from BCS

March and the highest levels in August/September (figure 3). It is known that fat reserves are used on a yearly basis to maintain the organism's metabolism during the coldest period of the year. It was not known that, in the cascade of subsequent effects, the liver contaminant levels behave similarly. More than half of the highest liver contaminant burdens, attained in August/September, are being released and redistributed in the winter months and accumulated again during the following warmer period. In terms of contaminant monitoring perspectives, August/September may be advised as the ideal sampling period, based on the highest POP levels, but this is disputable. EROD, for example, is in that period close to background values on the Belgian continental shelf, indicating that the CYP-receptor was not exposed during the influx and accumulation of potential inducers. It can be concluded that these chemicals have not been able to reach the receptors, despite their high affinity. On the other hand, very high EROD-levels are measured recurrently in early spring; just in the period when major quantities of these contaminants are being mobilised as fat reserves get metabolised. The question whether these contaminant releases are involved in the induction process cannot be answered simply. The main reason for doubt is that EROD-background levels are unknown in early spring and cannot be scientifically determined because of the lack of suitable (uncontaminated) reference sites. However, two arguments supporting 'early spring'-inductions by potential inducers are the release of the POPs during fat metabolism in the vicinity of the hepatic receptors and, secondly, the research showing that maturation results in an inhibitory effect in both sexes, with highest EROD-activities being found in juveniles.

The assumption that these POPs are more or less immobilised in the fat is correct in static situations, but the climate process and subsequent fat changes cause the release and redistribution of contaminants that may become available for exposure. Interesting is that these fluxes can be quantified as active doses of exposure and thus distinguished from the bulk of contaminants. The fluxes also identify the most vulnerable impact period of the year. With more data on a more frequent sampling basis, the mechanistic role of contaminants might be modelled kinetically, resulting in a better understanding and interpretation of the action of POPs. This could form the basis for a better interpretation of biological effects of contaminants in the most vulnerable periods of the year. In terms of toxicological equivalents (TEQ), these POPs can be ranked as follows: planar PCBs, dibenzofurans, dioxins and mono-ortho PCBs (figure 4).

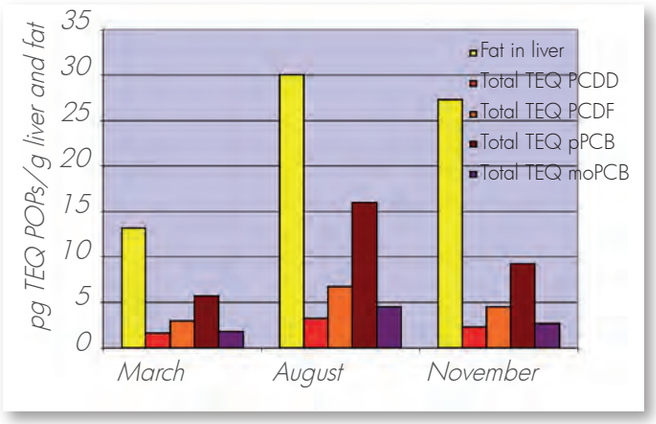


Figure 4: TEQ-values of PCDD, PCDF, pPCB and moPCB in dab liver from BCS

Dab Limanda limanda *L.*

8.8 Development of a species-selective electro trawl for the brown shrimp fishery to reduce discards and bottom contact

Brown shrimp (*Crangon crangon*) fishery is a widespread human activity in the coastal zones of the North Sea. The popularity of brown shrimp as a delicacy gives this fishery and its related food-processing industry great commercial importance. The fishery itself is carried out by an international fishing fleet of approximately 600 vessels, operating mainly off the coasts of Denmark, Germany, the Netherlands, Belgium and southeast England. Total landings can mount to approximately 35,000 tons a year. The discarding practices associated with the brown shrimp fishery have been a problem for many years. The poor selectivity of the small-meshed nets produces very high amounts of unwanted by-catch. The fact that the fishery itself is carried out in vulnerable areas like coastal zones and estuaries, often important nurseries for a wide range of marine species, intensifies this problem. Especially the by-catch of very young flatfish species, like sole and plaice, has a significant influence on the commercial fish stocks. An additional problem facing the fishery is the bottom contact caused by the heavy bobbin rope used to startle the shrimp (figure 5).

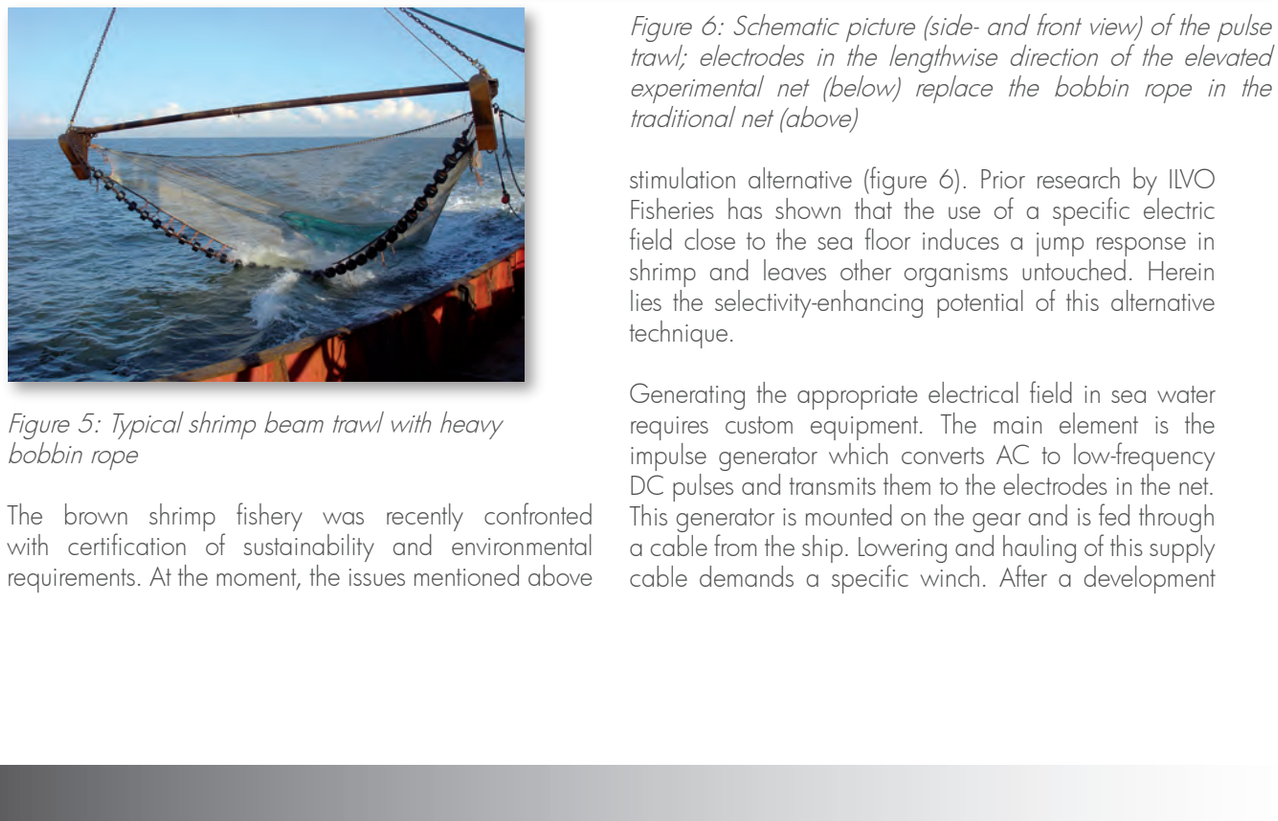


Figure 6: Schematic picture (side- and front view) of the pulse trawl; electrodes in the lengthwise direction of the elevated experimental net (below) replace the bobbin rope in the traditional net (above)

Figure 5: Typical shrimp beam trawl with heavy bobbin rope

The brown shrimp fishery was recently confronted with certification of sustainability and environmental requirements. At the moment, the issues mentioned above make it impossible to request an ecological label. A label, however, could improve the competitive position and the image of this important fishery. This could preserve the existence of several companies. Thus the implementation of adequate selectivity-enhancing and bottom-impact-reducing measures could result in both ecological and commercial improvements.

A national project was set up to investigate the potential of electric pulses as a means to develop a species-selective electro-shrimp trawl. 'Pulskor' is a multi-disciplinary collaboration between ILVO Fisheries, the Flemish Fisheries Association, Ghent University and Marelec NV with the goal of developing and evaluating a new type of shrimp trawl. This new fishing gear aims at stricter selectivity and reduced seabed contact. The fundamental idea is to replace the heavy bobbin rope with electrodes, in order to use electrical pulsation as a stimulation alternative (figure 6). Prior research by ILVO Fisheries has shown that the use of a specific electric field close to the sea floor induces a jump response in shrimp and leaves other organisms untouched. Herein lies the selectivity-enhancing potential of this alternative technique.

Generating the appropriate electrical field in sea water requires custom equipment. The main element is the impulse generator which converts AC to low-frequency DC pulses and transmits them to the electrodes in the net. This generator is mounted on the gear and is fed through a cable from the ship. Lowering and hauling of this supply cable demands a specific winch. After a development

Figure 7: Installed equipment on board of the testing vessel. From left to right: electrical cable winch; pulse trawl with mounted impulse generator; control box

phase, which took about one year, the equipment was installed on a shrimp trawler, on which extensive testing takes place (figure 7).

Preservation of the commercial catch and the reduction of discards and seabed contact are the decisive criteria in the evaluation of the pulse beam trawl. Extensive testing by direct comparison with a standard catch shrimp trawl revealed that at least as many shrimp can be caught. Furthermore, the catch efficiency seems less influenced by the time of day. This contrasts with the traditional shrimp trawl where catch efficiency increases with lower light intensity and higher turbidity of the seawater. At the same time, it is important to state that the experimental trawl reduces bottom contact with 80% in comparison to the standard brown shrimp trawl. This is not surprising since the use of a bobbin rope is no longer needed. The sea trials show that by-catch can be substantially reduced. An average reduction of 35% is a major step toward solving the discard problem (figure 8). In the near future ILVO Fisheries will continue to examine how to further reduce unwanted by-catch.

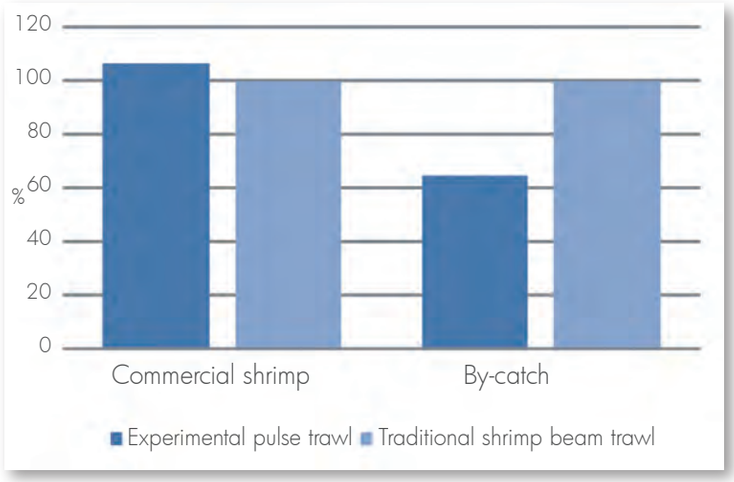


Figure 8: Catch comparison of pulse trawl with traditional shrimp beam trawl showing commercial shrimp and by-catch

8.9 MOTIFS implementation on Flemish dairy farms

The importance of sustainable agriculture can no longer be disputed, as illustrated by the recent reforms of the European Common Agricultural Policy (CAP). While the early CAP focused on encouraging better agricultural productivity so that consumers had a stable supply of affordable food, it now emphasises sustainable farming. The vast majority of aid to farmers is now paid independently of how much they produce. Farmers still receive direct income payments to maintain income stability, but the link to production has been loosened. In addition, farmers have to respect environmental, food safety, phytosanitary and animal welfare standards. Farmers who fail to do this face reductions in their subsidies (a condition known as 'cross-compliance'). Farmers are faced with increasing economic pressure and competition and are simultaneously expected to make great efforts to meet society's ecological and social wishes. Farmers are now required to manage their business with an eye for integrated sustainability, but this is still very difficult to put into practice. Questions such as 'What measures can farmers adopt to increase their farms' sustainability?' or 'When is a farm sustainable?' remain. There is an explicit need to make sustainability comprehensible and applicable in practice.

MOTIFS, the Monitoring Tool for Integrated Farm Sustainability, was designed to help farmers gain insight into the sustainability of their production. This instrument considers economic, ecological and social aspects. It was first developed for Flemish dairy farms. The first level of MOTIFS gives an overview of the farm's integrated sustainability (figure 9). Equal importance is attached to each of the three dimensions of sustainability (economic, ecological and social). Each dimension has three main themes that are weighted evenly (all segments have an equal width). Entrepreneurship is considered as a separate main theme because of its importance for each sustainability dimension. It is possible to zoom in on each of the three sustainability dimensions in MOTIFS by means of economic, ecological and social sub-diagrams (level 2). Further focusing can then occur by diagrams representing the individual indicator scores for a specific theme (level 3). These indicators make the themes tangible and allow measuring, monitoring and steering of farm gate sustainability. Through benchmarking the indicator values from 0 (not sustainable) to 100 (sustainable), the different components of a farm can be assessed, or the farm as a whole can be evaluated at a single glance.

As with many other theoretical tools that are designed for practical use, it is necessary to test MOTIFS in actual practice in order to optimise the tool. MOTIFS has now been applied on 40 Flemish dairy farms. In the Leader+ project 'Strong with Milk' (2006-2008) 20 Flemish dairy farms from 'Meetjesland' and 'Brugse Ommeland' participated. The project leader visited each farm every three months, collected on-farm data, calculated the indicators, and discussed the results with each farmer individually. Additionally, she organised farmer's discussion groups for different themes, in which the farmers could compare their results with each other and with the project leader and an invited expert.

In another ongoing application, MOTIFS is being used by two groups of dairy farmers that are members of two different farm consultancy agencies (Boerenbond and LIBA). Both groups consist of approximately 10 farmers, who meet on a regular basis to discuss their farm's accounts under the guidance of a farm consultant. In close cooperation with the groups' farm consultants, we have linked the data already available in the farm accounts (economic and environmental farm figures) to a basic system for automatic calculation of MOTIFS. The first farmer's meeting elaborates the principles of MOTIFS, while following meetings discuss a specific theme.

The experiences of the 40 dairy farmers are used to validate MOTIFS and improve the tool. The end-use value of MOTIFS as a communication and decision tool, and the willingness of potential end-users to use the tool in practice, are investigated by means of interviews and surveys with the participating farmers and farm consultants.

A few results are:

• In view of the stricter European and Flemish legislation and the increasing price of raw materials, there is growing attention for increasing sustainability in agriculture. There is a basis for sustainability among the interviewed farmers and farm consultants. They find it important to strive for more sustainable management.

• MOTIFS is considered a useful tool, which has a surplus value compared to other types of farm advice and accountancy, where the focus lies on economical aspects. By using MOTIFS, farmers can picture their farm's overall sustainability, as well as its strengths and weaknesses.

• Although the user-friendliness of the indicators was explicitly taken into account while developing MOTIFS, it still takes quite some work for the farmers and farm consultants to become familiar with MOTIFS and start working with the tool. Consequently, it is necessary to offer the end-users sufficient support for efficient and sustainable use of MOTIFS. This indicates the need for continuous exchange between ILVO and farm practice.

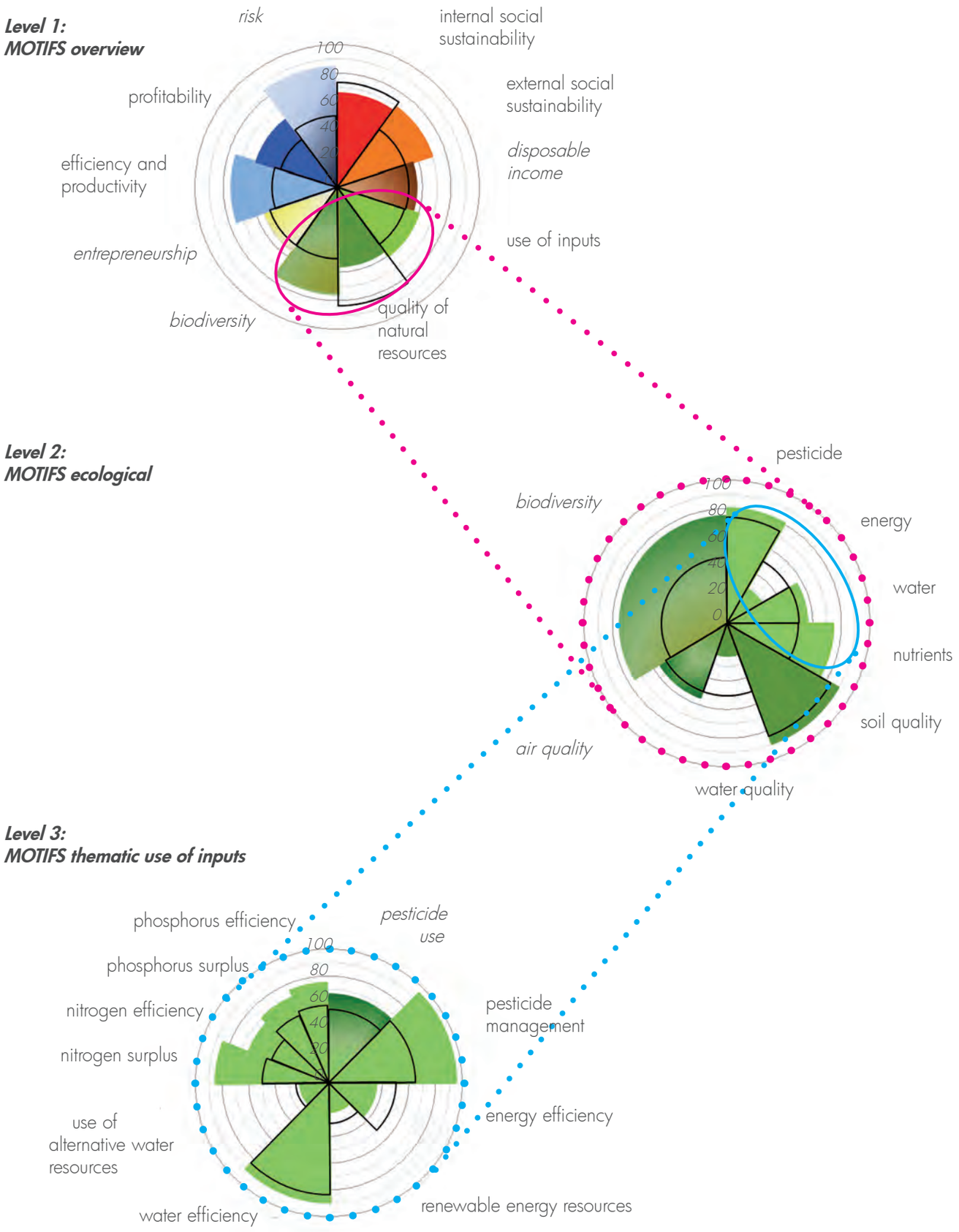


Figure 9: The first level of MOTIFS gives an overview of the integrated sustainability of the farm. On level 2 we zoom in on the three dimensions of sustainability. The indicator scores of level 3 make the sustainability themes concrete.

• The use of MOTIFS should always be coupled with advice to the farmer, in consultation with the farm consultant or in a farmer's meeting. Additional information and raw farm data needs to be looked at in order to give advice and adopt specific measures.

• The farmers expressed the view that MOTIFS is ideally used in meetings with their farm consultant. By participating in meetings where farmers could compare their results with colleagues, exchange knowledge and expertise on sustainability, and discuss technical aspects of their management, most participants learned useful measures to increase their farms' sustainability.

• In order to use MOTIFS efficiently and effectively in the farmer groups of farm consultancy agencies, the data collection and indicator calculation need to be automatised as much as possible, using existing accountancy data. In this way, farmers and farm consultants will need to invest a minimum of extra time.

ILVO's Social Sciences Unit will continue the research on MOTIFS. Currently, MOTIFS is mainly developed for dairy farms. Our unit develops new themes (the themes that are not yet worked out are given in italics in figure 9). The tool is being improved and will be adapted for implementation in other sectors. The application of MOTIFS by farm consultancy agencies is being continuously monitored. Since September 2008, the Division for Agricultural Policy Analysis (AM&S) of the Department of Agriculture and Fisheries has joined ILVO to cooperatively calculate and apply MOTIFS and organise meetings with farmers in their Farm Accountancy Data Network. An Interreg IVb project proposal will be submitted, in which MOTIFS will be used on dairy farms to evaluate abatement measures for energy use and nitrogen and phosphorus emissions in water and air, while simultaneously maintaining the farm's cost-effectiveness. These projects allow us to further validate the use of MOTIFS and refine our advice concerning the calculation and use of MOTIFS.

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Use of MOTIFS in a dairy farmer's discussion group

8.10 Public attitude towards the development of greenhouse clusters in Flanders

In recent years the agricultural sector has been confronted with several structural changes, including an increase in scale. In other strong horticultural countries such as the Netherlands and Spain, new commercial greenhouses are almost exclusively larger than 3 ha and may stretch over 30 ha in a single development (Badgery-Parker, 2001). If the Flemish horticulture sector wants to maintain or even strengthen its position in (inter)national markets, an increase in scale and a modernisation of the existing greenhouses is indispensable. The Flemish government in 2003 developed an 'Action Plan for the Horticultural Sector' (MVG, 2003) to tackle this problem. Part of this plan is dedicated to the problems the sector faces with spatial planning. Three tracks have been proposed to stimulate the renewal of greenhouses: guidelines for all Flemish municipalities on how to handle requests for development of new greenhouses, the development of macrozones, and the development of greenhouse clusters.

One track which receives a great deal of attention is the development of so-called greenhouse clusters, in which several large greenhouse companies are grouped. The idea is to create added value by cooperation in the fields of water, energy, transport, purchase and sales, park management, etc. Another idea is to site the clusters in order to use leftover warmth or CO_2 from nearby industry.

Despite the enthusiasm of many for the development of clusters, there also appears to be a lot of protest against their development (see photo).

Visual pollution and the loss of open is space are often cited as the main reasons for protest. When performing a previous research on the integration of large-scale clusters into the landscape, we had the impression that there is much more to this protest than the visual aspect alone. The main objective of this research is to discover the underlying reasons and motives for this protest. To this end, qualitative research approach based on 'Grounded Theory' seemed most appropriate.

In this method, a researcher does not start with a preconceived theory in mind. The objective is to fully understand a certain research situation based on data that is gathered and analysed. The data for this research was gathered based on 24 in-depth interviews. With each of the respondents, an open interview of about one and a half or two hours was performed. According to the theory one can stop gathering new data when the data collection stops yielding new insights into the research topic. The interviews were digitally recorded and transcribed. Subsequently, the data was coded and analysed. Each time a respondent mentioned an argument for or against the development of a greenhouse cluster, this argument was coded. Whenever two or more respondents mentioned the same argument the code became a concept. This stage of data analysis is referred to as open coding. The concepts were then grouped into categories, and links and relationships between these categories were sought. This part of coding is called axial coding. Finally, we tried to bring all concepts and categories together in a theoretical scheme that provides us with insight into the public acceptance of greenhouse clusters. As a result of this research we ended up with 65 concepts why people are for or against the development of greenhouse clusters. These 65 concepts were grouped into 12 categories that were eventually brought together into one theoretical scheme (figure 10).

Signpost with slogans against the development of large-scale greenhouses."'Open space is scarce because of project developers. Enjoy this sight while you still can, because everything will soon be built up"

Based on this schema, it is clear that the protest against the development of greenhouse clusters cannot be explained by one single concept. A multitude of different concepts are at the basis of the concerns people have about this development. One part of these factors is related to the value pattern of our society. For example, many of people have difficulties with the fact that clusters deviate from the traditional Flemish family-owned horticultural company. Another group of factors involve everything that has to do with the possible nuisance people might experience have when a cluster is developed in their neighbourhood. These concepts can all be related to

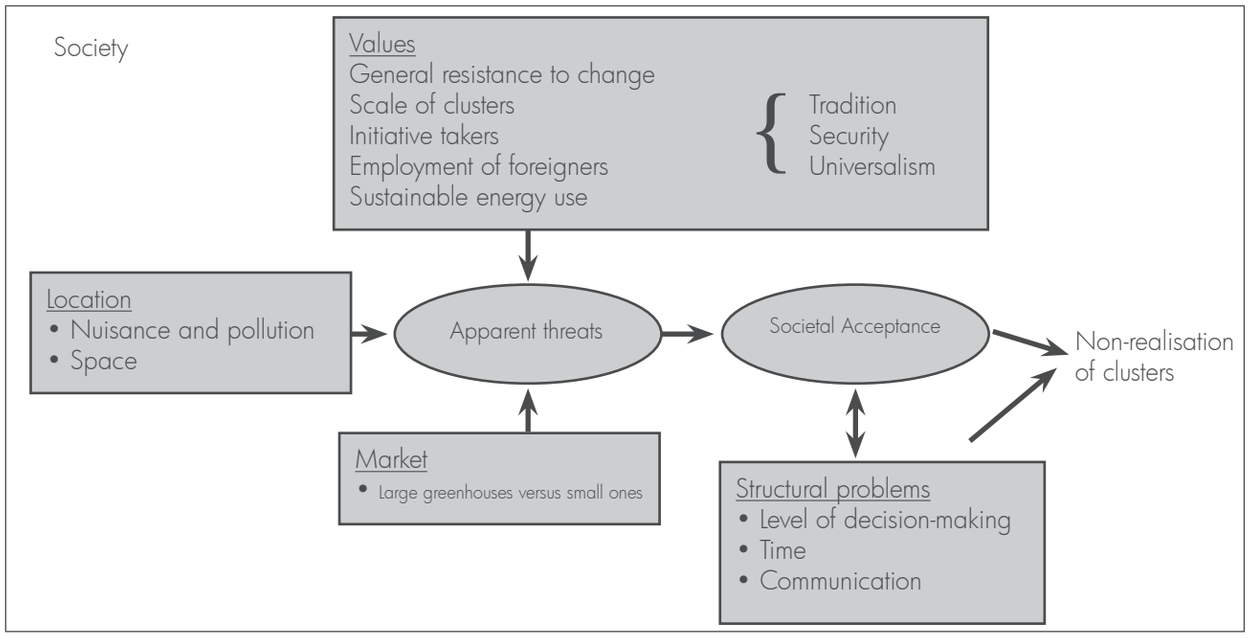


Figure 10: Theoretical scheme explaining the relationships between all factors that influence the public attitude towards greenhouse clusters

the NIMBY-syndrome (Not In My Back Yard). Further concepts have to do with the market. There especially seem to be some tensions between small and large horticultural companies. The smaller companies fear that competition from the clusters will be too harsh and they will be driven out of the market. Finally, there are some structural difficulties in permit-granting that hamper the construction of greenhouse clusters.

The theoretical scheme provides us with insight in the underlying motives for protest against the development of greenhouse clusters. This scheme shows us that we are dealing with a complex problem with various causes. If policymakers want to increase the public acceptance of greenhouse clusters, they will have to take measures in each of these areas.

8.11 New functional uses in rural areas: the impact of functional changes

At the end of 2003, the Flemish government enacted a decree that regulates functional changes of agricultural buildings located in agricultural areas. In this way, non-functional agricultural buildings may be put to use and new functional uses (farm tourism, residential buildings, etc.) can arise in rural areas. New functional uses can also have negative consequences, such as damage to the quality of the landscape and rural areas. Consequently, it is important to assess the impact of these new uses on rural areas.

The goal of this project is to create a problem analysis concerning the integration of non-agricultural (new) functions into rural areas, with special attention to changes in the functional use of existing buildings. We examine the qualitative impact - positive and negative - of these changes on the agricultural sector and the rural area, together with the possibilities, problems and

consequences for the current legislation. Some suggestions are then derived from the analysis in order to rectify current problems or avoid them in future, and to minimise the negative impact or strengthen the positive impact. The most important question is how the rural area can be organised in a qualitative way and how legislation can best anticipate these changes. Sustainable economic development, with an eye toward landscape quality, ecological and social aspects, plays an important role in answering this question.

Research on the impact of functional changes is faced with a lack of centralised data on these issues. This research aims to compensate for this lack by providing a qualitative analysis on the basis of in-depth interviews with privileged key people. The research technique used is "grounded theory" (Glaser and Straus, 1967), in which we try to deduct a theoretical framework based on data gathered in the in-depth interviews. As many key persons as possible were interviewed using unstructured and open questions. In this way, respondents could freely express

their attitudes and opinions. In order to create as complete a picture as possible, the "functional changes" subject was approached from different angles (researchers, license advisors, urban development personnel, and people from other sectors) with a vertical spread (on the regional, provincial and municipal level) and a horizontal spread (geographical distribution in Flanders). This strategy led to two groups of results, namely a number of hypotheses and some suggestions on how to solve the problems, or at least anticipate them.

The most important results are summarised in figure 11 and table 4. Beside the inherent impact on the buildings, functional changes also have indirect effects on agriculture itself. New functional use affects the arable land market and the activities of adjacent farms. New occupants of the agricultural area are willing to pay more for land, causing an increase of arable land prices. When an agricultural firm stops functioning, its production factors thus become less easily available to the surrounding agricultural firms. These changes in function also influence different aspects of social life (hypothesis 8), economic aspects (hypothesis 6), ecological aspects (hypothesis 4) and the geographical characteristics of the rural area (hypothesis 3).

Once the problems are diagnosed, suggestions to solve them are then formulated. These suggestions should not be interpreted separately. The first suggestion is to leave the one-sided approach of urban development and start a multidisciplinary approach. In this way, the different sectors learn about each other's needs and capabilities, which can prevent conflicts. Furthermore, it is not only important which functions are permitted, but also where, why, and in what way. One possibility to do this is the development of an area-specific vision at the local or regional level, in which the desired characteristics of the area are presented. In this way, the possibilities and restrictions are not the same for all Flemish rural areas, and the accent is put not only on the functions involved, but also on the planning and management of the area.

A third suggestion is to couple qualitative requirements to licenses (for example, restricting the choice of materials). In order to create a solid and credible license system, improved or extended enforcement is needed, instead of the current policy of tolerance. To do so, there is a need to bring in specialists at the level between the municipality and the region. These inspectors thus have a stronger and more objective position, which excludes favouritism, while still maintaining a connection with the area and knowing the history of firms and their surroundings.

In contrast with earlier research (West-Vlaamse Intercommunale, 2006), this research covers the entire Flemish area. This qualitative research for Flanders and the more regional quantitative research can complement each other. The results of this research can initiate more profound research, for example, goal-oriented quantitative research. In this way, our hypotheses from the qualitative analysis can be quantified, in order to get a more complete view of these issues. This would contribute to the development of an area-specific vision and support policymaking.

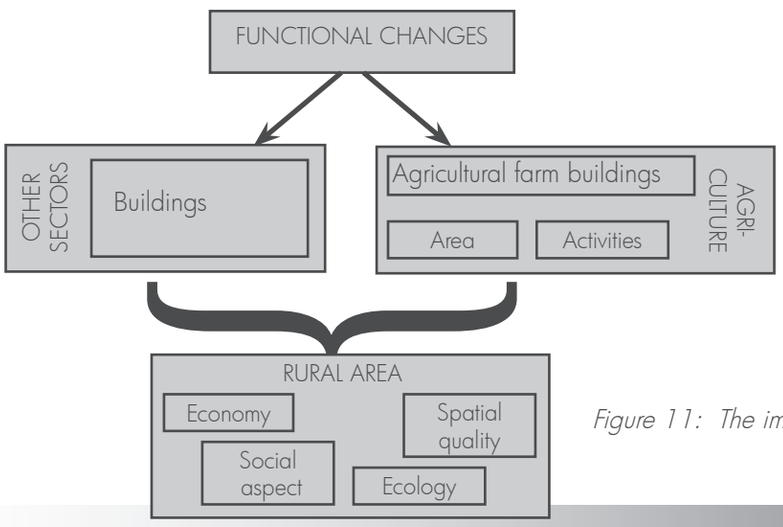


Figure 11: The impact of functional changes

Table 4: Hypotheses with quotes or examples, generated from the qualitative problem analysis of the integration of non-agricultural (new) functions integration in the rural area

Hypotheses	"Quotes"/Examples
1. Functional changes offer opportunities for new functional use of the rural area and maintain the value of the agricultural patrimony.	The possibility of giving agricultural buildings a new function can prevent lack of occupancy and dilapidation.
2. Functional changes do not affect only the buildings.	New inhabitants of the rural area sometimes have little or no affinity with agriculture, causing minimal tolerance of agricultural life.
3. Functional changes have both positive and negative impacts on the area's characteristics.	Positive: better maintenance of the premises when run as a guesthouse. Negative: pasture fencing, advertising boards.
4. Functional changes contribute to the proliferation of gardens and/or horse pastures and stables.	On the one hand these functions take up arable land; on the other hand they are perceived to detract from the landscape (exotic plant species, shelters and stables for animals, and showy fences).
5. Not the number of functional changes pose a problem; it's the geographical arbitrariness of their implantation.	"Because of the autonomy municipalities receive, the pressure on their urban development officials has increased."
6. "Evolution" of a licensed activity is often problematic.	"A farmer's son, as a hobby, starts repairing machinery in his father's shed; This activity expands gradually. Who is going to tell him to move to another district?"
7. The number of functional changes licensed is small.	"Some municipalities advise potential applicants against filing a request for a functional change; instead, they recommend carrying on as long as no complaints arise."
8. Functional changes create tension between different functions or sectors.	"Farms are often bought up by non-farmers with a bigger budget."
9. Some functions that are not allowed thus far are still desirable on the local level.	Many municipalities would like to authorise several families to live in one farm, because farm buildings becoming vacant are often too big for only one family.
10. Spatial planning on the municipal level can be a solution but also creates deficiencies.	In time new facts may arise which cannot have been foreseen during the planning process.
11. The legislation on functional changes is being abused.	"When authorising a new function, one should take care not to haul a Trojan horse into a rural area."

8.12 Exploitation of unreduced gametes for the creation of genetic variation

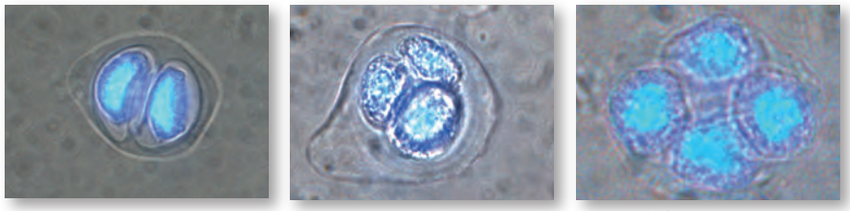
Gametes (egg cells or pollen) with somatic chromosome numbers, better known as unreduced or 2n gametes, originate from meiotic aberrations where one of the two meiotic divisions is inhibited or omitted. The heterozygosity within a 2n pollen depends on the cytological mechanism behind 2n pollen formation. These mechanisms are currently subdivided in first division restitution (FDR), second division restitution (SDR), indeterminate meiotic restitution (IMR) or post-meiotic restitution (PMR). With the exception of cross-over segments, FDR pollen retains all homologous parental chromosomes and inherits maximal heterozygosity of the parent plant. Because SDR gametes finally contain random combinations of sister chromatids as in normal gametes, the heterozygosity within one pollen is lower compared to FDR. IMR and SDR are less frequently reported.

Unreduced gametes are considered to be the driving force for polyploidisation of plants in nature. In plant breeding, the use of unreduced gametes offers an important alternative for the traditional mitotic chromosome duplication. Furthermore, they might result in a higher genetic variability and in the case of interspecific hybridisation, they might result in direct introgression of genes of two parents in an F2 generation.

The main aim of this research was to add to knowledge about the formation and practical use of 2n gametes in plant breeding. The genus *Begonia* contains more than 1400 species with very different phenotypic characteristics and chromosome numbers. Moreover, *Begonia* has a relatively short reproduction time and can flower throughout the year. Therefore, *Begonia* was used as a model crop to investigate the possible role of unreduced gametes in the creation of genetic variation in ornamental plant breeding. The research focused mainly on pollen, since this is easier to isolate and study than egg cells.

In a first step, a flow cytometric detection technique was developed which quickly detects and quantifies the presence of viable unreduced pollen. From a collection of 76 *Begonia* genotypes, 11 produced unreduced pollen, which shows that the occurrence of unreduced pollen is not a rare phenomenon. The presence of unreduced pollen was correlated with an increase in pollen size compared to normal pollen and the formation of mostly dyads during meiosis.

Cytological analysis of the meiosis showed that omission of the first meiotic division resulted mainly in the formation of FDR pollen, while the second meiotic division was usually normal. Moreover, chromosome pairing between homologous chromosomes was relatively normal in most investigated 2n pollen producers. This proves indirectly that the formation of unreduced pollen could be linked to a mutation in a gene active during meiosis. Some of the 2n pollen producers were used as a father plant in a crossing scheme. A large number of the obtained progeny were raised in ploidy level, as expected, and several of the seedlings also produced unreduced gametes. Remarkably, all seedlings with a raised ploidy level formed unreduced gametes, while this was not true of seedlings not raised in ploidy level.



Microspore genesis in Begonia*: diad, triad and tetrad forming*

In a second part of the research, the possibility to stimulate or induce unreduced gametes was investigated. Different strategies were used: temperature stress, creation of interspecific hybrids and mitosis - or cytokinese inhibitors during meiosis and N_2O fumigation of flowers. The application of temperature stress (an increase or decrease in normal growth temperature with 5°C intervals) was ambiguous: in some cases a raise in frequency of 2n pollen formation was observed, while in other cases no remarkable change in frequency was observed. Interspecific hybrids were performed between 20 different species with strongly different chromosome numbers and size, resulting in about 160 combinations. With the exception of one combination, no unreduced pollen was observed in the different combinations. One combination formed unreduced egg cells, but was male sterile. By the use of both mitotic inhibitors and N_2O fumigation, induction of unreduced pollen was possible. The use of N_2O fumigation is certainly promising: by the use of this technique, male-sterile genotypes were turned fertile again and the resulting seedlings were all raised in ploidy level.

Some of these results have already been applied with other plant species. Through use of the described techniques, the presence of unreduced pollen and/or egg cells was proven, among others, in genotypes of azalea and interspecific hybrids of *Hibiscus*.

8.13 New cultivars for sustainable agri- and horticulture

New cultivars are the starting material for sustainable agri- and horticulture. They reduce the application of crop protection agents or fertiliser, either due to better disease- and pest resistance or a more efficient use of nutrients. Their higher profitable yield, better product quality, or innovative character lead to an added value for the grower and the consumer. The cultivars bred by ILVO also capitalise on our knowledge and research.

New cultivars of agricultural crops are only marketable after registration on a national list. In order to be registered, they have to be sufficiently distinct, uniform and stable (DUS) and have a sufficient value of cultivation and use (VCU). Vegetables need only to be DUS, while ornamentals need to be DUS in order to obtain plant breeders' rights. The new cultivars prove their market value by their presence on recommended variety lists, results in practical centers, or prizes at international contests.

Currently, ILVO breeds fodder grasses (perennial ryegrass, Italian ryegrass, timothy and meadow fescue), turf grasses (perennial ryegrass and red fescue), clover (white and red), industrial chicory, green manure crops (fodder radish and white mustard), vegetables (leek, celery, parsley and scorzonera) and vegetatively multiplied ornamental crops: azalea, rose, and ornamental shrubs and trees. Some novelties introduced during the last year illustrate how research has resulted in new products for the Flemish farmer and nursery owner.

Based on research on nitrogen use efficiency in grasses, we developed the intermediate-diploid perennial ryegrass cultivar 'Meloni'. This variety yields relatively more dry matter at a reduced nitrogen application rate. In the group of the late perennial ryegrass varieties, the diploid 'Melways' and the tetraploid 'Melpetra' are high yielding, and the diploid 'Melpro' is very persistent. In Italian ryegrass, tetraploid varieties are preferred due to their rapid ground cover and their high yield. 'Meltop' and 'Elvis' illustrate these features. Further, these cultivars have a very good crown-rust resistance. From the breeding program of white clover in association with perennial ryegrass under grazing, 'Melifer' was born. This rather small-leafed variety is sufficiently productive and has a good persistence and competitive ability.

Use of rust catch rows for selection of crown-rust-resistant ryegrasses

Healthy Italian ryegrass 'Meltop'

Bolting-resistant next to bolting-sensitive chicory varieties

Hibiscus syriacus *AZURRI®*

The breeding program of industrial chicory focuses on the improvement of the bolting resistance and quality. Bolting resistant varieties allow for early sowing, which leads to a higher root yield because of the longer vegetative period. Quality is determined by the inulin content and the inulin chain length. Long chains improve the dietary fiber characteristics of the inulin. 'Echo', 'Continuo' and 'Enigme' are very bolting resistant. 'Echo' has the highest inulin content of the existing varieties and 'Continuo' and 'Enigme' have the highest average chain length.

Varieties of fodder radish and white mustard, resistant against the beet cyst nematode, are suitable green manure crops in a crop rotation with beet. To exploit the nematode-reducing potential, these crops have to be sown in time. Late flowering is desired to prevent seed development. The fodder radish variety 'Maximus' is the first tetraploid variety that is classified in the highest resistance class on the German list. The new diploid white mustard variety 'Rumba' is in demand because of its exceptionally late flowering.

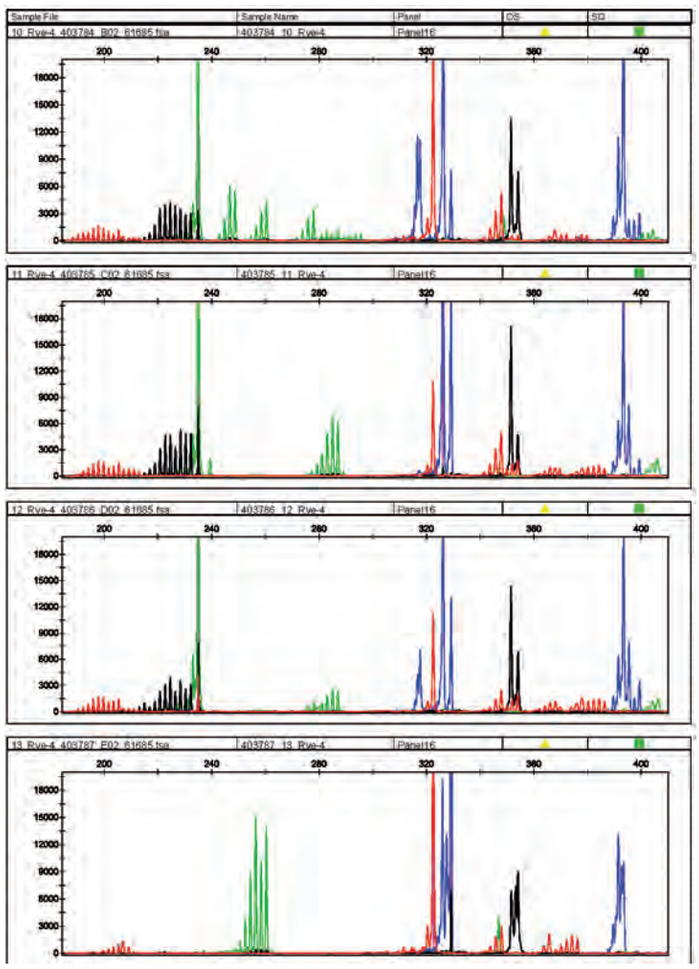
At the Floralien flower fair in Ghent, the *Hibiscus syriacus* AZURRI® ('DVP Azurri') was awarded a silver medal from the expert jury as a new introduction in the ornamental shrub assortment. It is a blue-flowering garden hibiscus, resulting from an interploid cross, without seeds. Due to this special feature, the plant grows and flowers much longer than other cultivars. This also prevents annoying seed wildshoots in the garden. The *Malus* APPOLLO® ('DVP Appollo') was acclaimed during 'Groot Groen' in the Netherlands. This ornamental crab apple attracts attention by its narrow columnar shape, beautiful rose-red flowers and fruits and exceptionally healthy leaf. Lastly, several ILVO rose selections (e.g. 'Xantippe', 'Rivierenhof', 'Cera' and 'Jacky's Favorite') obtained very good scores for disease resistance during variety tests carried out by the 'Proefcentrum voor de Sierteelt' in Destelbergen.

8.14 Development of a protocol based on the use of SSR markers to be used in disputes of essential derivation in *Lolium perenne*

According to the act of the UPOV (International Union for the Protection of New Varieties of Plants) convention of 1991, essential derivation is the process of using a protected variety (or 'initial variety' – IV) as the basis to develop another similar variety (the essentially derived variety – EDV). The breeding methods that can be regarded as leading to an EDV differ between species. Essentially derived varieties may be obtained, for example, by the selection of a natural or induced mutant, or of a somaclonal variant, selection of a variant individual from plants of the initial variety, backcrossing, or transformation by genetic engineering. The practice of essential derivation has clear advantages for the breeder of the EDV, who benefits from the years of breeding work carried out by the breeder of the IV, and can create a new variety in a relatively short period of time. Therefore, an EDV cannot be exploited without consent of the breeder of the IV. Although estimations of genetic conformity derived from DNA-marker information cannot be used on their own to demonstrate an EDV relationship, they can be helpful in disputes of putative essential derivation.

Some years ago, ILVO coordinated of a study on essential derivation in perennial ryegrass launched by ASSINSEL (International Seed Federation, now ISF). In that study, the ability of AFLP markers to provide a reliable and meaningful estimate of genetic conformity of different diploid perennial ryegrass varieties and breeding populations was investigated. For the set of test accessions analysed, the AFLP protocol accurately reproduced the same relationships as were evident from examining their morphology and both these results were consistent with the genetic relationships known to exist within the different test groups. It was concluded that the methodology developed could be used as a model to create a protocol for putative cases of essential derivation.

However, the intrinsic properties of AFLP markers make them less suitable to automation and to transfer among laboratories than, for example, microsatellite markers (SSR). Therefore, ISF recently launched a second study, also coordinated by ILVO, with the main purpose being evaluation of the usefulness of SSR markers to estimate the genetic conformity in perennial ryegrass. Ryegrass varieties are commercialised as genetically heterogeneous synthetic populations, wich makes the analysis of a representative number of individuals of each variety with SSR-markers time-consuming and expensive. We investigated whether the analysis of bulked samples provides appropriate resolution to accurately estimate genetic conformity between varieties. DNA from several individuals from the same variety was bulked and analysed as a single sample. Furthermore, multiplex-SSR tests were developed in collaboration with Prof. dr. Jurgen Del Favero (VIB Genetic Service Facility) that allow screening of several SSR loci in a single PCR reaction. A total of 57 varieties was analysed according to this methodology, with very promising results. This study was finalised in October 2008 and a report summarising the main results was prepared. This report is currently being examined by a working group of ISF (International Seed Federation) in order to assess the accuracy and usefulness of these results for development of a protocol to be used in disputes of putative essential derivation.

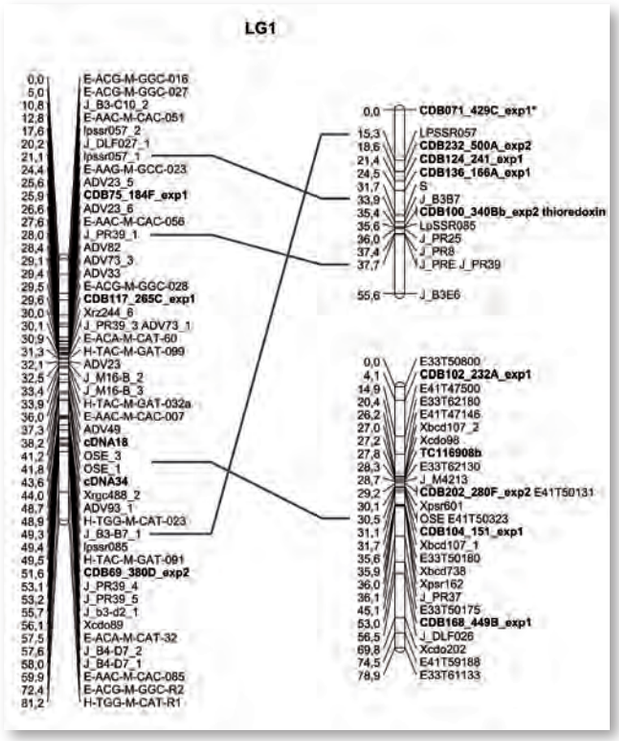


Multiplex-SSR fingerprint in perennial ryegrass

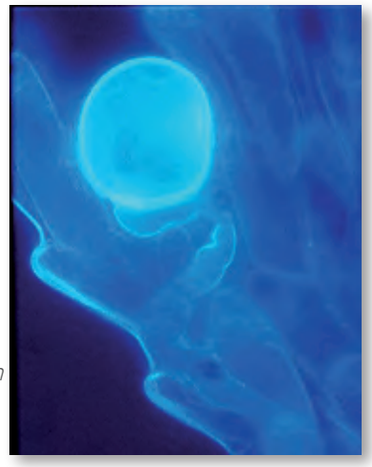
8.15 Functional markers for agronomically important traits in perennial ryegrass (*Lolium perenne*)

The last two decades have seen great progress in molecular markers suitable for mapping the plant genome and identifying genes and QTLs (genome regions linked with quantitative traits). Several linkage maps now exist for ryegrasses, but they are mainly based on anonymous, non- functional markers such as AFLP and SSRs.

Rust on ryegrasses



Linkage Group 1 of Lolium *with the thioredoxin maker linked to the S-locus*



Germinating pollen in perennial ryegrass

A candidate-gene approach, in which a correlation between an important trait and a marker derived from an expressed gene is made, identifies possible markers suited for marker-assisted selection. As the molecular markers reside in expressed genes, the linkage between the marker and gene cannot be undone by recombination. During recent years at ILVO, a candidate gene approach has been followed within different ryegrass research projects. Markers were developed in genes with a potential effect on self-incompatibility disease resistance and quality traits (e.g. digestibility and water-soluble carbohydrates). These markers were then mapped on mapping populations and their genomic position was compared to regions containing useful QTLs.

About 500 ESTs were used to design primer pairs in order to obtain length polymorphisms suitable for mapping in mapping populations. In the end, 67 markers were mapped. Some of the markers mapped in, or in the neighbourhood of, QTLs involved in self-incompatibility, disease resistance or quality characteristics.

For example, the marker developed in the thioredoxin-gene maps on LG1 in the neighbourhood of the S-gene, one of the most important self-incompatibility loci. This thioredoxin marker is interesting to study further, as thioredoxines play an important role in self-incompatibility in different plant species. The marker developed in the ubiquitine-gene maps on LG2 in the neighbourhood of the *Z*-gene, are also involved in the self-incompatibility. Two markers, respectively derived from genes coding for a glucanase and a chitinase gene, map on linkage group 1 in the neighbourhood of a QTL known to be involved in crown-rust resistance. Chitanases and glucanases are enzymes which can degrade the cell wall of fungi, which make them useful candidate genes for disease resistance.

The markers developed in these studies increase the total number of gene-derived markers in ryegrass. These gene-related markers allow a more profound comparison between different linkage maps of ryegrass. The self-incompatibility markers can be used in self-incompatibility studies in different grasses. The allelic diversity in these markers is the input for marker-assisted selection programmes in ryegrass.

8.16 Application of plant sap measurements as a diagnostic tool for assessment of nutrient availability in strawberry culture on peat and compost-amended substrates

The aim of this research was to assess whether plant sap NO_3 and K meters allow for evaluation of the nutrient status of strawberry in substrate cultures in a fast and reliable way. These measurements would then allow for adjustment of nutrient status of strawberry cultures. This is relevant especially in the case of compost-amended substrates, as compost may fix or release nutrients during culture. The technique is also potentially suitable for assessing and correcting the nutrient status of other substrates.

During the 2007-2008 growing season, Proefcentrum Hoogstraten (PCH) executed a trial with three N-fertilisation levels and two substrates (with and without compost added). Set-up and follow-up of the experiment, yield measurements, and sampling was executed by PCH. Substrate analyses, analyses of drain water and plant sap measurements were executed at ILVO.

At the time of first substrate sampling and analysis, it was clearly observed that the compost-amended peat had a strong N-immobilising character, which resulted in large differences in N availability between both substrates and between objects. Although it was initially expected that the N-immobilisation would gradually disappear during the culture due to N fertilisation, the effect of this process was still detectable at the end of the continued culture in spring. Object 4 already showed a large growth delay at the end of the autumn culture and was therefore not further sampled. Per object, 4 samples of petioles (1 for each replicate) were collected biweekly and stored at -15°C. Samples of 6 sampling periods were analysed with HORIBA plant sap meters. Samples for 3 of the 6 sampling periods were also chemically analysed. NO_3 was measured with a Dionex DX-600 ion chromatograph, and K was measured with a VISTA-PRO simultaneous ICP-OES (Varian).

For NO_3, a clear linear relationship was found between the results of the petiole sap measurements and the chemical analyses, but in the lower concentration range, the plant sap meters recorded higher values than the chemical analysis. K showed a linear relationship as well, but the plant sap meters gave lower K concentrations than the chemical analysis.

The lower NO_3 availability in the substrates amended with compost assessed during the substrate analyses is also reflected in the petiole sap measurements. The differences in plant sap concentrations for both NO_3 and K within the group of the 3 peat objects and within the group of the 3 compost-amended objects were small. Differences in aboveground plant biomass need to be taken into account. In both in the autumn culture and the continued spring culture, a decrease in K concentrations in the plant sap was observed for the compost-amended objects.

We concluded that plant sap measurements allow for fast and relatively reliable determination of K and NO_3 in strawberry plants. As the nutrient solutions were kept constant in this experiment, it was not possible to measure how fast a concentration change in the nutrient solution could be detected in the plant sap. We propose 3500 mg NO_3/l en 3500 mg K/l as minimum target concentrations in petiole sap of strawberry.

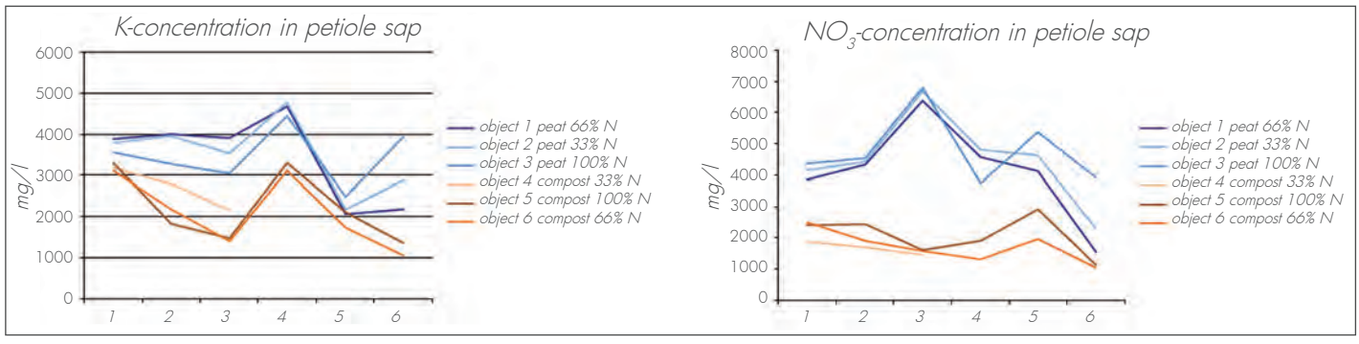


Figure 12: Evolution ot the NO_3 and K concentrations in the plant sap (measured with HORIBA meters) at 6 sampling times during strawberry culture on substrate or substrate amended with compost (1: 26/09/2007, 2: 7/11/2007, 3: 19/12/2007, 4: 20/2/2008, 5: 18/3/2008 and 6: 29/04/2008)

8.17 'Pest Risk Analysis':

Certain exotic plants, insects, mites, nematodes, bacteria, viruses and fungi have the potential to threaten the Belgian plant cultivation sector. Therefore, the Belgian government (FOD health, food chain safety and environment) has financed a project to estimate the potential of some of these threats through a 'Pest Risk Analysis' (PRA). These PRAs include a "Pest Risk Assessment" and a "Pest Risk Management" and are based on an EPPO (European and Mediterranean Plant Protection Organisation) document. Based on a questionnaire, this document gives a definite answer about the potential threat of a pest to a defined region. Detection, biology (reproduction cycle, spread, survival, and adaptability), present geographic spread, potential hosts, control measures, and possible pathways of the organism are investigated. When scientific literature provides insufficient information, data is provided through new research. The PRAs offer the government all the necessary information and instruments to assign, if necessary, quarantine status to a specific organism. They are also useful for implementation of import control programmes or programmes to limit or deteriorate the pest.

ILVO will provide PRAs of the tropical moth *Tecia solanivora*, the fungus *Fusarium foetens*, the bacterium *Xanthomonas axonopodis* pv. *dieffenbachiae* and the nematode *Meloidogyne minor*.

Tecia solanivora comes originally from Central America, where it has caused enormous damage to the local potato industry since the 1970's. International research has proven that chemical pest control of *T. solanivora* is often insufficient, and now focuses on control through natural enemies, the use of pheromone traps, and screening. If the moth were to be introduced in Belgium, the explosive development of the organism would mainly depend on the climatic circumstances and its influence on the number of life cycles during one season (optimal temperature for oviposition, fertility, mortality of the larvae, development of larvae and pupae). Because the moth was not signalled in Belgium at the start of the project, this research focuses on possible introduction of the organism. To this end, the warehouses at the harbours and some potato handling companies are monitored with pheromone traps. Moreover, the potato samples analysed in the Plant Diagnostic Centre (DCP, ILVO) are also examined for the presence of emerging holes, larvae and pupae. During this research, the moth was not detected. This confirms the hypothesis that the introduction of the moth is very small, even improbable, because potato import from the risk regions is not allowed, and because thus far there are no reports of the moth from the export regions. Moreover, potatoes imported from those southern regions are only for consumption. Those potatoes are always transported and stored at low temperatures, limiting or even excluding the development of the eggs or larvae into an adult. In the unlikely event of introduction, the chance of survival of the moth is very small, even excluded. The Belgian climate is too cold (< 10°C) and too wet during the import season for the moth to expand explosively. Therefore the threat of *T. solanivora* for the Belgian potato sector is regarded as almost non- existent.

The new *Fusarium* species, *F. foetens*, was described in 2004 as the cause of the aggressive wilt-and stem-rot disease of *Begonia x hiemalis* (*Begonia elatior* hybrids). Since 2002, this disease has been reported in the Netherlands, Germany and the USA. The control of the disease is problematic, because an existing infection is difficult to control with fungicides, only a few spores are sufficient to induce disease, and because different types of spores can spread though substrates, air and water. Moreover, early detection is difficult because external symptoms only develop in a late stage of disease development, and because the fungus is difficult to detect using traditional techniques. Until the start of this research, the control measures were based on sanitation measures and visual control of the plants.

Figure 13: Symptoms of Fusarium foetens *on* Begonia x hiemalis. *Left: early symptoms (see arrows) during an inoculation assay. Right: advanced symptoms on stem and leaves*

In this project, a molecular detection method is optimised to detect the pathogen in low concentrations *in planta* and in water samples. This technique gives insight into the developmental biology of the pathogen in *Begonia*. This technique was also used to follow pathogen streams in a Belgian *Begonia* company. In addition, the efficiency of certain decontamination techniques (slow sand filtration and chemical decontamination) was evaluated. At this time, the host spectrum of the fungus is being further clarified, and the efficiency of certain fungicides against *F. foetens* tested. All data from literature and research will be compiled in a PRA.

Xanthomonas axonopodis pv. *dieffenbachiae* (*Xad*) causes bacterial blight disease of *Araceae*. The bacterium first became of concern to the EU since it was introduced into Dutch nurseries through the use of contaminated propagation material from South America. Thereafter, the bacterium spread swiftly over several growth- and production companies of cut- and pot Anthuriums. The further spread of the bacterium in Italy and Turkey was associated with plant material from the Netherlands. According to addendum V of phytosanitary measure 2000/29, plants of the Araceae family need a plant passport before they can be used in trade. They are thus subjected to an examination which checks for EU quarantine pests. Part A, §2 of this addendum specifies that it is only applicable to plants produced in the EU or traded between professional dealers; this excludes plants sold to the consumers. Since Flemish companies perform *in vitro* propagation of the Dutch *Anthurium* companies, there is a risk that the pathogen will be introduced into Belgium. One of the largest Anthurium-growing firms in Europe is located in Flanders, and because of its specialisation, it is very vulnerable to the introduction of latent-infected material.

Xad infections occur through natural leaf openings and stomata, and persist in a latent form for a long time. This implies a large risk of unnoticed introduction and hinders visual inspection. Moreover, detection of the bacterium in the imported plant material is hindered by the large heterogeneity of the bacterial strains. Thus a molecular method to detect latent infections *in planta* has been developed during this project. This includes the optimisation of PCR protocols, such as a nested PCR to detect *Xad* strains from *Anthurium*, and a multiplex PCR to detect *Xad* from a larger host range. In addition, a procedure was developed to detect latent infections in leaf and rhizome segments of *Anthurium*.

Secondary spread of *Xad* occurs through watering, use of contaminated materials, etc., but especially through aerosols. Because of this, the developed molecular techniques were used to prove (latent) spread of the bacterium via root/drench inoculations. This research also showed that the bacterium survives well on inert materials used in the cultivation of *Anthurium*, e. g. plastic containers, root barrier fabric, and concrete tiles. The *in vitro* culturing of *Anthurium* offers the possibility of testing leaf discs of the mother plants as practical samples. In order to develop relevant pest management, the efficiency of a hydrogen peroxide decontaminant was tested on plastic containers, root-barrier fabric and concrete tiles. All data from literature and research will be compiled in a PRA.

Meloidogyne minor is a nematode that damages potatoes and causes yellow-spot disease in lawns. Although only first described in 2004, the nematode is already reported in the United Kingdom, Ireland, the Netherlands and Portugal. There are two theories regarding the spread of *M. minor*. On the one hand, it is believed that dunes are the natural habitat of this nematode. It is then spread through the use of dune sand in sports fields. On the other hand, the host spectrum not only includes several grass species, but also weeds and crops. This could imply a fast spread, or a general spread, of the nematode in grass biotopes. The latter explains the presence of the nematode in potato fields: they are often former meadows. *M. minor* has only been recently described because it shows remarkable morphological similarities

Figure 14: Bacterial burns on Anthurium andreanum *caused by* Xanthomonas axonopodis *pv.* dieffenbachiae. *Leaf infections via hydratodes and stomata; isolation of the bacterium on semi-selective growth media.*

with *M. hapla, M. fallax* and *M. chitwoodi*. Moreover, it is always found in combination with other *Meloidogyne* spp. and is often not recognised as a separate species. Therefore, a reliable diagnosis is essential, especially since the symptoms caused in potato are very similar to those caused by the quarantine organisms *M. chitwoodi* and *M. fallax*.

During this research, a survey on the presence and spread of the nematode in Belgium was conducted. It was concluded that *M. minor* is spread throughout sports fields, meadows and agricultural fields in Flanders. There is no correlation found with a specific grass spp. nor soil type. No problems in the potato sector have been reported yet, in spite of the general spread of the nematode. However, it is advisable to treat *M. minor* as a quarantine organism, in order to minimise the inoculation pressure caused by the import of seed potatoes. On the other hand, it is possible that *M. minor* is already generally spread in potato, but so far has not been recognised as a separate species. There is still too little known about the developmental and survival biology of the organism, and of the potential damage caused by this nematode, to assess the danger of further spread in the potato sector.

Within this project, we collaborate with the Faculté Universitaire des Sciences Agronomiques de Gembloux (FUSAGx) in order to produce PRAs of the invasive plants *Ambrosia artemisiifolia, Fallopia* spp. and *Senecio inaequidens*; the Univerisité Libre de Bruxelles (ULB) will generate PRAs of *Dendrolimus sibiricus* and *Heterobostrychus hamatipennis* (two insects) and the Université Catholique de Louvain is working on the PRA of the Pepino mosaic virus.

In order to produce PRAs efficiently and accurately, but also to generate practical and effective phytosanitary and control measures, it is not only important to converse and collaborate at the national level, but also on a European/international level. Not only the involved governments should be part of these consultations, but also the research institutes, and breeders and farmers' associations. Joining forces in this way can provide optimal protection against pests and plagues not only in the agriculture and horticulture sector, but also in public greens and woods.

8.18 Control of insect pests with nematodes

Entomopathogenic nematodes (EPN) are applied worldwide to control insects. Since the 1980's, the research and commercialisation of EPN strongly increased in high-quality crops such as lawns, ornamental horticulture, mushroom cultivation, and recently in vegetable crops and orchards (www.COST850.ch). In particular the genera *Steinernema* and *Heterorhabditis* are applied, as they can be reared fairly easily and kill their host in a relatively short time. EPN penetrate an insect through natural openings (*Steinernema*) or pierce a path through the cuticula (*Heterorhabditis*). Once inside the insect, the nematode disseminates its bacterial symbiont, which finds a suitable breeding ground on the haemoceel. The bacterial symbionts are specific to the EPN strain. The nematode feeds on the bacterium, develops further and increases over several generations (in larval, pupal or adult stage). Meanwhile, the bacteria produce toxins that lead to the death of the insect. The nematodes remaining in the insect body are in a dauer state (infectious juvenile). The symbiont contributes to the protection of the corpse against saprophytes.

EPN are used to control harmful stages (mainly larvae) of all kinds of insect groups: *Diptera, Lepidoptera, Coleoptera* and *Thysanoptera*. The search for suitable EPN species and strains within the EPN group is continuously underway. Recent problems with residues in fruit caused an explosion of research on EPN in orchards, with the main target organisms being codling moth, cherry fruit fly, Oriental codling moth and weevils. Most applications involve use of EPN in cultivated soil. Leaf applications of EPN are still rare because EPN are susceptible to dehydration and UV-light. Yet leaf treatments have already been successfully applied against thrips, leafminers, apple sawfly, and others. Improved additives and research on adapted spraying techniques are making

Figure 15: Cultivated wax moth with thousands of Heterorhabditis *nematodes ready to serve as biocontrols against soil-dwelling crop pests in orchards or greenhouse soil. Photo: Peggy Greb, USDA Agricultural Research Service, United States*

Table 5: Overview of research projects on EPN in ILVO's Crop Protection - Nematology research group

Dates	Title
1993-1997	Bionomics of naturally occurring entomopathogenic nematodes in Belgium.
1998-2002	Infectivity and persistence of entomopathogenic nematodes used to control the cabbage root fly *Delia radicum.*
2000-2004	Diversity in entomopathogenic nematodes (*Steinernema* and *Heterorhabditis* spp.) in Vietnam and their potential for the biological control of pest insects.
2000-2004	Biological control of *Hoplia philanthus* (*Coleoptera: Scarabaeidae*) with entomopathogenic nematodes and fungi.
2006-2010	Occurrence, diversity and distribution of entomopathogenic nematodes in Cameroon. Pathogenic potential of native isolates for the control of the cassava root mealybug, *Stictococcus vayssierei* Richard (*Homoptera: Stictococcidae*).
2006-2010	Entomopathogenic nematodes: a durable alternative for the management of white grubs in Nepal.
2007-2011	Entomopathogenic nematodes for sustainable control of the chive midge in Northern China.
2007-2011	Formulated entomopathogenic nematodes for control of the chive midge and flea beetle in China.
2007-2011	Entomopathogenic nematodes for sustainable control of chive midge and flea beetle in China.

the future for leaf applications look promising. Research on optimisation of leaf applications in vegetable crops is in progress (IWT project 070588) and will yield useful information.

The Crop Protection research group conducted numerous studies on naturally-occurring EPN both in Flanders and abroad. These studies examined detection, culturing, identification, pathogenicity, population dynamics and conditions, in order to determine the interaction between these nematodes and their hosts (table 5). This has resulted so far in 17 publications. The knowledge was used, among others, for strategies to control summer chafer in lawns. In addition to the description of 11 new foreign species, *Steinernema glaseri* was found for the first time in Europe. This EPN strain has now been commercialised.

EPN work more specifically, and are less of a threat to the environment, than chemical insecticides. Since the first use of EPN, not even inferior damage or hazards to the environment have been recorded. Use of EPN is safe for the application personnel and consumers of agriculture products. The associated bacteria cause no detrimental effect to mammals or plants and not a single document reports on any effect on humans. EPN are considered to be exceptionally safe biological control agents.

Figure 16: The entomopathogenic nematode Steinernema scarabaei. *Photo: Patricia Stock, Plant Pathology and Microbiology Department of the University of Arizona, USA*

8.19 Development, optimisation and validation of methods for the detection and characterisation of new emerging pathogenic *Escherichia coli*

Shigatoxin-producing *E. coli* (STEC) is a food-borne pathogen able to cause severe illness to humans, ranging from diarrhea to life-threatening HUS (Haemolytic Uraemic Syndrome). HUS includes acute renal failure, a condition in which the kidneys stop working and toxic components accumulate in the body, in combination with breakdown of the blood. Half of the patients need dialysis. Cattle are the main source of pathogenic STEC. Human infection generally occurs through the intake of contaminated beef, contaminated dairy products, contaminated vegetables or sprouted seeds, or through direct contact with contaminated cattle feces. An internationally standardised detection method is available (ISO 16654), but is focused on only one serotype, the non-sorbitol fermenting (s-) O157 serotype. Yet, strains belonging to other serotypes, as O26, O103, O111, O145 and sorbitol fermenting (s+) O157, can also cause HUS. In an initial project of the Federal Science Policy concerning the detection of non-O157 STEC, a detection and isolation method was developed for these serotypes. In a second project of the Federal Science Policy, in 2007-2008, the method was optimised and validated. A collection of strains belonging to the serotypes O157 (s-), O157 (s+), O26, O103, O111 and O145 was also characterised.

The STEC isolation method is a plating method using a selective differential agar, preceded by selective enrichment of the sample. On the agar plate STEC colonies obtain a recognizable morphology (color) through sugar fermentation. In the previous project 1 cfu/g (colony forming unit) of the target organism was detected in food, while only 15 cfu/g was detected in cattle feces. In collaboration with Prof. L. De Zutter of Ghent University, various enrichment times and the implementation of Immuno-Magnetic Separation (IMS) was evaluated to lower the detection limit in feces. IMS is a technique which uses magnetic beads coated with antibodies that specifically bind to target bacteria. By means of a magnet, target bacteria are held in the tube, while other bacteria and sample particles are washed away. The efficiency of IMS and the sensitivity of the method was determined through artificial contamination of fecal samples. Results showed that the efficiency of IMS for the isolation of STEC from feces was remarkably positive for the serotypes O157 (s-) and O157 (s+), generally positive for the serotype O26, fluctuating positive and negative for O103 and O145, and never positive for O111. This was clarified by experiments on pure suspensions of STEC, showing a high specificity for the serotypes O157 and O26 and a low specificity for the serotypes O103, O111 and O145. The detection limit was lowered from 15 to 1-4 cfu/g for all tested serotypes; for O157 (s-) and (s+) and O145 by only using IMS prior to plating, while for the serotypes O26, O103 and O111 by using direct plating as well. It can be stated that the implementation of IMS is useful only for some serotypes. Yet, in order to decrease the frequency of sporadic negative results, further optimisation of the method is obviously called for.

In collaboration with Prof. J. Del-Favero of the University of Antwerp (UA-VIB), a direct screening test based on multiplex Polymerase Chain Reaction (mPCR) was designed. This screening method contains selective enrichment of the sample, DNA extraction and mPCR. The purpose of this protocol is speedy identification of potentially dangerous samples. The mPCR reaction mix contains primer sets for 9 target genes, of which the 5 above mentioned serotypes and 4 virulence genes, namely *VT1* (verocytotoxin), *VT2, eae* (intimin) and *ehx* (enterohaemolysin). DNA was extracted according to the method described by Zhongtang Yu (2004). The mPCR reaction (without sample enrichment) was able to detect at least 10^3 cfu/ml STEC in ground beef, and 10^4 cfu/ml STEC in raw milk cheese and cattle feces. The complete screening test (with sample enrichment) had a detection limit below 20 cfu/g both for raw milk cheese and ground beef and of 200 cfu/g for cattle feces.

Next, both detection methods (isolation on plate and mPCR detection) were validated for various food matrices. By using artificially contaminated samples, the sensitivity of each method was determined. Strains belonging to the 5 serotypes were either cold-stressed or not prior to inoculation. Results using the plating method showed that 10-30 cfu/25g was successfully isolated from ground beef and raw milk cheese samples, whereas the level of 600-2000 cfu/25g could not reliably be detected in sprouted seed samples.

Lastly, a collection of 300 human clinical and animal STEC strains of the Belgian STEC Reference Center from Prof. D. Piérard of the UZ-Brussels was characterised using PCR and Pulsed Field Gel Electrophoresis (PFGE). Using PCR, *VT1* was detected in 39%, *VT2* in 71% and *VT1+VT2* in 16% of the strains. PFGE was performed to determine the level of relatedness between the collection of 300 strains. The tree of relatedness showed that strains belonging to the same serotype clustered together. Strains also clustered together according to their *VT*-profile, but often more groups carrying the same *VT*-profile were scattered within the serotype group. Secondly, some strains did not cluster in the group as they should according to their *VT*-

profile. Thus it was suggested that clustering is based on multiple factors. Apart from that, clusters contained strains isolated during a period of several years, which points to the presence of persisting strains.

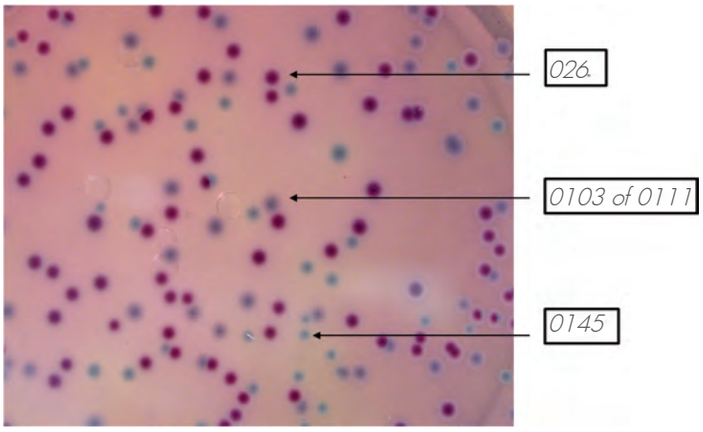


Figure 17: Isolation medium for STEC belonging to the four serotypes O26, O103, O111 and O145. Colonies of the serotype O26 have a purple colour, O103 and O111 a blue colour and O145 a green colour

Cattle are the main source of STEC (Shigatoxine producing E. coli)

8.20 Optimisation and evaluation of real-time RT-PCR methodology for detection of noroviruses

Noroviruses (genus *Norovirus*, family *Caliciviridae*) are a group of closely related single stranded RNA or ssRNA non-enveloped viruses that cause acute gastroenteritis in humans. This genus (formerly know as Norwalk-like viruses) is subdivided into 5 genogroups, of which mainly genogroep I (GI) and II (GII) are infectious to humans. Noroviruses are considered to be one of the main causes of human gastroenteritis worldwide. It is estimated that half of the foodborne gastroenteritis in the USA is caused by these pathogenic micro-organisms. A low infectious dose (10 to 100 virus particles) combined with a high attack rate and the (long)lasting period (days to weeks) of virus excretion is probably responsible for the high number of infected persons every year. The actual number of patients is presumably underestimated because of the mildness of the affliction (main symptoms are vomiting, diarrhoea and slight fever during 12 to 60 hours). Shellfish, fresh (minimally treated) fruit and vegetables and ready-to-eat foods are–besides person-to-person contamination–the most frequent sources of contamination. Virus particles can be present in these food products due to contact with contaminated water in food harvesting or handling areas, or due to unhygienic circumstances during handling or preparation of the food articles. At this time, however, no standard validated method is available for detection of noroviruses in food.

The aim of this project is to optimise methods of detection of noroviruses in different food matrices to allow a speedy analysis of possibly contaminated food samples and to elucidate the transmission routes and contamination sources of norovirus-related food borne outbreaks. Since cultivation of noroviruses is not yet possible, detection of noroviruses (subsequent to extraction and concentration from food samples) is based on real-time reverse transciptase (RT)-PCR technology.

So far in this research project, a multiplex real-time RT-PCR assay was optimised for the simultaneous detection and quantification of GI and GII noroviruses and the murine norovirus 1 (MNV-1). MNV-1 is a recently described genogroep V norovirus and is infectious to mice. In contrast to human norovirus strains, MNV-1 can be cultivated and quantified *in vitro* using a mouse-specific cell line. This multiplex real-time RT-PCR assay will be used to test the presence of human pathogenic GI and GII noroviruses with MNV-1 functioning as a process control during the entire extraction procedure. Different described primers-probe sets and real-time PCR mastermixes were compared for the individual real-time PCR assays, after which the most sensitive were combined into 1 multiplex real-time PCR test. Specificity of this assay was analysed by a number of clinical samples and a norovirus RNA

reference panel. Results showed that specific detection of a wide range of human norovirus genotypes is possible. No cross reaction between the different genogroups was noticed and other human enteric viruses were not detected using the multiplex assay. Competition between the 3 real-time PCR reactions within the multiplex assay was investigated. Results showed that this competition was not a negligible factor when a ≥2 log concentration difference is present between GI and GII noroviruses. The frequent occurrence of amplification in negative controls was also investigated, and it was shown that migration of short ssDNA fragments (used as positive controls) to negative controls during the real-time PCR runs was in most cases responsible for this phenomenon. The use of plasmids instead of ssDNA fragments, combined with other preventive measures, seemed to solve this problem.

This research is conducted in cooperation with Prof. M. Uyttendaele (Ghent University, Faculty of Bioscience Engineering, Department of Food Safety and Food Quality) and is funded by the Belgian Science Policy Domain.

In vitro *culture of murine norovirus 1*

8.21 Development of a multidisciplinary methodology for controlling unwanted fungi and secondary metabolites in silage

Crop preservation, such as ensiling maize, is a process that leads to longer preservation and has been a very important agricultural activity for many years. The production of maize silage of good quality mainly depends on creating anaerobic conditions and reaching a stable, low pH. Disruption of these conditions, or not reaching them quickly enough, can lead to growth of unwanted fungi and other micro-organisms. The most prevalent moulds in maize silage are *Aspergillus, Penicillium, Monascus* and *Byssochlamys*. Spoilage by fungi not only reduces the nutritional value of feed, but can also result in high amounts of allergenic spores and the production of mycotoxins. Especially the mycotoxins, or toxic secondary fungal metabolites, can have adverse effects on animal production, health, and welfare. Since mycotoxins can be carried over into animal-derived products such as milk, eggs and meat, the occurrence of these toxins not only implies a risk for animal health, but also for human health.

Moulded maize silage

The aim of this study is to contribute to the development of a methodology for the detection and identification of fungi and mycotoxins in order to reduce and/or prevent their occurrence during the crop preservation process.

Both visually unmoulded and visually moulded silage samples were taken on several farms. On the one hand, these samples were used to compare 6 different, fungi-specific growth media in function of their suitability for the isolation and quantification of moulds. The fungi present in these silage samples were also purified and subsequently identified. The evaluation of the six growth media

showed that Dichloran Rose-Bengal Chloramphenicol was the most suitable medium for the quantification and isolation of fungi in silage. This medium gave the highest enumeration results (amount of colony forming units per gram silage = CFU/g silage) and the highest macromorphological diversity. The identification of the fungal isolates was started by microscopic identification to the genus level. To obtain a better insight in the number of species within each genus (*Aspergillus* or *Penicillium*) "Random Amplification of Polymorphic DNA (RAPD)" profiles were analysed. Strains with a different RAPD profile were considered to be different from each other. An example of such a RAPD dendrogram is given for the species complex of *Penicillium roqueforti* (figure 18).

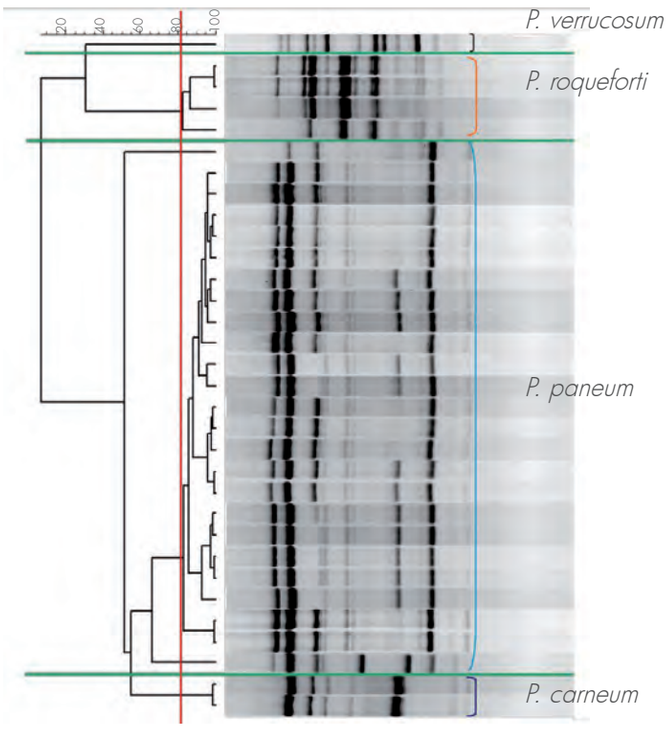


Figure 18: RAPD dendrogram for isolates from silage belonging to the Penicillium roqueforti species complex

Within each group of isolates with the same RAPD profile, strains were selected to be identified to the species level by means of molecular analysis (sequencing). The sequence data indicate that *Penicillium paneum, Penicillium roqueforti* and *Aspergillus fumigatus* are the most prevalent moulds present in silage. Small amounts of P*enicillium carneum, Aspergillus versicolor, Aspergillus niger, Monascus, Paecilomyces, Trichoderma, Fusarium, Alternaria*, and others were also found.

Besides the molecular techniques, a multimycotoxin method to detect 22 different mycotoxins in one analytical run was developed. Chromatography was used to separate the components from each other, followed by mass spectrometric detection. The mass spectrometric and chromatographic conditions were profoundly examined for the High Performance Liquid Chromatography – Mass Spectrometry technique (HPLC-MS/MS). Subsequently, the Ultra Performance (or Pressure) Liquid Chromatography – Mass Spectrometry technique (UPLC-MS/MS) was considered. This technique allows to separate and detect the components quickly, with high sensitivity and high resolution. This optimised technique will be applied for multimycotoxin analysis of pure fungal isolates (chemotaxonomy) and of maize silage.

This research is conducted in cooperation with Prof. A. Verbeken (Ghent University, Faculty of Sciences, Department of Biology, Laboratory of Mycology). This research is funded by a Ph.D grant of the Institute for the Promotion of Innovation through Science and Technology in Flanders (IWT-Vlaanderen).

8.22 Alkaline phosphatase as possible indicator for pasteurisation of mare's milk

One of the many enzymes naturally present in raw milk is alkaline phosphatase. Phosphatases are esterases that catalyse the splitting of phosphate radicals from phosphate monoester molecules. In bovine milk, alkaline phosphatase is inactivated at normal High Temperature Short Time (HTST) pasteurisation conditions (71.7°C/15s). Hence the enzyme is widely used internationally in the confirmatory test to demonstrate that milk has been correctly pasteurized and additionally, once pasteurized, has not been recontaminated by raw milk.

Alkaline phosphatase occurs in the milk of all mammals, although the levels present may vary considerably. Considering the substantial consumption of mare milk-based beverages by inhabitants of Eastern Europe and Asia and considering the increasing interest in Western Europe, heating criteria need to be defined to guarantee a safe and high quality dairy product for human consumption. Therefore, the inactivation kinetics of equine alkaline phosphatase and its usefulness as indicator for correct pasteurisation in equine milk were evaluated using the fluorimetric determination method (EU reference method).

Experimentally determined D, z and Ea-values demonstrate that equine alkaline phosphatase is, at pasteurisation temperatures, more sensitive to heat in equine milk than its bovine counterpart. Moreover, alkaline phosphatase activities in equine milk are about 400 times lower than in bovine milk, which makes this indicator less sensitive. As a result, levels of residual alkaline phosphatase activity below detection limit will not guarantee the complete inactivation of pathogens such as *Listeria monocytogenes* and *Salmonella Senftenberg*. Further, small (< 0.2%) contaminations of raw milk in the pasteurised product cannot be detected due to the low intrinsic equine alkaline phosphatase levels and the subsequent detection limitations of the method. Thus, using the reference method, equine alkaline phosphatase will not be suitable as indicator for correct pasteurisation of equine milk. And further research for a more sensitive determination method or a more suitable indicator is desirable.

Horse milking

8.23 Development of measuring methods for determination of the quality of dairy products

8.23.1 Development of a semi-quantitative assessment of taste

Sensory analysis is an important instrument in product development and the evaluation of food and beverages. This scientific discipline is defined as a structured and formal methodology and is based on the skills of the sensorial analyst. Because sensorial analysts' behaviour varies widely over time and within a group, it is very important to develop a reliable sensory evaluation test.

The objective was to develop a high-quality scale evaluation test to minimise variation between the sensorial analysts in the tasting panel and in the same sensorial analyst over time. A series of four samples, all variations of a single product, were presented to the panel at random. Thirteen persons were trained and participated the tasting panel. They examined different beverages with different sweeteners. For each test, the test panel was asked to evaluate the drinks on a hedonic line scale of 10 cm length going from 'not sweet' (0 cm) to 'too sweet' (10 cm) and to order the drinks according to the sensorial characteristic 'sweetness'. Two correction parameters were introduced to minimise the differences in manner of scaling. A first correction parameter involves a correction within the tasting panel. The difference between the two farthest marks on the line scale was examined and indicated by five explanations going from 'the difference is not noticeable' to 'the difference is very noticeable'. Each of these statements was correlated with a corrected difference in cm going from 0 cm (not noticeable) till 4 cm (very noticeable). A second correction parameter involves a correction for the sensorial analyst. For each sensorial test, the reference product was randomly placed in the series. Three drinks were compared to the reference product, which was automatically given a score of 5 on the line scale. The difference between the position of the reference product, as indicated by the sensorial analyst, and the corrected position (= 5) was calculated and this correction was added to the three test samples. The sensorial test gave reliable results for all tested beverages and was reproducible for each sensorial analyst.

Test room

8.23.2 Screening of dairy powders by near infrared spectroscopy (NIRS)

NIR spectroscopy is widely used as an expedient and non-destructive analytical tool in many sectors. The objective of this research was the development of a dairy powder data bank containing the following; powders of a broad range of the more current types: the study of the possibilities of near-infrared reflection spectroscopy for routine determination of moisture, fat, protein and lactose content: and the heat class by means of the Whey Protein Nitrogen Index (WPNI). Due to the severe limitation of the number of reference analyses, it would be possible to reduce analytical costs, time, and environmentally damaging reagents.

Within this study, a heterogeneous set of 185 dairy powders (60 whole milk powders, 50 skimmed-milk powders, 40 equine milk powders, 25 whey powders, 6 butter milk powders en 4 ass's milk powders) was used. The powder diversity was very broad. Within the whole-milk powders, some high fat content (minimum 42%) types were incorporated. A high texture variation was obtained with some instant powders. The skimmed-milk powders contained a wide variation of ash content. Within the set of whey powders, some powders with a very poor lactose content were included.

NIRS reflectance spectra within the wavelength region of 1100 to 2500 nm of all powder samples were collected with the Foss NIRSystems 5000 spectroscope at Plant-T&O.

After scanning the entire set of dairy powders using the statistical approach of principal components, a minimal subset (61 powders) was selected which encompassed the entire spectral variation in the sample population. These calibration powder samples were analysed by means of the following reference methods: drying-oven method (moisture): Röse-Gottlieb (fat): Kjeldahl (protein): HPLC (lactose): and turbidimetric method (WPNI). Also the standard errors (SEL values) of each analytical method were determined. With these calibration samples, calibration equations or calibration models for the different quality parameters of the dairy powders were developed by means of the statistical approach of the modified partial least squares regression. The statistical values of the NIRS calibrations are summarised below.

Table 6: Statistical values of the NIRS calibrations for the composition and quality properties of dairy powders

Parameter	n	Range	SEC	SECV	SD	SEL	R^2
Moisture	59	0 – 9,07	0.14	0.18	1.59	0.14	0.9
Fat	57	0 – 46,34	0.35	0.43	11.82	0.29	0.99
Protein	59	0,77 – 45,57	0.31	0.40	7.47	0.29	0.99
Lactose	60	12.24 – 89.14	1.20	1.44	12.82	1.27	0.99
WPNI	58	0 – 22.66	1.12	1.41	5.45	1.05	0.96

n = number of samples
SEC = Standard Error of Calibration
SECV = Standard Error of Cross Validation
SEL = Standard Error of Laboratory reference analyses
SD = Standard Deviation
Units of moisture, fat, protein and lactose: g/100 g
R^2 = Coefficient of determination
Units of WPNI: mg WPN/100 g fat free dry matter

From the calibration values, it can be concluded that very good NIRS models can be obtained for the composition parameters moisture, fat, protein, and lactose. The calibration equation for the WPNI content is still acceptable (SD/SECV = 3.9).

The parameters of all the powder samples of the entire sample set were calculated with the developed calibration models. In conclusion, the NIRS technique offers excellent possibilities to very quickly determine the composition of main organic components. This technique showed also possibilities to quickly analyse the heat class of dairy powders.

With this analytical tool, it is possible to quickly screen the type of dairy powder. In addition, the use of NIRS sharply reduces the analytical time, the analytical costs and the quantity of reagents.

Fast analysis of dairy powder via NIRS

8.24 Strategies for control and detection of "stacked" events and unauthorised GMOs

8.24.1 Stacked GMOs

The combination or 'stacking' of different properties or genes in one plant is gaining popularity very quickly in the production of genetically modified (GM) or so-called biotech crops. In 2007, 42 million hectares of crop area were planted in the US with transgenic crops combining insect-resistance and herbicide-tolerance genes,

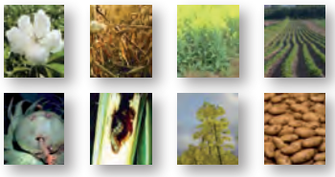


*Figure 19: Stacking, or combining via hybridisation, of the biotechnological transformation processes of two or more agronomical features in one plant are applied the most to cotton (78% of the **cotton** production in the US in 2007) and **corn** (63%), in particular the combination of insect resistance with herbicide tolerance, but also more and more with **rapeseed** (combination of herbicide resistance with hybrid male sterility and restoration of fertility) and **potato** (combination of insect resistance, herbicide tolerance, and virus resistance) (source: James, 2007)*

comprising approximately 37% of the total biotech crop area (figure 19). A "stack" is normally considered as an event harbouring different transgenic constructs and resulting from the crossing of individual GM parental lines or "single events." However, stacking of genes in the most broad sense of the word also covers the combination of traits or genes through other means of production. These include re-transformation of an already transformed plant, co-transformation with multiple transgene vectors, or a single transformation with a multigene transgene cassette (figure 20).

The FP6 European project 'CoExtra – Coexistence and Traceability of GM and non-GM supply chains' (2005-2009) primarily aims to improve or adapt existing detection procedures, or to develop new ones, in order to maintain the co-existence of GM with non-GM agricultural systems as well as the traceability of GMOs throughout the production and distribution chains. This project considers stacks to be an important challenge. ILVO's contribution as a project partner was publication of a position paper and a scientific review describing the following: the categories of stacks; existing terminology; global regulations on the presence and tracing of stacks in agricultural products; definitions and norms; and approaches and technical solutions for the detection and quantification of stacks. The different means of stacking in plants were outlined (figure 20), where attention was mainly paid to the duality of the term: stacking is firstly the combination of new agronomic properties or traits in plants, but secondly, and more widely, refers to all the different types of combinations of genes in one plant genome. An overview of EU-authorised stacks can be found at http://gmo-crl.jrc.ec.europa.eu/statusofdoss.htm.

In Canada and the US, stacks are considered as products of conventional breeding, and are thus exempt from separate biosafety evaluations. In the EU, however, the result of the crossing of 2 individual GMOs, each harbouring a single property, is considered as a new GM event, even if the parental lines each received a separate EU-authorisation. Based on this regulation, a

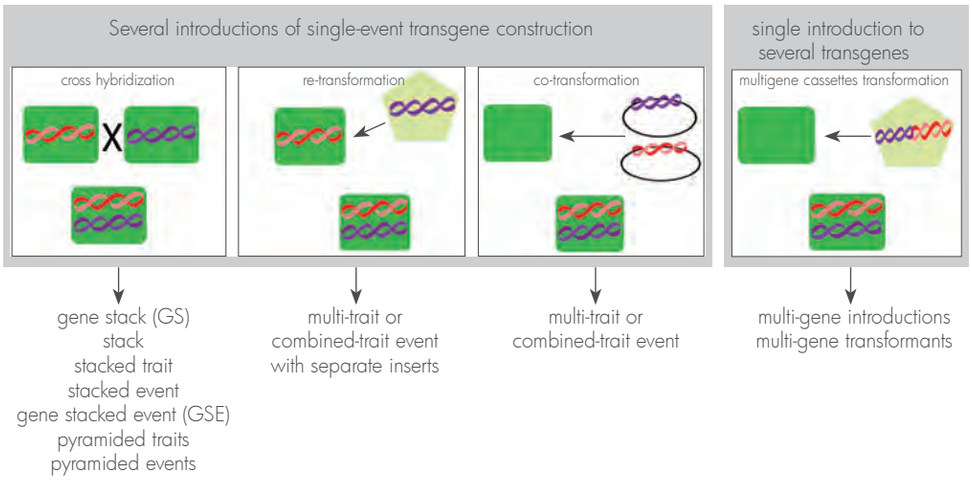


Figure 20: Overview of the different ways stacks can be produced. The combination of features in one plant can happen via (1) classical hybridisation between two or more GMOs, (2) retransformation of an existing GMO with a new transgenic construct, (3) co-transformation of a conventional plant with various events, and (4) multigene introduction via transformation with a complex multigene event.

stack obtained by the crossing of two single GM events, as for any other stack, is subject to a new biosafety evaluation. This EU legislation also implies that stacks must be traceable and thus need to be distinguished from a mixture of their parental lines. European GMO-control programs consider single event-specific PCR methods to be standard detection and identification methods. According to this basic principle, two or three individual event-specific PCR assays are required to identify duple- and triple stacks, respectively.

Detection and quantification of stacks is possible only if individual seeds can be analysed. Seed-based procedures exist, where sub-sampling or pooling of seeds are followed by real-time PCR analysis. However, there is a need to optimise such procedures in function of cost and time efficiency. ILVO developed a set of 2D- and 3D-pooling schemes for the analysis of large amounts of seeds. Depending on the percentage of GMO present in the seed lot and on the number of seed pools being analysed, a distinction can be made between a mixture of stacked seeds and conventional, non-GM seeds on the one hand, and a mixture of seeds from 2 individual GM events and non-GM seeds on the other hand. However, due to mixing and processing raw materials further down the production chain, detection of a stack in a processed end product such as feed or food becomes nearly impossible. In certain cases, based on quantitative data, an indication of the presence of stacks may still be obtainable.

It is crucial that legislation corresponds to the practice of controlling for GMOs. To this end, it is important to apply one uniform unit for the measurement and expression of GM content, and to do this throughout the whole chain from (sowing) seeds, to raw materials, all the way to processed products. We believe that a consistent application of the haploid genome equivalents (HGE) unit for GMOs (Holst-Jensen et al., 2006), which determines that a GMO % is expressed on the basis of DNA copies, is the only practical and scientifically sound legal solution for quantification of the presence of stacks throughout the chain. The advantages and arguments for this kind of uniform approach from farm to fork are also outlined in a scientific article (Taverniers et al., 2008). The applicability of the different strategies for detection of stacked GMOs will of course depend on the economical significance of this subject.

8.24.2 Non-authorised GMOs

Out of more than 100 GM events authorised worldwide, at the moment about 30 only are approved for the European market. As a consequence of the continuous development of new GM products, in addition to global differences in the approval procedures, the chance for the accidental occurrence on the European markets of non-approved products is increasing. The occurrence of non-approved products on the market has disadvantages for international trade and carries potential risks for the safety of human health and the environment. The latter is especially the case for unknown GMOs. The need for detection of non-authorised (or unknown) products puts additional pressure on analytical-detection technologies. In the framework of a doctoral fellowship study on the use of plant seeds as a production platform for recombinant proteins, ILVO detected commercialisation of a non-authorised GMO on the European market. The analytical procedure in the routine lab for GMO detection was applied and the results showed that it concerned a non-authorised product. The practical analysis is based on a combination of (1) methods which screen for generally-occurring GMO elements like promotors and terminators, (2) an approach where all EU-authorised events can be qualitatively detected simultaneously by means of a single, pre-spotted real-time PCR plate, and (3) profiling unknown parts of the surrounding plant genome by means of anchor PCR, starting from the positive screening elements which function as "anchors." At the moment, the applicability of such an approach for the detection and molecular characterisation of an unknown and non-authorised GMO is being evaluated. This incident showed that information-based analysis can be a complementary approach, allowing the detection of potentially commercialised unknown products such as unknown GMOs. This methodology, which is based on a structured search for information and its subsequent compilation, is further elaborated through a collaboration with the National Institute of Biology (NIB) and the Jozef Stefan Institute (JSI) (both in Ljubljana, Slovenia), and the Joint Research Centre (EC-JRC, Ispra, Italië). A strategy such as this one, complementary to analytical detection, aims to detect potential risk factors and incidents in a very early stage, in order to later develop suitable analytical detection methods.

8.25 A new ammonia-emission model for Flanders

8.25.1 Introduction

The European NEC Directive (2001/81/EC) imposed emission ceilings for some major air pollutants including ammonia. With 1990 as a reference year, Belgium must reduce its ammonia emissions to 74 kilotons per year by 2010. For Flanders, this means a maximum emission of 45 kilotons. This limit must be met primarily by the Flemish agricultural sector, since it represents over 90% of the emissions. Europe also requires annual emission reports at the sector level from Flanders, together with the projections for 2010. The coming review of the NEC directive will also include emission ceilings for 2020.

In the past, the Flemish environmental services (VMM)

has used a mathematical model developed by Ghent University (Pollet, 1996) to meet its European reporting duties. This model estimates the ammonia emissions based on the number of animals per animal category and farmland use, as indicated in surveys by the National Institute of Statistics (NIS). Based on this data, emissions were calculated from animal housing systems, manure storage sites, pastures, and field application of animal manure and chemical fertilisers. The "Pollet-model" was updated annually, providing new statistics and regular adaptations in view of changing agricultural practices. In doing so, the model was reviewed to calculate the emissions at municipal level, and some emission factors were changed accordingly. However, the Flemish legislation has changed considerably since 1996, and of course, science has also evolved. An update of this model has become necessary, and in 2007 the VMM mandated ILVO's Technology and Food Science Unit – Agricultural Engineering research domain to optimise the ammonia emission model for agriculture. The project was conceived as the development of a modified model for the period 1990 (reference year) to 2000 and a new model for the following years with a application horizon of 2020, in light of the review of the NEC directive. In consultation with the client, MS Excel was selected as the development platform. This project was performed in cooperation with Ghent University.

8.25.2 New information leads to two new models

The first step in the project was to update the model for 1990-2000. This update was still based on the NIS statistics at the municipal level. The estimates of the ammonia losses were carefully reviewed for the following emission stages: animal housing, external manure storage, and chemical fertiliser use. More varied housing types and related emission factors were considered for cattle and poultry. The emissions from external fertiliser storage were now calculated based on a study performed by Ecolas and Ghent University (2006). The chemical fertiliser use was calculated using the municipal pasture and cropland areas, and related to the respective agricultural region (Campens & Lauwers, 2002). The corresponding emission factors for 4 different types of fertilisers were based on Demeyer (1993) and van der Hoek (2002).

This new model for the period 1990-2000 allows simulations in a relatively simple manner. Changes in calculation and emission factors are easily translated using VBA-macros into a new model output for the various emission stages. The model also provides for custom reporting for the emission stages, for every municipality, and for each animal species. This allows visualisation of the geographical emission data using GIS (ArcMap 9.2). This new model for the period 1990 to 2000 was named EMAV_NIS (EMAV is the Dutch abbreviation for "Emission Model Ammonia Flanders").

The second model starts with 2000 as a verification of EMAV_NIS and has a application horizon of 2020, as stated above. The NIS data were no longer used as input for the model. Instead, a much more detailed information source was used, which came from a more recent database created by the Flemish government (Vlaamse Landmaatschappij, VLM). This database works at farm level and is fed by about 47,000 annual manure returns, including manure-collecting points and manure-processing firms. This paints a much more accurate picture of manure production and movement in Flanders. This trove of information, combined with a customised calculation method, allowed ILVO to develop a second modular and user-friendly computer model: EMAV. This model uses the following at farm level: animal numbers and gross N production per animal category, number and types of low-emission animal housing, farmland surfaces, and use of chemical fertilisers. This last data was again checked against available statistics for each agricultural region. This resulted in a correction factor for this data until more reliable and complete statistics become available.

In addition to the farms, the new model approach now also includes all manure collection points and processing firms as individual entities. With this extra information, and through analysis of all manure transports within (and also into and out of) Flanders, it was possible to assess the manure flows to these two new emission stages. By calculating the mass balances, the quantities of manure applied to the land could sequentially be calculated. The emissions from the manure treatment plants were calculated using production information from the VCM (Flemish coordination centre for manure treatment) and the emission factors as listed in the recent BAT study (VITO, 2007). No data is currently available for emissions from collection points, so these were set to zero in the model. Figure 21 gives a schematic model flow of EMAV indicating the information used, the manure flows, and the 7 emission stages.

The transparent and modular design of EMAV results in relatively easy simulation exercises. The model provides for custom reporting of the data per emission stage and per animal species. A link with GIS is provided using the Lambert coordinates of the firms, in order to present the emissions data at farm level, per km^2, per municipality, and for Flanders as a whole. In this way, emissions can be assigned as closely as possible to their location of

origin. This farm- and location-based approach was also necessary in view of the obligatory EU reports regarding IPPC exploitations (starting at 40.000 chickens, or 2.000 finishing pigs, or 750 sows). Of course, this kind of location-specific approach requires compliance with privacy protection laws. To this end, all individual farms and firms were given a fictional (non-traceable) serial number by the VLM before the data was sent to ILVO.

Lastly, a Monte Carlo simulation was conducted to assess the uncertainties of the model for the two main emission stages (stables and land application).

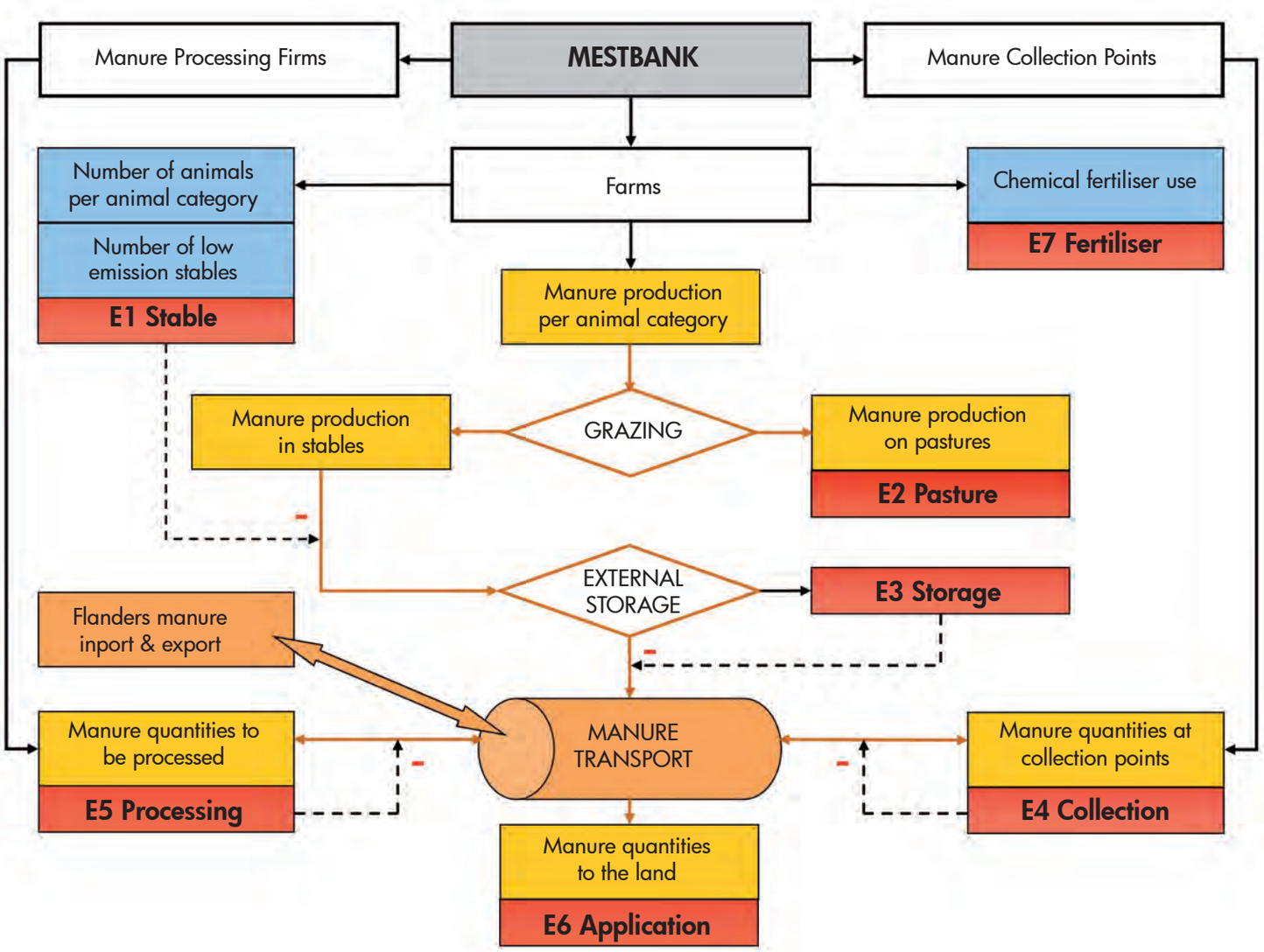


Figure 21: Model build up of EMAV starting from the VLM data (MESTBANK) with the 3 types of firms, the information used, the manure flows (brown arrows) and the 7 emission stages indicated in red (E1-E7). The dotted lines indicate where the calculated N losses are used as corrections for the respective manure quantities

8.26 Evaluation of agitation systems for the application of entomopathogenic nematodes

Entomopathogenic nematodes (EPN) can be applied as biological pesticides in organic and traditional agriculture. Scientific research has shown that the application of these nematodes against soil insects is usually successful. Despite soil being the natural habitat of EPN, they can also be applied against foliar insects. This has been proven extensively under laboratory conditions. However, more knowledge is necessary to ensure an effective field application (soil and foliar). The application technique is one of the aspects that need to be researched. Since no specially-adapted spray application machinery exists to apply biological pesticides, they need to be applied with regular machinery. This can cause damage to EPN and decrease the nematode efficacy.

A good agitation of the spray liquid is important to prevent sedimentation. In 2008, a series of experiments were performed to study the suitability of three agitation systems (mechanical, hydraulic and pneumatic). To this end, a modular spray application system, described in ILVO's 2006 annual report, was used (picture).

The modular spray application system

The chosen EPN was *Steinernema carpocapsae* (Nemasys, Becker Underwood - Biobest). For every experiment, a new tank solution of 50 l was prepared with a concentration of approximately 1000 EPN/l. Mechanical agitation was performed using a metal propeller composed out of three blades. This propeller rotated in the spray tank at a speed of 696 revolutions/min. Pneumatic agitation was created by injecting pressurized air in the spray liquid at the bottom of the spray tank. The air was pressurized at 2 bar using a compressor. The hydraulic agitation was tested with two pump types: centrifugal and diaphragm. The agitation was performed by recirculating the spray liquid.

During every experiment, samples were taken at the bottom of the spray tank at 0 (control), 15, 30, 60 and 120 minutes of agitation. Nematode damage was quantified measuring the viability and the infectivity (with *Galleria mellonella*) of EPN. The capacity of the agitation systems to keep EPN in suspension was examined using EPN concentration in the samples. The agitation system can only be approved if the nematodes do not settle in the spray tank and consequently the concentration at the bottom of the spray tank is not higher at the end of the agitation.

Based on the viability (figure 22) and infectivity measurements it could be concluded that the mechanical, pneumatic and hydraulic agitation using the diaphragm pump during 120 minutes was not detrimental to the EPN. The hydraulic agitation with the centrifugal pump however was very detrimental to the nematodes. De viability decreased to 18.9% and the infectivity to 0%, meaning that not a singular nematode was capable of infecting a caterpillar. There are two possible reasons for the observed damage. The rise in spray-liquid temperature after 120 minutes was on average 23.7°C. A maximum temperature of 49.0°C was measured. This high temperature could be the reason for the nematode damage. Another reason could be mechanical damage caused by passage through the pump. Additional experiments should be performed to reveal the exact cause of the damage.

Based on the concentration measurements, it can be concluded that the mechanical agitation system is the only system that keeps the EPN perfectly suspended. To improve the agitation of the other systems, some adjustments such as a rise in air pressure with the pneumatic agitation, and the installation of an agitation tube with the hydraulic agitation, should be considered.

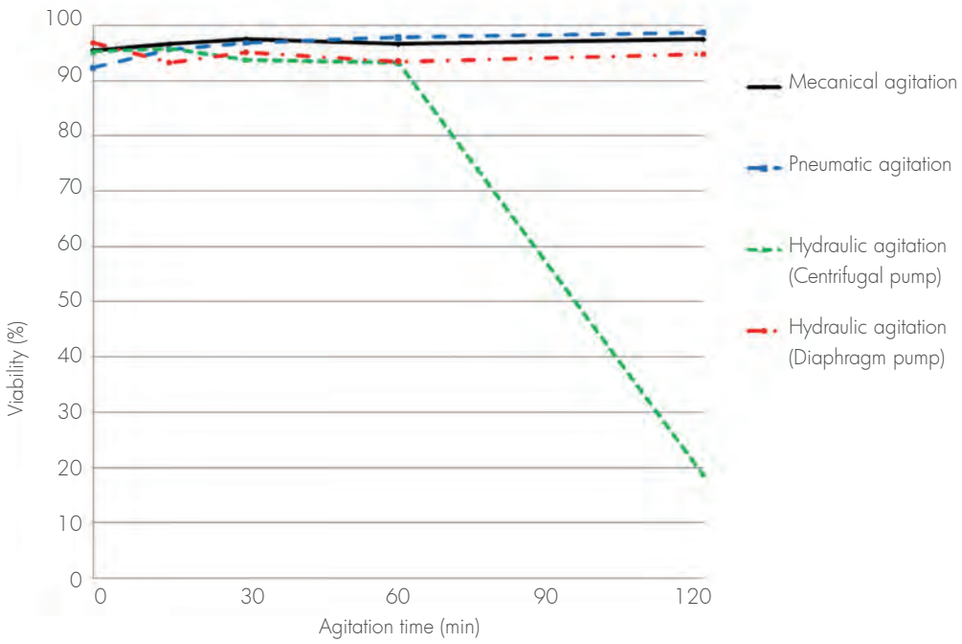


Figure 22: Survival of Steinernema carpocapsae *after agitation with various agitation systems*

8.27 Automated lameness detection by cow gait analysis: Does cow locomotion reveal claw health ?

Hoof trimming is recommended twice a year, but more frequent examination of the hooves could alleviate many of the hoof-health issues that characterise current dairy production, with increasing herd sizes and prolonged indoor housing periods. When hoof examinations are unavailable, or in addition to bi-annual examinations, gait-scoring techniques are being used as a tool to assess cattle lameness. This lameness might be defined as "*abnormal* gait of the cow" (e.g. reduced speed and ground contact force, changes in hoof placement, lowering of the head, etc.) "in an attempt to *minimise pain*". Observer gait-scoring techniques need extensive training (subjectivity issues) and still require significant labour, but they prove very useful in herd health surveys and in the assessment of animal welfare.

Beside the above-mentioned reaction of coping with the pain associated with these common leg and claw problems, abnormal walking behaviour can be the result of many things. Depending on what is regarded as the "normal" reference situation, cow individual anatomy and attitude, udder size and health, oestrus, days in milk, or even the condition of the floor might account for additional variance in walking behaviour.

Sound vs. lame cow behaviour

In an initial series of weekly experiments, ILVO and Ghent University recorded the hoof health of 24 Holstein cows over a period of 3 months. Additionally, cow gait was recorded, and hoof positioning and timing extracted from manually digitized images to investigate the relationships between cattle gait and claw lesions present in the literature (e.g. Flower and Weary, 2006).

In this herd, particularly because cows with a sole ulcer or with interdigital hyperplasia were present, signs of differences in gait pattern were noticed. Decreasing speed, tracking and stride distance, double support time and increasing stance and stride time (with the sound legs) seemed correlated with some of the diseases measured. However, due to inter-cow variability in "normal" gait, no reasonable health prediction could be expected on the individual cow level.

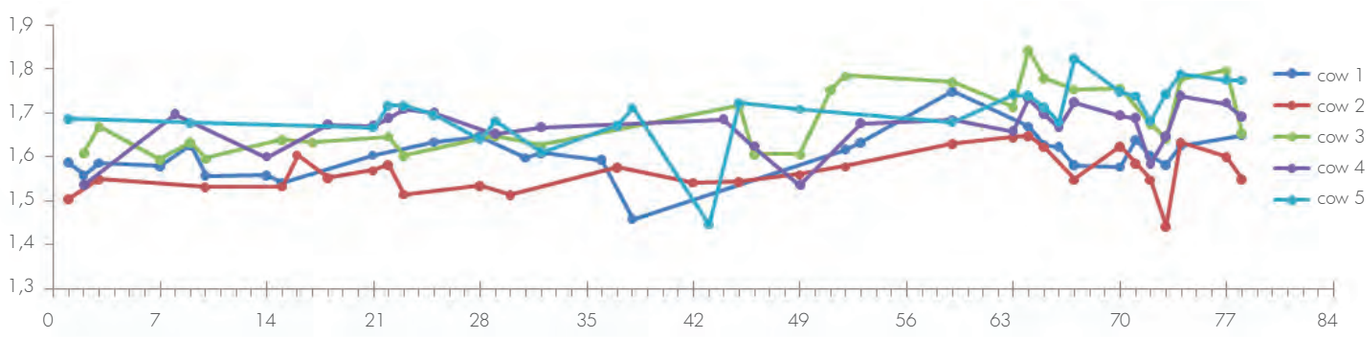


Figure 23: Cow gait analysis in function of time

Individual cow monitoring

Since 2007, a system based on a pressure-sensitive surface (CIR Systems, Inc.) is able to measure all hoof imprints of about 3 consecutive gait cycles of 90 cows once a day. Hoof imprints are analysed offline using custom quadruped gait analysis software. This upgrade to a semi-automatic gait analysis method was needed to assure that a larger amount of cows could be followed individually and more frequently. Currently, about 70% of the cow walks can be used for data analysis. Measurements with cows accelerating, running, slipping or walking very irregularly (e.g. due to extreme lameness) cannot be used.

In contrast with the first herd-level study and multivariate analysis covering health and gait variables, the objective is to detect changes in gait, and to find out whether they relate to the onset of clinical lameness. Now, instead of comparing "sound" and "lame" cows, each cow serves as its own reference. Since August 2008, weekly health records, gait scores and cow management data (days in milk, production, oestrus, etc.) are added to the gait analysis data in an effort to explain some of the measured shifts in walking behaviour.

Expectations

Several systems have been made available for daily cow monitoring. BouMatic has commercialised the StepMetix system, and the use of step counters or activity measurements might also be interesting. Research on cow weight distribution (e.g. in a milking robot) looks very promising (Pastell et al., 2006). Time will tell whether automated cow gait analysis is sensitive (and selective) enough to make it another dairy farm management tool.

Cow on a pressure-sensitive surface

9. In the Spotlight

9.1 The importance of omega-3 fatty acids in poultry

In recent years there has been much interest in nutritional enhancements by direct or indirect (via the feed of the animals) enrichment of food products with omega-3 (ω-3) fatty acids (FA). Omega-3 FA as well as ω-6 FA belong to the poly-unsaturated fatty acids (PUFA). Two of them, namely α-linolenic acid (LNA) and linoleic acid (LA), are essential for humans. They cannot be produced within an organism from other components and should therefore be provided by the diet. LA and LNA are the parent components or the precursors of the ω-6 and ω-3 families, respectively. The most important ω-3 FA are α-linolenic acid (LNA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).

Not all ω-3 FA have the same beneficial effects on human health. Especially EPA and DHA have a clear effect on some ''western society" chronic diseases and are crucial for optimal functioning of our cells, tissues and organs. *In vivo* synthesis of EPA and DHA from dietary LNA is very limited and not at all effective, so these ω-3 PUFA should be classified as semi-essential and must be supplied in the food. The EPA and DHA are mainly found in fish oil or marine algae, whereas good dietary sources of LNA are green vegetables, walnuts and oils from flaxseed or linseed.

Not only the level of ω-3 FA is of importance, but also the ω-6/ω-3 ratio plays a major role. There is competition between the ω-6 and ω-3 FA families for metabolism. Efficiency of conversion of LA and LNA into arachidonic acid (AA, ω-6) and EPA, and DHA, respectively, depends on the amounts of substrates and the ratio of both. EPA and AA are used for the synthesis of eicosanoids (prostaglandins, prostacyclins, thromboxanes and leukotrienes). The amounts and balance of these fats will affect the body's eicosanoid-controlled functions such as blood pressure, inflammatory reactions and functions of blood platelets. They also influence the level of triglycerides and cholesterol of the blood. Both classes of eicosanoids have opposite effects and therefore the absolute level as well as the ω-6/ω-3 ratio are of importance for many metabolic functions.

Plant oils are clearly richer in LA (ω-6) than in LNA (ω-3), thus intake of the former is much greater as most of these plant oils are used in cooking (e.g. sunflower oil and rapeseed oil). The consumption of ω-3 PUFA is relatively small in Western diets and is below the recommendations.

Turkeys

The ratio of ω-6/ω-3 in the diet seems to have moved from values of 1:1 to much higher values (10:1) in modern Western lifestyle. The Belgian Health Council (2006) recommends a 5:1 ratio. Therefore, dietary changes are necessary to decrease the intake of ω-6 and increase that of ω-3 long chain (LC) PUFA. This may help to prevent food-related diseases, such as cardiovascular and inflammatory diseases, cancer, obesity, etc.

Plenty of studies about FA have already indicated the possibility of enriching animal products with fatty acids and providing a more optimal ratio of LC PUFA for human consumption. Monogastric animals, specifically poultry, are a good model to perform nutritional studies with LC ω-3 fatty acids. It has been clearly demonstrated that the ω-3 FA content of meat and eggs can be substantially enhanced through altered feeding strategies - especially through the replacement of ω-6 rich grains and oils (such as wheat or soybean) with ω-3 rich oils and oilseeds (such as flaxseed or fish oil) in the animal's diet.

The objective of an ILVO trial was to investigate the effects of diet composition on turkey performance and meat fatty-acid concentrations and the influence of the age of the turkeys on the effective conversion of these FAs. A 16-week growth trial was set up with three experimental diets, differing only in supplemental fat, to obtain a high-variable fatty acid profile. Diets contained 30g/kg added oil, which was either soy oil (control), linseed oil or fish oil. Performance parameters did not differ among the groups, which is an important criterion for economic and sustainable animal - production systems. The content ω-3 PUFA in the tissues was positively related to dietary ω-3 PUFA; a better ω-6/ω-3 FA ratio was achieved if linseed or fish oil was added to the diet. Linseed oil was not very efficient as an LC ω-3 PUFA precursor, and highest levels of LC ω-3 PUFA were obtained when fish oil was supplemented to

the diet (figure 24). A longer feeding period (16 weeks) failed to show an increase in the conversion rate of LNA to its derivatives.

It is clear from the experiment that animal products can be enriched with fatty acids. Beside the positive health effects for the consumer, the animals themselves may profit. Some studies support the view that supplementation of breeder diets with FA will affect FA composition of different chick tissues and exert a positive effect on the health of the offspring.

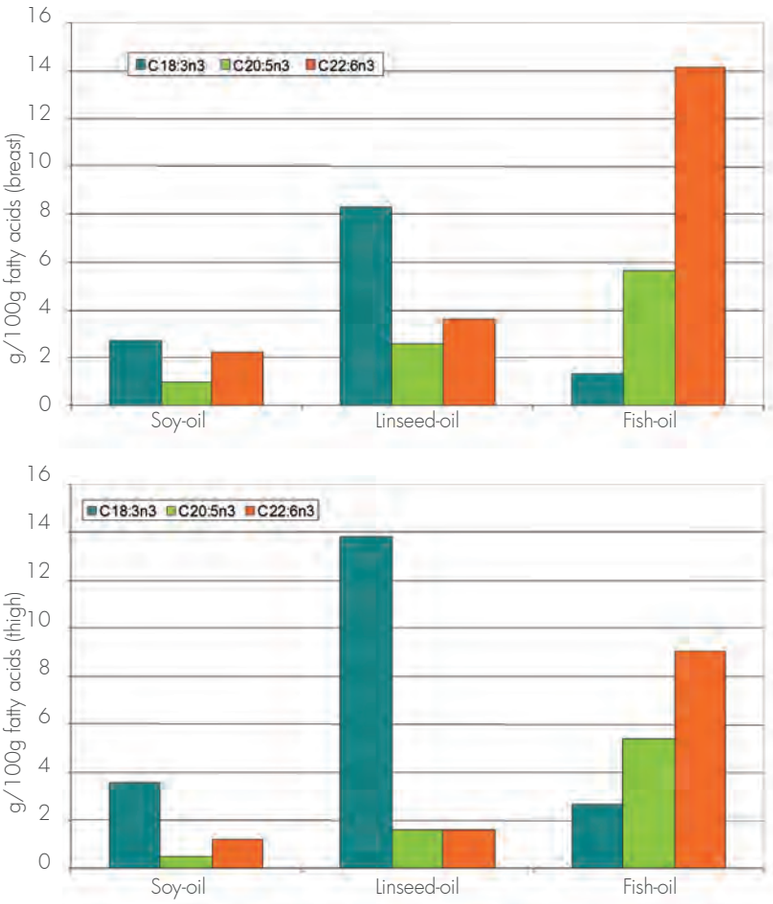


Figure 24: Influence of feed on fatty acid profile of breast and thigh of turkeys

9.2 Attitude of stakeholders towards castration of male piglets

Given the growing public concern about the current practice of surgical castration without anaesthesia (OC) of male piglets, several alternatives are considered for dealing with the problem of boar taint. These alternatives are: the use of anaesthesia (VC), immunocastration (IC), sperm sexing (SS) and the production of entire males with separation of carcasses with boar taint at the slaughter line (IB). When debating the voluntary or compulsory implementation of these alternatives, the opinion of all stakeholders involved ought be taken into account.

As part of the EU PIGCAS project (2007-2008) 472 questionnaires about the attitude towards these alternatives were completed by representatives of 7 stakeholder groups (table 7). This survey was carried out in 24 European countries. In order to investigate whether the opinion of a small number of stakeholder representatives accurately reflects the opinion of the people they represent, ILVO Animal Sciences (in collaboration with the University College Ghent conducted the same survey among Flemish pig producers (160 completed questionnaires).

The use of anaesthesia and sperm sexing were considered as good alternatives by most European stakeholder groups (table 7). Immunocastration and entire male production, though, were viewed less favourably, with the exception of the animal welfare NGOs, who considered entire male production to be the best alternative.

Table 7: Mean scores (from 1 to 5) from the European survey about the alternatives for castrating pigs per stakeholder group

	CONS	NGO	PROD	NICHE	ADM	SLAU	VET
Surgical castration no anaesthesia	2.7	1.2	3.6	3.1	2.7	3.0	3.1
Surgical castration with anaesthesia	3.8	3.2	3.5	3.4	3.3	3.6	3.7
Immunocastration	2.7	2.9	2.5	2.4	3.0	2.8	3.0
Entire males	2.5	4.0	2.3	2.8	3.0	2.4	2.5
Sperm sexing	3.3	3.8	3.0	3.5	3.1	3.3	2.7

CONS: consumers and retailers;
NGO: animal welfare NGOs;
PROD: pig producers (main stream), feed companies and breeders;
NICHE: pig producers (niche);
ADM: public/government administration;
SLAU: slaughterhouses, meat industry and wholesalers;
VET: veterinarians

The order of preference of the Flemish pig producers for the different alternatives was OC > SS > VC > IC > IB. This differed from the order of preference of the 3 PIGCAS-representatives of Flemish pig producers organisations: IC > OC > VC > SS = IB (figure 25). Pig producers with more self-reported knowledge about these alternatives gave a lower score to VC and a higher score to SS. Large-farm pig producers were more negative towards OC and VC but more positive towards SS.

The PIGCAS project illustrates that the attitude towards certain strategies to deal with the boar taint problem may differ profoundly between stakeholder groups. It remains a considerable challenge to find, let alone implement, an alternative strategy supported by the majority of the parties involved. The PIGCAS results, ought to be interpreted with caution, as the order of preference for the different alternatives reported by the small number of representatives of the national pig-producer's organisations did not always correspond with the opinion of the farmers themselves. Surveying the actual people involved also allows valuable in-depth analyses of what influences their perception and attitude. A better understanding of each stakeholder group's opinion may improve and facilitate communication between the different parties involved in this intricate issue.

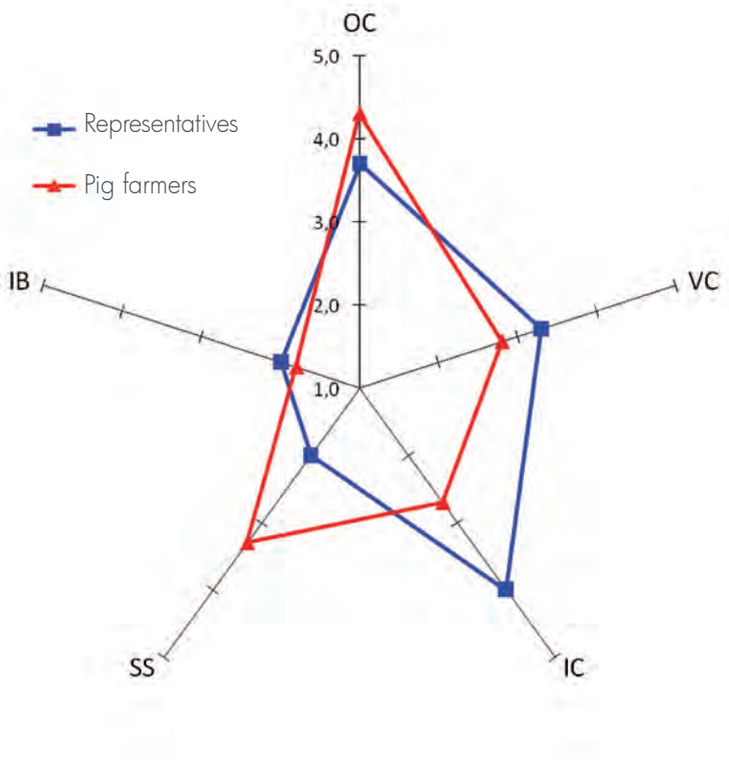


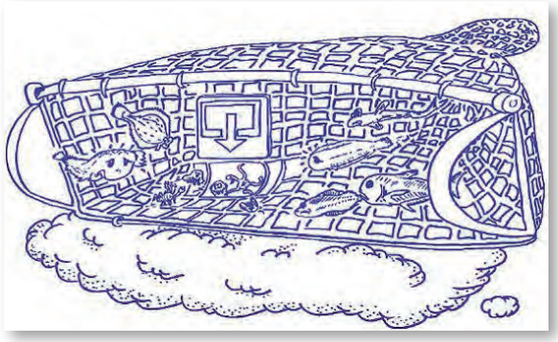
Figure 25: Preference for 5 strategies against boar taint according to Flemish pig farmers (n=160) versus representatives of pig producers (n=3)

9.3 Don't get caught! Discards in beam trawl fisheries and possibilities for reduction

The reduction of the environmental impact and the high discard rates resulting from beam trawl fisheries is a hot topic in fisheries research. ILVO has recently invested considerable effort in the evaluation of the discard composition and development of discard-reducing technical adaptations to beam trawls. Part of this research was carried out in the framework of 'TOETS', a project financed by the Flemish Government and the European Commission (FIOV). The acronym TOETS stands for 'discards in beam trawl fisheries: optimisation of the research, evaluation of reducing technical measures and awareness-raising in the sector'. The project dealt with methodological, technical and policy-related aspects of discarding, and was based on close interaction with the fisheries sector.

Up to now, the by-catches and discards of the Belgian beam trawl fleet have been recorded with a focus on the most commercially valuable species. From 2009 onwards, the discard recording within the National Data Gathering program will be significantly intensified, and will include all fish species (both commercial and non-commercial) and a selection of benthic invertebrates. In order to enable intercomparability between observations and hence allow the detection of changes in the spatial and temporal distribution of by-catches and discards, a standard sampling procedure needed to be developed and adopted. This procedure had to be unequivocal, applicable on every Belgian beam trawl vessel, and require the work of only one seagoing observer (most vessels can only accommodate one extra person). During five fishing trips between October, 2007 and March, 2008, several sampling procedures were tested for applicability and the resulting quality of the data. This evaluation resulted in a recommended standard procedure for the processing of the catch per tow, yielding data on at least three tows per twenty-four hours. Data is gathered according to the following priority list: (1) weights of all fractions (landings, discarded fish, benthos, inert matter) and an estimate of the total weight of the catch, (2) data on the composition of the fish to be landed (numbers, weights and lengths per species), and (3) data on the composition of the discards, with emphasis on the commercially valuable species. If time and circumstances permit, data is also gathered about the remainder of the discards.

Sorting discards



Cartoon of a beam trawl with benthos release panel

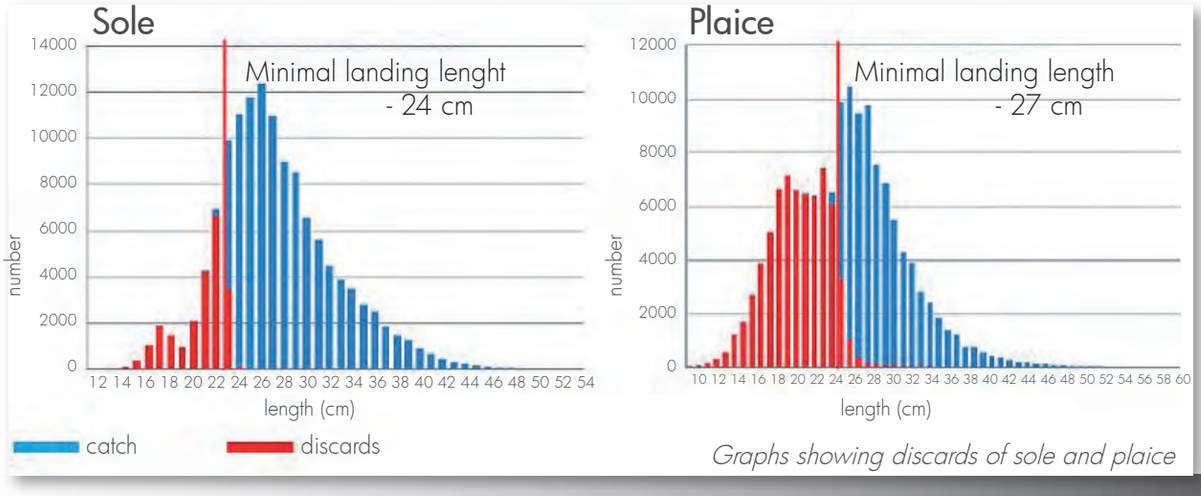
After quantification of the discards, the next logical step is to attempt to reduce them. Within the project called TOETS, special efforts were done to reduce the discards of organisms without any commercial value, chiefly invertebrates and undersized fish. The beam trawl adaptations tested during the course of the project were based on a substitution of the classical diamond-shaped mesh in the belly of the net and the cod end with square mesh panels. Large square meshes (120mm) in the belly (Benthos Release Panel or BRP) allow the escape of benthic invertebrates. Square meshes (80mm) in the cod end (Square Mesh Cod End or SMCE) hold their shape better under tension than diamond meshes, which results in increased escape opportunities for undersized fish. Tests with both adaptations at sea quickly resulted in the optimisation of the design, since the original concepts suffered from mesh deformations (SMCE) and secondary net effects (BRP). The improved designs proved to be very promising for discard-reduction. When using a SMCE, there was no significant loss of commercial catch, and the workload of processing of the catch was reduced. The cod end appeared to be stable in the water column and caught more small marketable sole and undersized sole. The effects of the SMCE, however, varied strongly between species and fishing grounds, and the effects on the numbers of invertebrates, fishes, and inert matter

need further investigation. The use of a BRP resulted in a mean reduction of 45.8% in the numbers of invertebrates. Furthermore, there was a clear reduction in the weight of the inert fraction (48.6%), which is very positive since high amounts of inert matter such as broken shells and rocks can cause damage to the fish and can increase the work load during sorting. The effects on the catch efficiency of sole were positive, with a loss of undersized individuals and an increase in the proportion of marketable individuals of 24-28cm.

The analyses within the project were fed both by data from recent experiments at sea, and by existing data on the discard behavior of the Belgian beam trawl fleet. Within this fleet, the beam trawl fisheries on demersal species, such as sole and plaice, are highly dominant. ILVO has been gathering data on the discard behavior of Belgian beam trawlers since 2004, with an emphasis on the commercially most important fish species and fishing grounds (central and southern North Sea, English Channel, Irish Sea, Celtic Sea, Bay of Biscay).

According to estimates, 8% of the catches in fisheries worldwide are discarded, which represents a yearly amount of 7.3 to 27 million tons. Trawling for shrimps and flatfishes gives rise to 50% of the worldwide discards, while they only account for 22.5% of the total landings. These high discard rates, together with other disturbance effects, imply a substantial environmental impact of this fishing technique. For the Belgian fleet, the results can be summarized in the following numbers:
In total, 58 commercially important fish species have been identified during catch analyses, with a mean number of 13 species per tow. About a quarter (25,5%) of the total catch weight is being discarded. An hour of trawling yields on average 88kg of marketable fish and 36 kg of fish thrown overboard. Species with a low market value, such as dab and bib, are more frequently discarded. Species with an important commercial value such as sole and plaice, however, are discarded just as well, which is mainly due to legal restrictions (minimum landing size, quota). Sole represents a smaller proportion (5%) of the discards than plaice (22%) as a result of discrepancies in minimum landing sizes between the species.

Picture catch comparison: experimental setup for testing SMCE and BRP: at the port side a standard net without adaptations; at the starboard side a beam trawl fitted with a SMCE and/or a BRP. The catches of both sides were analysed separately.



Graphs showing discards of sole and plaice

9.4 NOBL, a network with ambition

Sustainable food production is an important component of Flemish agricultural policy. The authorities have given organic farming a leading role. Beside the pioneering role in sustainability, organic farming also creates economic opportunities for Flemish agriculture. Demand for organic products is increasing quickly, in Flanders as well as internationally, and is currently not met by supply.

Flemish agriculture is missing many opportunities. Therefore the Flemish government, together with the organic sector and the conventional farmers' organisations, worked out a joint strategy for the organic agriculture sector for the period of 2008-2012. The most important objectives are anticipating new market opportunities and initiating the necessary impetus to do so. An essential element of this plan is the development of a good research and information policy for organic agriculture.

Research on organic agriculture is still a rather new field within the agricultural research landscape. A high-quality research policy requires better coordination of the research being done. Disclosure and dissemination of knowledge become crucial while analysing the need for research, along with the optimal use of the existing resources and infrastructure for research in Flanders. Cooperation and communication are very important in this process, where the government wants to play both a binding and a stimulating role.

The first steps toward cooperation have been made through the establishment of a network for organic food and farming research (Netwerk Onderzoek Biologische Landbouw & voeding, NOBL). The organic sector requested this network, and the Flemish Department of Agriculture and Fisheries initiated it. The network acts mainly as a platform for discussion and communication for stakeholders who play a role in the generation and dissemination of knowledge for the organic sector in Flanders. The ambition is to develop new initiatives that strengthen knowledge generation and dissemination for organic agriculture, and to approach problems within the organic agricultural research in a more integrated way. The network's initiatives need to give added value for all the stakeholders, which makes the initiatives' reach as wide as possible. The mainstays of the group are the values of openness, cooperation and trust.

NOBL
Netwerk Onderzoek Biologische Landbouw & Voeding

The initiatives of the group are:

- Improved steering of research for the organic food and farming sector through an in-depth analysis of research needs, based on better interaction between researchers and the organic sector.
- Optimal use of available resources and infrastructure for research for organic food and farming. It will be important to improve the link with international research and agricultural research in general.
- Better disclosure and dissemination of research information and results.
- More support for research into organic agriculture in Flanders.

Members of the NOBL network represent the whole field, from research institutions to the government and the organic sector. ILVO's Social Sciences Unit coordinates the network. At the moment, 13 organisations and institutions meet on a regular basis.

Started in 2007, the network gradually took a more definite shape in 2008 and accomplished its first goals.

In the spring of 2008, the Flemish Department of Agriculture and Fisheries, together with the members of NOBL, prepared a research agenda for the organic food and farming sector in Flanders. The research agenda organised the desired research for the organic sector in Flanders by theme and provides researchers with recommendations for the period 2008-2012. Starting from the research agenda, the NOBL network further prioritises the defined research themes and needs in order to compose a research programme for organic food and farming research.

In June, network members visited the Netherlands to see how they organise research on organic food and farming. At Gerrit Verhoeven's organic dairy goat farm 'De Groene Geit' in Biezenmortel (NL), they listened to anectodes of real farm practice, and learned why the Dutch Ministry of Agriculture, Environment and Food Quality has opted for 'Bioconnect'. Bioconnect is a knowledge network where farmers, marketing chains, government, and social organisations cooperate to formulate research questions and supervise projects.

The databank centralises information about research projects, results, and publications for organic food and farming carried out in Flanders.

In 2009, priority will be given to the creation of a better link between research into organic food and farming

Visit to 'De Groene Geit' Farm

and agricultural research in general, as well as a better alliance with international research into organic food and farming. Furthermore, the network will examine how concrete research projects can be initiated to answer the need for research as defined in the research programme.

For more information about the network, contact lieve.decock@ilvo.vlaanderen.be or info@nobl.be.

Homepage of the NOBL-website

9.5 Growing and processing flax as a basis for a bio-based economy in Flanders

Linseed and flax both belong to the species *Linum usitatissimum* L. Depending on the purpose (seed or fiber), the varieties are classified as "linseed or fiber flax." The cultivation of flax and its processing into useful finished products is embedded in Flanders into three sectors on which this project focusses: the farmers, processors and consumers of flax fibers, and processors and consumers of linseed (oil). These three sectors are connected by using the same raw material, namely flax. Although these sectors have different requirements and expectations with respect to this material, this relationship is an ideal starting point for synergies and maximisation of the use of this commodity. All parties are aware of the potential, but currently this synergy is not exploited. This IWT project runs under the Thematic Innovation Promotion programme and aims to create momentum and build on this synergy. It is run by 3 knowledge centers: Centexbel, ILVO and Ghent University.

Target

Each of the targeted sectors is characteristic of Flanders, and together they form a valuable contribution to our economy.
Flax is a crop with several advantages within agricultural policy and it can help optimise the use of agricultural land, due to the fact that flax is an ideal plant for the creation of agrobiodiversity.
The flax-processing sector is, after France, the second largest producer of flax fibers in Western Europe. Traditionally, flax fibers have primarily been used for textile applications (clothing, household linen, interior textiles, etc.). There is now a rising interest in the application of natural fibers, and flax fibers in particular, for technical applications due to a growing environmental consciousness. The use of these technical "klodden" (lower quality fibers) for bulk applications may not be sufficiently developed because of the uncertainty about the quantities available. The current sowing of flax fiber is mainly determined by the sales potential of long-flax fibers for textile applications and exports to China.

Linseed remains a rather marginal crop in Flanders, despite the fact that Flanders is the largest importer of linseed, and largest processor of linseed to oil, in Europe. The linseed manufacturing sector is completely dependent on imports of flax seed from Canada. Moreover, there is a danger of a linseed shortage, because farmland is increasingly used for the cultivation of various crops, including biofuels. The added value of the secondary flows for various alternative uses and new products is also worth remembering. The flax plant is an annually renewable resource from which all ingredients are incorporated and exploited.

Objectives

The challenge is to create a streamlined whole by finding the right interfaces and common objectives among the various sectors. This project aims to develop new varieties of fiber and/or oil for specific applications that give added value to each of these sectors, and which can greatly improve Flanders' competitiveness in Europe (and the world). The development of a mixed breed that shows an acceptable quality fiber for use in technical applications, and simultaneously has a sufficient yield to linseed oil, would be a clear step forward for both sectors. Moreover, it would enable the agricultural sector to ensure preservation of a valuable crop.

Flax field

Results

The ultimate goal of this study is to define priority themes where research can be an important impetus for improved quality, competitive market positioning, development of new products, and exploitation of new markets and applications.

Improving communication between the various sectors and their contacts with the scientific actors will result in a better flow of information between the various parties and enable research activities to reflect the needs of industrial sectors. The result will be a conversion from a traditional industry to a high-tech sector that can provide an answer to global trends and answer the challenge of competition from abroad. In the long term, the relationships built will contribute to the maintenance of not only a unique culture within Flanders, but also the industry responsible for the conversion of raw material to finished product. These renewable raw materials could become an exceptional asset for Flanders, especially because this material can be transformed into high-technology products.

9.6 Plant architecture – an alternative route to more persistent ryegrass and red clover

Plant architecture is a very important component of crop yield and quality. A complex interaction of genetic and environmental factors determines the final plant architecture. Changes in plant architecture have made a major contribution to the evolution of the various plant species we know today. Similarly, the genetic diversity in plant architecture was an important source for the domestication of crop plants. One of the best known examples is the TEOSINTE BRANCHED 1 gene that explains the striking difference between maize and its ancestor teosinte. Although large architectural changes are explained by only one or few gene(s) and a wealth of knowledge exists in model plants, the genetic control of plant architecture remains poorly understood in most crop species.

The exploration of plant architecture offers new traits and concepts for the improvement of yield and production methods and is, therefore, an important challenge for Flemish agriculture. Traits of forage grasses influenced by plant architecture comprise persistence, sward density, and yield. By modifying plant architecture, the yield stability throughout the years, as required in permanent grasslands, can be improved. With the introduction of the legal restrictions on nitrogen use, the interest in sowing clovers into grasslands has grown tremendously among farmers. Even though red clover has a high nutritional value, the use of it for these purposes is currently limited by its poor persistence in grasslands. Here, branching and/or creeping cultivars would probably display better persistence and allow a broader use of red clover in grazing systems.

Today, the importance of plant architecture as a yield component is widely accepted, but plant architecture only seldom turns up among important traits in production or breeding, often because of a lack of readily applicable knowledge. To solve this dilemma, knowledge needs to be generated at two different levels. First, the ideal branching phenotype of a crop needs to be delineated and the relationship of branching with other major crop traits

needs to be established. Second, the genetic regulation of branching in the crop needs to be unravelled: which genes are important, what their allelic diversity is, and how this genetic knowledge can be applied in breeding and crop production. For genetic control, the Plant Growth and Development team is currently developing a translational approach that will transfer knowledge in model plants, such as *Arabidopsis*, to ryegrass and red clover. Research on plant architecture will result in strategies to modify branching in both breeding and production of agricultural crops.

Significant architectural differences in red clover populations

9.7 Damage by wintering geese to agricultural crops

About four million geese migrate every year from Svalbard (Spitsbergen) and Siberia to Western Europe to spend the winter. In addition to the Netherlands, Belgium is also popular destination: in the coastal region of Flanders, geese numbers can rise to many tens of thousands (ca. 80.000). The species involved are mainly the white-fronted goose and the pink-footed goose. Their numbers

Pink-footed goose on pasture

have steeply increased in the past decennia due to nature conservation measures such as a hunting stop, amongst other reasons. Flanders has a responsibility for the conservation of the geese populations, since important proportions of protected species choose to spend their winter in our region.

Taking responsibility for these wintering guests also means acknowledging the negative consequences of their presence. Foraging geese can cause damage to a number of agricultural crops present during winter, such as winter wheat, rye grasses for seed production, and pasture. This can lead to strain between farmers and nature-conservation organisations. A compensation procedure for farmers exists, but it is complicated and has to pass through small-claims court. The Flemish government wants to replace this with a simplified administrative procedure. The Nature and Forest Agency (ANB) will be responsible for performing a damage assessment. Such an assessment should be done in an objective and practical way.

To develop a practical and scientifically sound method of damage assessment, ANB decided to launch a project on the subject. This resulted in an assignment for ILVO and INBO (Research Institute for Nature and Forestry), who will cooperate to complete the project. ILVO is responsible for the agriculture and researching the effect of goose grazing on winter wheat, rye grasses for seed production, and pasture. INBO monitors the goose populations–their distribution and evolution in numbers

and species–by means of bird counts. By determining densities of goose droppings, the relationship with grazing intensity and subsequently caused damage will be investigated.

The objective of this project is to generate supporting scientific evidence for an objective method of assessing damage caused to agricultural crops by wintering geese. In addition, the researchers will be able to develop expertise in assessment. Lastly, the researchers will estimate the yearly damage caused by wintering geese in Flanders.

These objectives will be realised by perfoming field experiments in parcels of winter wheat, ryegrass seed production and pasture, both on ILVO's experimental fields and fields of cooperating farmers. This way, effects of (simulated) grazing by geese on the development of the crop can be studied. Grazing can occur under various conditions, which can have variable effects on final crop

Goose grazing in ryegrass

yield. Date of sowing and development stage of the crop in which grazing occurs are of major importance, as is grazing intensity. Yield measurements reflect quantitative losses, but qualitative losses are also important. To study the latter, indicators of quality such as moisture content, weight per thousand seeds, etc. are measured during and after the harvest. Furthermore, the possibility that the presence of geese on fields could affect the nitrate level in the soil is under investigation. In this way, the researchers aim to describe all aspects of grazing damage caused by wintering geese.

9.8 National Reference Laboratory for Plant Diseases

On September 1, 2007, ILVO's Plant Sciences Unit-Crop Protection received official designation as a National Reference Laboratory (NRL) for Plant Diseases from the Federal Agency for the Safety of the Food Chain (FASFC). The NRL Plant Diseases is established as a consortium between ILVO and the Centre Wallon de Recherches Agronomiques (CRA-W) and is coordinated by ILVO. The scope of the National Reference Laboratory covers support of the FASFC policy concerning quarantine plant-pathogenic organisms. ILVO acts as NRL for bacteriology, entomology, nematology and mycology, whereas CRA-W represents mycology and virology.

The most important tasks of the NRL are:

- Maintaining high-level scientific expertise and technical competence
- Participation in inter-laboratory studies
- Organisation of ring trials on a national scale
- Supplying technical and scientific advice to the FASFC and to the FASFC-recognised laboratories
- Organisation of workshops and informative meetings
- Playing an active role during crisis situations

The scientific expertise and technical competence are mainly supported by in-house research, two important aspects of which are development of diagnostic methods and quality control. We also represent Belgium in European networks on regulated organisms on plants. We actively participate in working parties and expert groups of the 'European and Mediterranean Plant Protection Organisation' (EPPO), the 'European Mycological Network' (EMN), the 'European Association of Phytobacteriologists' (EAP), the Werkgroep AardappelCysteaaltjes Onderzoek (WACO), and the *Meloidogyne*-werkgroep, among others. The latter two are Belgian-Dutch nematology associations. Of course, these NRL activities and networks also facilitate international partnerships for research. ILVO is involved in the EU-ERAnet EUPHRESCO, whose task is to stimulate coordination and collaboration of plant health research in Europe.

The workshop on 'Quarantine disease and plagues on potato'

The first NRL-workshops were organised in 2008. On March 10, a study day on 'Guidelines for Sample Submission' took place for the inspectors of the FASFC. On October 23 and 24, a workshop was organised for these inspectors about the recognition of some possibly significant pathogenic organisms. The workshop 'Quarantine Diseases and Potato Plagues' (November 27 and 28) was then presented for inspectors of the Flemish and Walloon regions.

9.9 Validation of methods for the detection of antibiotics, chemotherapeutics and non-steroidal anti-inflammatory products in meat

Upon the demand of the Federal Food Agency, methods for the detection of residues of antibiotics, chemotherapeutics, and non-steroidal anti-inflammatory drugs were developed and validated at ILVO-T&V. The goal was to detect as many compounds as possible with as few different methods as possible, in order to minimise the work pressure and analysis costs.

Each administration of a veterinary drug to food-producing animals can lead to the presence of residues in edible tissues, e.g. meat. The concentrations can be rather high on the place where the drug was injected. To protect the health of the consumer, the European Union published legislation in which maximum residue limits (MRL values) were set for residues of veterinary medicinal products in foodstuffs of animal origin. These values were determined on the basis of toxicological data. They take the kind of foodstuffs into account where the residues may be present as well as the maximal consumption pattern. The values are set for certain substances in certain matrices of a determined species. In beef tissue for example, the MRL (maximum residue limit) for flunixin is 20 µg/kg whereas in chicken production this compound is not allowed because no MRL value was determined.

In order to be able to monitor these substances in a reliable way, there is a need for methods able to detect the substances at the MRL level in case a MRL was set, or at a level as low as possible for forbidden compounds. Regarding the screening of antibiotics and chemotherapeutics, the broad spectrum microbiological inhibitor test Premi-Test (after a solvent extraction) and the *E. coli*-plate test (detection of quinolones) were validated. In a primary validation of the Premi-Test after a solvent extraction, the detectable concentrations of 26 different inhibitory substances in "spiked" blank pork meat were determined. The reading was performed both visually and reflectometrically by means of a flatbed scanner with special software (PremiScan), expressing the colours in z-values. In a preliminary study the z-value with the highest likeness (positive – negative) between instrumental and visual reading was determined: a z-value = -4.50 could be used as cut-off value. Out of the validation results we could conclude that the tetracyclines present on the MRL list, the tested penicillins and cefalosporins with an MRL, and some of the tested sulfonamides or macrolides (tylosin and erythromycin), can be detected on MRL level. On the other hand, the test is poorly sensitive for fluoroquinolones, aminoglycosides, colistin and chloramphenicol. If possible, other screening tests like the *E. coli*-plate test (quinolones), B. *cereus*-plate or Tetrasensor Tissue (tetracyclines, beef meat), CAP EIA (chloramphenicol), and others should be performed in addition to the Premi-

Test after solvent extraction. Regarding the detection of tetracyclines, erythromycin, chloramphenicol, dapsone and sulfa drugs the detection limits described by Stead *et al.* (2004) were not met, despite the fact that the same extraction procedure was performed with an exception for the temperature during the evaporation. A second set of experiments validated a limited number of substances (penicillin G, oxytetracycline, tylosin, gentamycin and sulfamethazine) on meat of other animal species (beef, chicken and fish (*Pangasius*)).

Regarding the primary validation of the *E. coli*-plate test, the detectable concentrations of all quinolones present on the MRL list (danofloxacin, difloxacin, enrofloxacin, ciprofloxacin, flumequine, marbofloxacin, oxolinic acid and sarafloxacin), and also of norfloxacin were determined in 'spiked' pork meat. Out of the results we can conclude that all quinolones with a MRL in pork meat can be detected at their respective MRL with the *E. coli*-plate test. In a secondary validation study, tests were performed on tissue of other animal species (beef, chicken, fish (*Pangasius*)) for the quinolones registered in Belgium for food-producing animals.

Non-steroidal anti-inflammatory drugs are substances that have a analgesic, antipyretic and anti-inflammatory effect. In contrast to the corticosteroids they don't have a steroidal base, hence their name, but they comprise a

E. coli-*plate test*

group of substances with several different structures. Many of these compounds are also used in human medicine, such as Voltaren®.

For the anti-inflammatory drugs a liquid chromatographic-mass spectrometric method was developed and validated. At the moment, 9 different compounds can be analysed in one single analysis. With the method used it is possible to add new components so that the scale of detected compounds can be extended. All forbidden compounds can be easily detected at the level of 5 µg/kg and the MRL-compounds at half MRL.

9.10 ILVO's networking in Europe: participation in three new COST Actions

COST, 'European COoperation in the field of Scientific and Technical Research,' the first and the widest European network of its kind, was established to improve EU-level coordination of research activities funded by national authorities. COST's mission is to strengthen Europe's scientific and technical research by supporting cooperation and interaction between European researchers. The funds provided by COST cannot be used to finance research itself, but rather support networking activities within the overarching policy of increasing support to early-stage researchers. This funding supports, for example, the organisation of meetings/workshops/conferences around a specific research subject that has been positively evaluated by the COST office.
Also short-term scientific missions (STMS) and exchanges of (young) scientists between participating Parties is one of the possibilities. Furthermore, COST provides support for the organisation of Training schools, the setup of a website

dedicated to the Action, and so on. For more details please have a look at http://www.cost.esf.org.

Briefly summarised, participation in COST Actions is the ideal way to built up new networks or to extend existing ones. Being part of such networks makes it is easier to contribute to new national and international research projects and hence to gather funding for the intended research projects.

In the coming four years ILVO will actively participate in the following three COST Actions:

9.10.1 COST Action FA0802: "Feed for Health"

As in human nutrition, concepts in animal nutrition are changing. Optimal nutrition is now considered fundamental whereas in the past adequate nutrition was considered sufficient. Optimal nutrition implies that feeds must be considered not only in terms of their nutritional properties but also in terms of their ability to promote health and protect against disease. The health of the animal is fundamental in determining the quality, safety and wholesomeness of foods of animal origin for human consumption. This COST Action creates a research network concerned with: the role of animal nutrition in improving animal health; the role of animal nutrition in designing functional foods for humans; and the development of the concepts of feed safety, feed quality and feed functionality, as counterparts of these ideas as they are currently applied foods for humans. The main task of the network will be to promote the acquisition and facilitate the dissemination of knowledge in these areas and encourage cooperation between various groups working in the area.

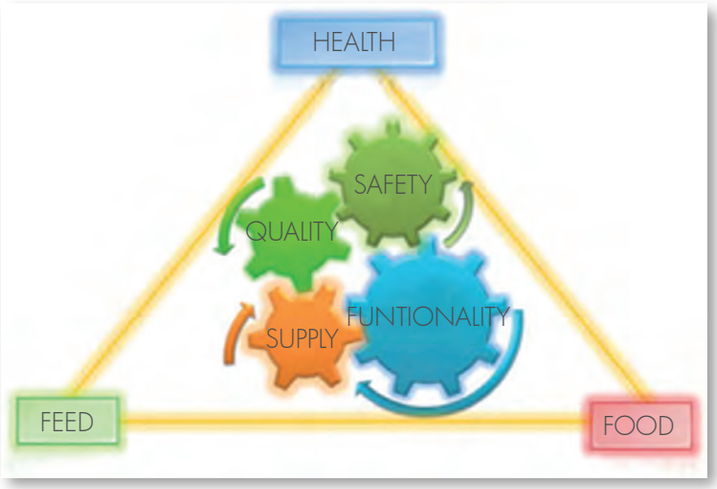


Figure 26: The Feed-Food-Health triangle

9.10.2 COST Action FA0804: "Molecular farming: plants as a production platform for high value proteins"

Proof-of-principle for Molecular Farming (MF) has been established over the last 15 years through sustained efforts of a growing number of European research groups. This work has been supported by the strategic decision of the EU to fund several initiatives through FPs 4-6 resulting in an impressive volume of generated knowledge. The aim of the Action is to leverage fruits of earlier EU, national and industrial investments in Molecular Farming to reach the next level, i.e. to move from R&D to applications, to develop product-oriented platforms, to enable new classes of products, to lower the costs and ultimately to commercialise the products. This Action will create new opportunities for European agriculture, horticulture and related technology sectors as the plants dedicated to Molecular Farming constitute new high-value crops. The Action brings the key players together and will increase European momentum, capacity and infrastructure. It will also expand activities to countries that have not thus far been able to participate, including developing countries. The concrete outcome will be a sustainable European Molecular Farming community with a clear vision, and links and input into scientific, regulatory, biosafety, intellectual property (IP), dissemination and public engagement activities.

9.10.3 COST Action FA0602: "Bioactive food components, mitochondrial function and health"

Good functional mitochondria are essential for a healthy organism. The performance of mitochondria can be influenced by diet and dietary components. This provides opportunities for the improvement of human health and represents development opportunities for the food industry and science. Despite its importance world-wide, research in this area is extremely limited. This COST Action will set up a structure to bring the mitochondrial research community and the nutrition-research community together and build an integrated European research community aimed at understanding the interdependency between bioactive food components and mitochondrial function. Better understanding of this interaction may lead to important economic and social benefits by improving health, boosting industrial innovation and sustaining European competitiveness in this field.

9.11 ILVO's work to improve chicory harvesting techniques

Nearly the entire chicory crop of Belgium is used for the extraction of inulin in the Orafti and Warcoing Group extraction plants. Inulin has several valuable qualities. It is a polysaccharide and slow-to-assimilate sugar without a sweet taste. It has a low caloric value and doesn't influence the blood sugar level, which makes it particularly suited for diabetics. It is a bifidogenic factor, which enhances the growth of bifidobacteria in the intestinal flora. Inulin is a white creamy compound without a sweet taste, and is an ideal substitute for fats and bulk matter. It is also in high demand as a technical medium for the cosmetic industry.

Harvesting chicory roots

The chicory plant's long and vulnerable roots cause harvest losses. Generally, modified sugar beet harvesters are used to lift the roots and remove the excess soil from the roots. During harvest and transport, mechanical root damage should be avoided as much as possible.

Harvesting chicory roots

Commissioned by the Agricultural Centre for Beet and Chicory (CABC-LCBC), the Institute for Agricultural and Fisheries Research, the Walloon Agricultural Research Centre (C.R.A.), ORAFTI and the COSUCRA group all work together to improve the harvest quality of chicory. Currently, harvesting losses reach about 5 to 15%, mainly due to the root tips breaking off and remaining in the ground. From 2003 to 2005, ILVO's research focused on tuning of the chicory harvesters to minimise root damage. Since 2007, ILVO has compared different types of subsoiler teeth, which break up the soil just before lifting the roots, to evaluate their effect on harvest quality. In 2007, an initial experiment was planned on a test field of ORAFTI. Three harvesting techniques were compared: a sharp-pointed subsoiler tooth, a newly developed goosefoot-shaped tooth, and no subsoiler. The specific design of the second subsoiler type was developed based on extensive experience and insights in chicory harvesting. The teeth were drawn by means of CAD software and constructed in the ILVO workshop. Each type of subsoiler should be tested under dry, normal and wet soil conditions. Due to wet weather conditions in 2007, no tests were carried out under dry and normal soil conditions.

Example of a subsoiler

The new Orafti hoe

Two times six rows were harvested using each technique. For each technique 400 roots were collected. The root length, head diameter, and breaking diameter were precisely measured on each root. The data was statistically processed using a nested Anova technique in the Statistica software. This analysis shows an effect of the technique on the relation between the break diameter and the head diameter (figure 27). Harvesting with subsoiler teeth did not yield better results than without subsoiler teeth. Also, the new tooth design showed no improvement compared to existing models. Similar conclusions could be reached from the root length and break diameter. These disappointing results can be explained by the adverse harvesting conditions. Based on the results of this test, it seems that subsoilers should not be used under wet conditions.

In 2008, new tests were carried out. The results of these measurements are currently processed and will be published in a thesis in cooperation with KH Kempen of the Katholieke Universiteit Leuven Association.

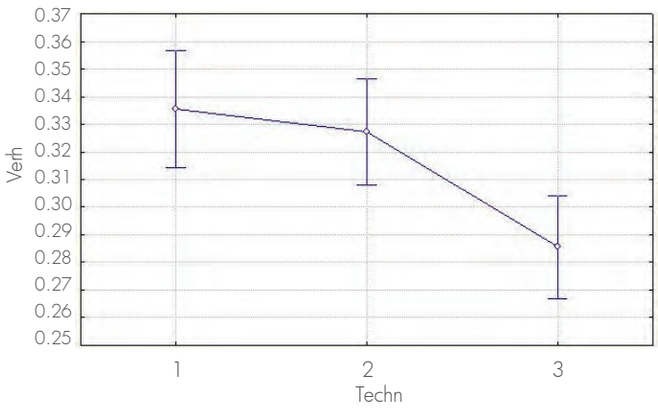


Figure 27: The effect of various techniques on the relation between break diameter and root diameter

10. Service Provision

10.1 Animal Sciences

10.1.1 Reference laboratory ANIMALAB

The implementation of quality controls has become increasingly important due to the evolution towards integral and sustainable quality management of animal and human nutrition in an ecological, economical and social context. These controls encompass among others, the monitoring of the biological and chemical quality of the marine environment and habitat, the determination of contaminants within fishery-related environmental control, and the composition and nutritional value of fish and animal feed and of animal products like eggs, milk, meat, and fishery and aquaculture products. Correct and reliable analyses are therefore extremely important for government authorities, the fish- and animal feed industry, and for private fish hatcheries and livestock farmers. Taking the growing importance of quality and customer service into account, the board of directors of ILVO-Animal Sciences decided at the end of 2007 to execute all analytical activities both in the framework of its policy-supporting mission as well as its contract research in 16 testing laboratories (unified in the so-called «ANIMALAB»). All of these laboratories work according to the criteria of the European standard NBN EN ISO/IEC 17025. This means concretely that the laboratories in Ostend will also have to meet the same accreditation criteria as the laboratories in Melle, which have been accredited since March 6, 2007 according to the standard mentioned above (certificate T-315).

Considering that over 80 persons spread over 2 locations will have to conform to this standard, the organisation as well as the existing management system required considerable reform in 2008.

The first step taken was to group all activities of the reference laboratory ANIMALAB into the Business Unit of ILVO-Animal Sciences, and assign each activity, according to the type of parameter, to one of the sixteen laboratories. Each laboratory has a specific scope of expertise and analysis: biochemistry, chemistry, chromatography, physics, genetics, immune physiology, nursery, microscopy, wet, organoleptic analyses, otolith analyses, plankton, technical science, digestion physiology, fish, and fish quality.

We renewed a number of administrative matters in and around the laboratories together with these organisational changes. After an internal move of laboratories, offices and rooms, we reassigned analyses and related equipment; prepared the purchase and management of goods and equipment in a unit-based manner; and we wrote or adapted procedures relating to the trial and analysis cards. Staff was kept abreast of the ongoing implementation of the standard through written communication and information sessions.

The final step was to re-evaluate the unit's services and compile a global and versatile document that outlined the technological, analytical and scientific aspects of the unit.

Whereas we mainly reformed organisational and administrative matters in 2008, in 2009 we will mainly prepare for achieving accreditation in the spring of 2010 through writing and executing validation tests and quantifying the uncertainty for an number of analyses. Besides chemical parameters like PAC's or PCB's and genetic parameters like authenticity and parenthood analysis, there are also more biological analyses such as the determination of the age of fish, the determination of marine organisms to the level of species, and the determination of the optimal growing conditions for organisms in aquaculture. This reorganisation will be a stiff challenge, not only because of the analyses involved, but also because of the significant scientific research required. However, once achieved, the accreditation will certainly contribute to the reference working of ANIMALAB and related scientific research groups, and will increase the standing of the Animal Sciences Unit and ILVO in general.

Lab

10.1.2 ILVO PreventAgri

The 'PreventAgri' project was started in 2001 thanks to the financial support of the Federal Government Service WASO (Federal Government Service for Employment, Labour and Social Consultation) and ESF (European Social Fund). The project focuses on welfare of the farmer and horticulturist, and consists of various initiatives, such as on-farm-audits and information sessions. After having been coordinated for two years by ILVO's Technology and Food Sciences Unit-Agricultural Engineering, the project is now coordinated by ILVO-Animal Sciences under the name ILVO PreventAgri. As of July 1, 2008, the Flemish Government's Cabinet of Agricultural and Fisheries took responsibility for the financial aspect of the project.

On the European level, the agricultural and horticultural sector accounts for most of labour-related accidents and injuries, after fisheries, construction, and metal industries. Many of the victims are children. The accidents often have dramatic consequences. Sustainable agriculture requires that farmers and growers have to consider the environment, food safety and animal welfare. However, they receive barely any support or advice on safety and health issues. The creation of sustainable agriculture and horticulture also implies the development of a safe and healthy work environment.

The Consultancy Service of ILVO PreventAgri wants to meet this shortcoming by issuing information, increasing awareness, and providing training. In 2008, ILVO PreventAgri organised different trainings about safe handling of phytopharmaceutical products, safe methods of working with machinery, prevention of back problems, and welfare regulations and risks in agriculture and horticulture. Hundreds of brochures were distributed with information on these issues. The distribution of the DVD on the safe use of crop protection products was continued. Almost 400 subscribers received a bi-monthly newsletter. Various popularising publications and the presence of ILVO PreventAgri at agricultural fairs and exhibitions assured that many people from the sector were exposed to the project. Moreover, the project provides individual consultancy in order to give the farmer or grower insight in the risks for diseases and accidents on the farm.

PreventAgri warning

10.2 Social Sciences

10.2.1 Coordination of the Network for Organic Food and Farming Research

The network brings together relevant stakeholders (researchers, policymakers, the agricultural sector, etc.) to generate and disseminate knowledge and information for the organic agriculture sector in Flanders. It mainly acts as a platform for discussion and communication. More information can be found on the network's website (www.nobl.be) and in chapter 9.4 'In the Spotlight'.

10.2.2 Provision of agriculture/environment indicators

- Research on indicators for the relation between agriculture and the environment relates directy to monitoring. Included in our activites are contribution to the annual State of the Environment Report (MIRA), including writing (parts of) the chapters on Agriculture and Eutrophication. We also contribute background documents and indicators for the indicator report and the website www.milieurapport.be.

- Delivery of indicators to the OECD, EUROSTAT, VMM, etc., e.g. concerning the soil nutrient balance, agriculture, environment, rural development, and others.

10.2.3 Advice on the implementation of MOTIFS, the Monitoring Tool for Integrated Farm Sustainability

MOTIFS is an instrument for sustainability assessment at the farm level. It was designed to help farmers toward more sustainable production while considering economic, ecological, and social aspects. The Social Sciences Unit advises farm consultancy and accountancy agencies, extension agents and public authorities who want to start using the instrument with their customers. More information on MOTIFS can be found under 8.9.

10.2.4 Advice for policymakers

- Application of available models to analyse possible consequences of policy measures. This can be at the farm level or for the entire sector and considers both economic and environmental outcomes.

- Advice concerning policy issues, usually on topical matters (in the past recommendations have been formulated concerning, organic farming, manure policy, sugar policy, rural development, and others).

- Participation in various stakeholder and feedback groups, and referee work for policy-preparation documents.

10.2.5 Organisation of activities to stimulate the exchange of knowledge

• Publication of a book of proceedings from the Farming for Health conferenceorganised at the end of 2007. This book is a reflection of the work of both academics and people from the field. It is based on both scientific research about and daily experiences with Farming for Health initiatives.

• Joint organisation of the 12th conference of the European Association of Agricultural Economists, which was held in Ghent from August 26- 29, 2008. 781 delegates reflected there on global trends and European strategies for food production, capturing elements relevant to agriculture and its environment, with a focus on human well-being.

10.3 Technological advice and service in horticulture: SIETINET

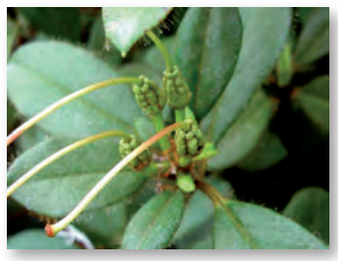
Ornamental production in Flanders is a very innovative sector. Consequently, Flemish horticultural products occupy an important place on the world market. Nevertheless, strong competition comes from countries offering lower wages and those with a more favourable climate. However, Flanders has the advantage of technical know-how. Flemish research institutes occupy a prominent research position and have access to worldwide scientific knowledge. Difficulties arise, however, in the transfer of expertise to the horticultural business. Therefore, a project offering technological advice and service in horticulture, called SIETINET, was started in 2004 and was recently extended for four years. SIETINET brings together both Flemish horticultural companies and research centres. The project receives financial support from IWT as a technological and advice project.

Currently, more than 60 companies have joined the consortium. Members represent a variety of core businesses: *in vitro* companies and production or young plant companies, with or without their own breeding activities. The participating companies produce diverse plant species and also differ in company size. Both one-man companies and large international concerns take part in SIETINET.

ILVO coordinates the project. The other scientific partners are the Research Centre for Ornamental Plants (PCS), Ghent University, Ghent University College, Flanders Institute for Biotechnology (VIB), Brussels Free University (VUB), University of Antwerp (UA), Catholic University of Leuven (KULeuven) and KATHO-campus Roeselare. SIETINET employs a technical advisor who is responsible for the fluent transfer of know-how from the research institutes to the hortibreeder companies. This information transfer is focussed on four topics:

- breeding,
- *in vitro* technology,
- DNA marker technology,
- plant physiology.

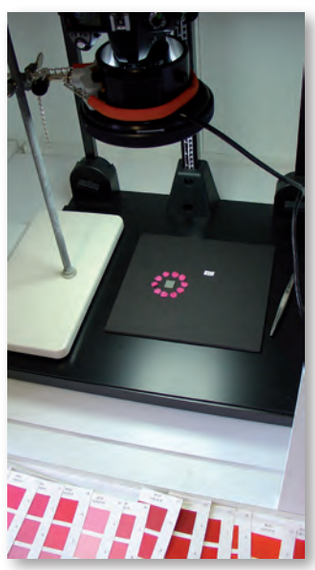
The last topic is novel and contains many promising prospects for sustainable technological development and sustainable production. Also, the companies will be informed about new possibilities related to genes and Genetically Modified Organisms (GMOs).



Rhododendron *fruit*

As part of the service, hortibreeders can contact SIETINET for technological advice. In this context, more than 100 instances of advice are given yearly. Another service is the opportunity for each member to request specific research. IWT contributes to the cost of this research. Workshops and symposia are organised to keep members informed. In the past, themes like plant protection, intellectual property and ploidy research received much interest. Members receive a quarterly newsletter. Additionally, SIETINET sends an overview of the most recent developments in scientific research every 2 months. The advisor also helps members with innovative ideas for compiling documents for financial support from funding organisations like IWT. As technological innovation and improvement play a crucial role in hortibreeder companies, services offered by SIETINET may have an important impact on members' R&D investments.

in vitro *propagation of* Rosa *hybrids*



Measurement of colour variation of azalea flower

10.4 Varieties developed by ILVO-Plant PGV

Cultivars on variety lists and commercialised

10.4.1 Seed multiplied

Perennial ryegrass – fodder type		
	diploid	- Achat
		- Isabel
		- Meloni
		- Melpico
		- Melpro
		- Melways
		- Merbo
		- Merganda
		- Merks
		- Milvo
		- Paddok
		- Plenty
		- Odessa
		- Rebecca
		- Vigor
	tetraploid	- Ernesto
		- Floris
		- Graciosa
		- Melpetra
		- Meradonna
		- Merkator
		- Merkem
		- Merlinda
		- Pandora
		- Pomerol
		- Roy
Perennial ryegrass – turf type		
		- Ilio
		- Olano
		- Oxiana
		- Relon
Italian ryegrass		
	diploid	- Adin
		- Bellem
		- Belluna
		- Davinci
		- Lemtal
		- Melcasso
		- Melchior
		- Melclips
		- Meribel
		- Merode
		- Mertaki
		- Meryl
		- Muriello
		- Nadine
		- Prospect
		- Romeldo
	tetraploid	- Gemini
		- Fedra
		- Meltop
		- Melquatro
		- Meritra
		- Meroa
		- Salomé
Hybrid ryegrass		- Hymer
		- Lemsor
Westerwold ryegrass		
	diploid	- Melworld
		- Mendoza
	tetraploid	- Lemnos
		- Melmondo
Meadow fescue		- Merifest
Timothy		- Anjo
		- Comer
		- Dolina
		- Erecta
		- Tibor
Red fescue		- Nevski
		- Rolf
Red clover		- Global
		- Lemmon
		- Mercury
		- Merian
		- Merviot
		- Rotra
		- Violetta
White clover		- Merida
		- Merlyn
		- Merwi
Chicory		- Arioso
		- Belcanto
		- Continuo
		- Crescendo
		- Echo
		- Enigme
		- Hera
		- Melci
Stubble turnips		- Durmelander
		- Dynamo
		- Leielander
		- SF0701G
		- SF0702T
Forage rye		- Jobaro
Fodder beets		- Adagio
		- Bolero
		- Gonda
		- Ilbo
		- Ribondo
White mustard		- Chacha
		- Flamenco
		- Meringue
		- Polka
		- Rumba
		- Salsa
		- Solea
		- Swing
Fodder radish		- Brutus

	- Cassius
	- Dux
	- Lucas
	- Maximus
	- Nero
	- Sirius
	- Sixtus
Forage rape	- Dino
	- Napoleon
	- Wilma
Parsley	- Mersil
Scorzonera	- Antonia
	- Keukenfee
Leek	- Makostar

10.4.2 Vegetatively multiplied

Roses	- Adolf Papeleu
	- André Brichet
	- Annelies
	- Anton Van Dijk
	- Archimedes
	- Balduinus
	- Benoit Friart
	- Celientje
	- Cera
	- Cicero
	- Dream
	- Floranje
	- Florizel
	- Godelieve
	- Gold Cup
	- Gomery
	- Graaf van Vlaanderen
	- Hertog van Brabant
	- Jacky's Favorite
	- Joke
	- Kanegem
	- Kasteel van Ooidonk
	- Koksijde
	- Liparfum
	- Lysa
	- Margriet Hermans
	- Marie Louise Velge
	- Melglory
	- Melgold
	- Melrose
	- Michelle d'Hoop
	- Nele
	- Pink Kanegem
	- Prinses Astrid
	- Prinses Mathilde
	- Professor Boesman
	- Rafael Braeckman
	- Rivierenhof
	- Rosarium Den Blakken
	- Sabine
	- Showy gold
	- Slot van Laarne
	- Toporanje
	- Ville du Roeulx
	- Wettra
	- White Symphonie
	- Windekind
	- Xantippe
Cut roses	- Païline
Bromelia	- Cathy
	- Diabolo
	- Fernanda
	- Festival
	- Regine de Ligne
	- Romero
Hibiscus	- DvP Azurri/Azurri®
	- Melmauve
	- Melroze
	- Melwhite
Malus	- DvP Appollo/Appollo®
	- DvP Obel/Red Obelisk®
	- Pompom
Azalea	- Cheops
	- Cupideau
	- Directeur Van Slycken
	- Flamenco
	- Gilbert Mullie
	- Lara
	- Laura Ashley
	- Lara Rood
	- Mevr. André Heungens
	- Mevr. Jozef Heursel
	- Mevr. Marcel Vanbelle
	- Mevr. Roger De Loose
	- Mevr. Van Eetvelde
	- Mistral
	- Phoenix
	- Prinses Claire
	- Roger Raveel
	- Rolinda
	- Roxane
	- Roxette
	- Schuman
	- Vinivi
Ligustrum	- Melgreen/Green Century®
	- Melblack
Begonia	- DvP
	- Optima Savanna
	- Optima Taiga
Chamaecyparis	- Melgold
Prunus	- Melred
	- Melred Weeping
	- Melstar
Hydrangea paniculata	- DvP Pinky/Pinky-Winky®

10.5 The Diagnostic Centre for Plants

Quality has become a prerequisite for a competitive agriculture and horticulture in Flanders. Consequently, production and trade are increasingly being challenged by the demand for assurance of plant health. Reliable and early diagnosis of pests and diseases is therefore indispensable.

The Diagnostic Centre for Plants (DCP) is the prominent plant health laboratory in Flanders. Safeguarding and improving the health and quality of commercially-produced plants and plant products provides significant support for the policy of sustainable agriculture and horticulture. The offered services are accessible for growers, consultants, private customers, research facilities and government extension services. A number of important tests for the certification of planting materials and for the implementation of the European plant health legislation, are performed at the DCP to ensure that high-quality planting material, substantially free from plant pests and diseases, is available to growers. The DCP also detects and identifies quarantine organisms in plants, plant products, soil, growing substrates and surface water. The DCP treats more than 6500 samples per year, from individual samples to large-scale surveys.

In the DCP, bacteria, fungi, viruses, mites, insects and nematodes are traced, isolated en identified. An extensive variety of conventional and molecular analytical methods are available to provide timely and accurate results.

The DCP is a dynamic force in both the diagnostic and research activities in Plant - Crop Protection. Diagnosis exploits methods developed in the various research programs, and research results are used to create tailor-made advice for disease and pest management, vigilant for the impact on the natural environment. At the same time, new diagnostic reports from DCP can be the source for new research initiatives.

Significant adjustments have been made to the laboratories to handle quarantine organisms according to biosafety requirements. The facility for reception, storage and treatment of potato tuber samples has been rebuilt to guarantee reliability of these processes.

The DCP obtained accreditation according to the ISO17025 standard for a number of high-risk statutory organisms. The first supervision and extension audit has been planned for early 2009. Obtaining this accreditation certificate is the official affirmation of the DCP's technical competence, as well as the objectivity of the results obtained through analytical methods, then normalised and validated for application in the analytical matrices.

10.6 Variety Testing – Post-control trials – Seed Testing Laboratory

In the context of a mandated assignment of the Agency for Agriculture and Fisheries' Product Quality Management Division, ILVO's Plant Sciences Unit – Crop Husbandry and Environment research area (Plant-TO) gives scientific, technical and logistical support for the execution of the EU directives concerning the national variety catalogue of agricultural crops (Directive 2002/53/EU).

In the case of agricultural crops, a new cultivar can only be traded when it is registered on the Belgian or European variety catalogue. A cultivar admitted to the national variety catalogue of an EU-country automatically enters the European catalogue after several months (Directive 70/457 en 98/95). A new cultivar is admitted for inscription to the Belgian variety catalogue when it has an approved name, is sufficiently distinct, uniform and stable (DUS), and has a sufficient value for cultivation and use (VCU). To evaluate the DUS and VCU, a new cultivar is tested during 2 to 4 years in comparison to standard varieties, i.e. Variety Testing. The protocols for the DUS and VCU trials are set by the Technical Interregional Working group (TIW).

10.6.1 DUS-trials

Plant-TO executes the DUS-trials for chicory and fodder beets, according to the UPOV-criteria (Union pour la Protection des Obtentions Végétales). For other crops, there are bilateral agreements, e.g. with France for maize. At this time, 3 chicory varieties (among 24 standard varieties) are tested in the DUS-trials. ILVO also executes DUS testing for tuberous begonia hybrids for the CPVO (European breeders' rights).

10.6.2 VCU-trials

ILVO-PlantTO executes the VCU-trials for each agricultural crop when there is a new requirement for registration, with the exception of sugar beets. In 2008, trials were carried out for silage maize and corn (55 varieties in trial), ray grasses (25 varieties in trial), chicory (2 varieties in trial), flax (1 variety in trial) and cereals (34 varieties in trial).

VCU trial silage maize

Sample taking VCU trial silage maize

A cultivar has a sufficient value for cultivation and use when it demonstrates a clear improvement compared to the current cultivars for cultivation, value of the harvest, or products obtained. Sometimes lesser performance of certain characteristics (e.g. yield) can be compensated by specific favourable characteristics, such as disease resistance.

Depending on the species, 6 to 10 trials are laid out on different locations in Flanders (Merelbeke, Geel, Poperinge, Bassevelde) and the Walloon Region (executed by CRA-Gembloux). In these trials, the new cultivars are compared with standard varieties (i.e. the current best varieties in the commercial circuit) according to previously determined criteria by using a weighing factor. The new cultivar is admitted for inscription into the Belgian variety catalogue when the results of the VCU and DUS trials are positive, and once it has an approved name.

10.6.3 Post-control trials and Seed Testing Laboratory

The following activities were set up for the executive control tasks connected to the legal quality control of plant material concerning the whole chain, from testing a new variety to control of the seed production and post-control of seed multiplications:

- Official pre- and post-control trials for grasses, flax and potatoes
- Supporting activities for the Seed Testing Laboratory

Sowing fodder beet with plotspider

VCU trial flax

10.7 Reference laboratory for plant and soil

The reference laboratory for plant and soil performs analyses to support policymaking and the functioning of the Plant Sciences Unit. It also provides services to third parties. The most important analyses are:

Flow analyser for determination of mineral N in soils

Sample preparation of soils for analysis of mineral nitrogen

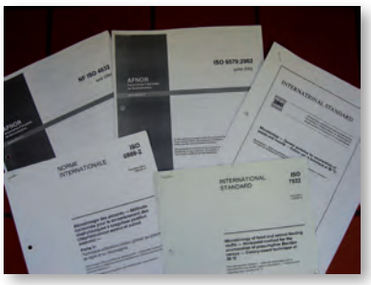
- Determination of the quality of plants and forages
  - Chemical composition: moisture, crude ash, crude protein, crude fiber, cell wall components NDF, ADF and ADL , and starch (accredited according to ISO/IEC 17025: 2005).
  - *In vitro* digestibility of the total plant and plant cell walls.
  - NIRS analyses for screening of varieties and potential varieties of grasses and maize to support variety testing trials and breeding programs. For moisture, crude protein, crude fiber, and starch content. These analyses became accreditated in 2008.
- Analysis of the sugar content (inulin) and degree of polymerisation in chicory
- Determination of quality and nutritional status of substrates and composts (chemical and physical)
- Analysis of mineral soils (residual nitrates and ammonia, organic carbon and pH)

10.8 National Reference Laboratories (NRL) for GMOs and Milk and Milk Products

The NRL for GMOs was established in July 2006 as a consortium between the three official laboratories for GMO control: ILVO-T&V, CRA-W and ISP/WIV. Routine tasks of the NRL-GMO include: harmonisation of GMO detection procedures between the three labs; validation and implementation of official CRL methods for GMO analysis; improvement of existing procedures for routine control for GMOs in food and feed products; participation in workshops organised by the FASFC and CRL for GMOs; technical and scientific collaboration with the CRL-GMFF and within the ENGL, and organisation and coordination of visits to the NRL-GMO laboratories. In addition to these permanent tasks, the NRL organised two practical workshops as well as a theoretical training in 2008. The subject of the practical workshops, organised for the external labs by the CRA-W in Gembloux and by ILVO-T&V, was real-time PCR. Several specific problems were addressed regarding preparation, setup, and processing of a quantitative real-time PCR run, and data interpretation in function of GMO quantification. A theoretical training in September 2008 addressed the current challenges of "stacked" GMO events as well as the presence of "botanical impurities" in feed products that might contain GMOs or that are derived from GMOs. These topics were extensively explored through presentations and interactive discussions. Last year, the first NRL-GMO ring trial for detection, identification, and quantification of EU-authorised GM events in solid matrices was started. Additionally, the NRL-GMO supported the Agency by delivering scientific and technical advice about several themes and recent problems concerning GMOs through position papers, discussions, and collaborative meetings. Examples are control of the presence of non-authorised GMOs and possibilities for detection of stacked GMO events.

In 2007, the National Reference Laboratory for Milk and Milk Products was established as a consortium between ILVO's Technology and Food Science Unit (ILVO-T&V) and the Walloon Agricultural Research Centre – Department of the Quality of Agricultural Products (CRA-DQPA). The NRL is coordinated by ILVO-T&V. The scope of the Reference Laboratory covers microbiological analyses, residues and contaminants, and other well-defined analyses (e.g. somatic cells, alkaline phosphatase, etc.) on milk and milk products.

In 2008, besides the more routine tasks and action points, some specific goals were met. On May 6th, the workshop 'Heat Treatment of Milk: From Technology, Impact of Shelf Life and Microbiological Safety to Analytical Assessment' was organised. During this workshop, four presentations were given by ILVO-T&V researchers and one by a guest speaker. The program closed with a laboratory demonstration.



Setting standards

In September, a ring trial entitled 'Screening β-lactam Antibiotica in Milk' was organised. On December 2nd, the workshop 'Chemical Residues in Milk: From Legislation to Analytical Techniques' was organised. The program included two presentations and a laboratory demonstration by ILVO-T&V researchers.

October 9th and 10th, ILVO-T&V participated in the 'EU CRL workshop for Milk and Milk Products (MMP) dedicated to Alkaline Phosphatase' where we were also invited to present. A representative of the NRL consortium attended the CRL workshop 'Proficiency Testing Studies: State of the Art', organised by the Community Reference Laboratory for Antimicrobial residues in food of animal origin (AFSSA-LERMVD).

The NRL, mainly by the CRA-W-DQPA, has investigated the application of the reference method for counting the number of somatic cells, and will form part of the panel of experts established by the CRL Milk and the IDF. Within the context of the melamine crisis, validations and/or method developments were performed for the determination of lactose and melamine in milk and milk products.

10.9 Scientific guidance of MCC-Flanders

The Milk Control Centre – Flanders (MCC-Flanders) is responsible for the determination of the quality and composition of raw farm milk delivered by the dairy farmer. The price of this milk is fixed according to quality and composition parameters, which are determined by routine methods. These parameters are then calibrated with results obtained by reference methods executed by ILVO-T&V and some other departmental laboratories.

Preparation of reference samples

Preparation of calibration examples

The scientific guidance is organised in cooperation with our colleagues in Gembloux (CRA-W). They organise the scientific guidance in the Walloon part of Belgium. Thanks to this cooperation the scientific guidance is uniformly organised throughout Belgium.

Scientific guidance gives the Milk Control Laboratories the possibility to work uniformly and accurately, which in turn guarantees correct payment of the milk delivered by the dairy farmers.

The scientific guidance of the Milk Control Laboratories contains following the aspects: comparative studies, standards, control samples and standard reference samples.

10.10 Accredited laboratory analyses for food authenticity and food safety

The accredited laboratories of the Quality Division of the research areas Food Safety and Product Quality and Innovation are useful to both the food sector and the government. Since September 26, 1995, the laboratories of the Quality Division have been accredited under the BELAC criteria in accordance with the NBN EN ISO/IEC 17025:2005 standard and the Guide ISO/IEC 43-1:1997.

Four different laboratories perform and organise more than 70 accredited analyses and 6 types of proficiency studies.

In 2008, more than 9,000 samples were analysed at ILVO-T&V's accredited laboratories, accounting for about 30,000 analyses. The scope of accredited analyses has been further extended in 2008. In the microbiological lab the enumeration of *Listeria monocytogenes* in all food matrices was added. Concerning the issue of "plastic" chickens, the determinations of hydroxyproline, fat content, humidity and protein content in meat and meat products were audited in December 2007, and in 2008 were added to the scope of the laboratory of physical and chemical analyses. We also determine the level of ash in meat and meat products and in milk and milk products. Scope of the antibiotic laboratory was also expanded by the detection of streptomycin in milk, milk powder and cream (streptomycin EIA), the screening of inhibitory substances in tissue of animal origin (Premi-Test after solvent extraction) and screening of quinolones in tissue of animal origin (*E. Coli* plate-test).

The complete scope of accredited analyses can be found on our internet site http://www.ilvo.vlaanderen.be/T&V/documents/scope_QA.pdf.

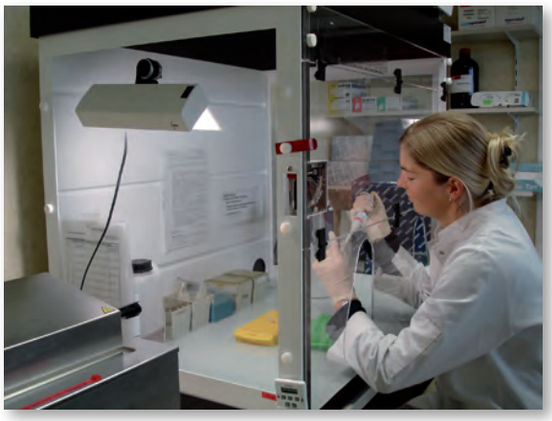
Registration of accredites samples

Determination of inhibitory substances

10.11 Laboratory analyses for EU legislation on coexistence and labelling and traceability of GMOs

The GMO laboratory is a national reference laboratory (NRL) for participation in international validation studies of new official CRL methods for GMOs. We are also an NRL for official analyses of traceability and labelling of genetically modified products (2003/1829/EC, 2004/882/EC, 2006/1981/EC). On behalf of the Belgian Food Agency, approximately one hundred food and feed products are analysed yearly for the presence of all EU-authorised GM events, as part of a national GMO control program. These analyses are accredited by BELAC and conform to the ISO/IEC 17025:2005 norm. In 2008, event-specific PCR test methods for a number of newly EU-authorised GMOs were added to the flexible scope of accreditation. Since labelling of food/feed products is mandatory above a legally fixed threshold of 0.9% at the ingredient level, quantitative real-time PCR is applied in order to determine the exact percentage of GMO in the sample.

Contrary to food/feed control, which is a national competency, the control of GMOs in sowing seed lots is a competency of the Flemish Community. In anticipation of the coexistence legislation that is currently being established in Flanders (2003/556/EC; Ontwerp van Decreet van het Vlaams Parlement, Stuk 1885 (2008-2009) nr. 1), we are proactively developing procedures for the detection and quantification of GMOs in seeds. In addition to a BELAC accreditation under ISO/IEC 17025, it is also our goal to obtain an ISTA accreditation for these seed analyses. This work is done in close collaboration with the Laboratory for Seed Testing of the Unit Product Quality Management (ALV, Ministry of the Flemish Community). In this way, we will be ready for the analysis of GMOs in seed lots when the coexistence legislation comes into force in Flanders.



PCR reaction for GMO analyses

10.12 Ring trials in the context of auto control

The dairy industry must determine the composition of raw farm milk, and benefits from reference methods (Röse-Gottlieb for fat content and Kjeldahl for protein content). ILVO-T&V organises ring trials for these parameters. We also organise ring trials for certain microbiological parameters. Part of the auto control described in the Council Directive 92/46/EEC of June 16th, 1992 requires the Belgian dairy industry to use rapid tests (ßeta-s.t.a.r., Charm MRL(3) Test (ROSA) or SNAP Beta-Lactam Test) or/and microbiological tests (Delvotest SP-NT or CMT Copan Milk Test) to screen their incoming milk for residues of ß-lactam antibiotics (penicillins and cephalosporins). Since this testing can result in the destruction of the whole tanker load, the accuracy of the test result is very important. ILVO-T&V also organises ring trials for this group.

Ring trials

10.13 Activities of the Technological Advisory Service Dairy

The Technological Advisory Service Dairy, in short TAD Dairy, is an IWT-VIS TD-project serving dairy farmers, dairy farmer producers, and SMEs from the dairy industry. ILVO-T&V experts advise producers on milk quality, product innovation, technology and hygiene.

In addition to individual technological advice for companies, seminars and a workshop. We also organised several seminars and a workshop about ice cream. Agricultural magazines and the project's website featured our articles about ice cream production and red smear cheese. Various ILVO experts gave on-site advice to dairy producers on technological problems or product expansion. Two dairy products were developed in the pilot plant and further developed based on thorough technological advice.

Partner van FoodGate netwerk voor innovatie

The TAD Dairy is a member of the FoodGate network, operational since June, 2008. ILVO's advisor wrote articles for the FoodGate Science & Technology Watch. More information can be found on www.foodgate.be.

Tuning equipment

10.14 New applications in the pilot plant

In 2008, more than thirty-five companies from the agro-food sector (including dairy farm producers, SMEs, large companies, and institutes) frequently used the pilot plant of ILVO-T&V. UHT production was our most important test activity for third parties. Powder preparation was also siginifant. Ice cream production also served as a practical support to ILVO-T&V's scientific research in 2008. For two industrial clients (including Ajinomoto), ILVO-T&V has cooperated with the Flemish Institute for Technological Research (VITO). VITO has a great deal of scientific knowledge and experience with filtration technologies. It has even several mobile filtration units which can be incorporated into ILVO-T&V's pilot plant. The flexibility and creativity of both institutes made it possible to respond to clients' specific questions. This year, the pilot plant added a pilot installation for high-pressure homogenisation (max. 1200 bar). The chemical and pharmaceutical industries use this technology to improve the emulsion stability of liquid products. Little literature exists on the potential applications in the dairy industry. This equipment will first support a scientific project about the influence of high-pressure homogenisation on the emulsion stability of dairy products and macromolecules (proteins, polysaccharides and lipids).

10.15 Spray Tech Lab & Inspection of Sprayers

ILVO's Spray Tech Lab is the only BELAC-accredited laboratory in the world. The lab first achieved the BELAC-accreditation (Certificate 259-T ISO 17025) in the spring of 2002. This accreditation covers four specific tests concerning spray equipment, namely 1) the flow rate of individual nozzles at a given spray pressure, 2) the liquid distribution of an individual nozzle or a short spray boom (up to 3 m) at a given spray height and pressure, 3) the liquid distribution of a set of nozzles mounted on a standard spray boom at a given spray pressure, height and offset angle and 4) the liquid distribution of a field crop sprayer at a given spray pressure, height and offset angle.

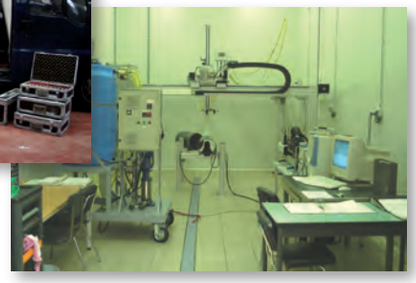
Apart from these four accredited measuring methods, the laboratory possesses a range of measuring and test devices to characterise sprayers and/or sprayer parts. Recent examples include a PDPA laser-based measuring set-up for the characterisation of spray droplets and a measuring set-up for the evaluation of the spray application of biological plant protection products. Moreover, the Spray Tech Lab has experience with different types of field experiments like spray drift measurements, deposition tests in different crops, operator exposure measurements, etc.

The laboratory performs these (accredited) tests for internal research projects with respect to spray application techniques and external customers: manufacturers of

Dairy products

High-pressure homogenisor

Certification of spray apparatus



Testing lab

spray equipment and accessories, scientific institutes, governmental bodies, plant protection companies, etc.

Besides the Spray Tech Lab, ILVO – T&V – AT is responsible for the mandatory and periodic inspection of sprayers in Flanders. Every three years, about 12,000 field sprayers, 2,000 orchard sprayers and 1,000 greenhouse sprayers are tested by four mobile inspection teams. During these tests, all parts influencing the distribution of the crop protection products are checked, e.g. the pressure gauge, nozzles, pressure distribution, spray boom stability, etc. Our inspections are guaranteed by the BELAC accreditation certificate number 197-INSP ISO 17020:2004.

10.16 Quality Control of Milking Installations

A good milk installation and operation and maintenance of the milking machine are crucial for udder health and production of milk of impeccable quality. Trained and certified technicians carry out the maintenance of the machines. These technicians use several different measuring apparatuses when assessing the milk installation: air flow meters, control vacuum meters, and pulsator testers. These meters must be checked regularly in order to ensure that the apparatus is working properly and the measurements stay within certain bounds.

The technicians receive qualitative training and regular advanced training in order to guarantee the quality of their maintenance activities. Control coordinates the activities in Belgium about the technical assessment of the milking apparatus (milk installation and milk cooling tank) and organises the training and guidance of the milk cooling tank technicians, milk machine technicians, and milking apparatus specialists. All measurement reports of milk installations and milk cooling tanks are inventoried annually and all technicians are evaluated via a fully automated report. An annual seminar, which provides a context for repeated contact between the fitters, has also given rise to valuable cooperation. Besides monitoring the milking apparatus and the technicians' work, we also resolve questions about maintenance of the milking machine or cooling tank.

10.17 AgriCONSTRUCT

AgriCONSTRUCT began as a technological advisory service for farmers, builders of animal housing, and manufacturers of construction materials, to give advice about building and outfitting animal housing. In June, 2008, this project ended with a final workshop called "AgriCONSTRUCT: From Pioneering Service to Market-Ripe Advice".

During the past ten years, AgriCONSTRUCT has advised more than 1500 farmers, builders, manufacturers and other members of the agricultural sector. What began as service provision to farmers grew to a transfer of research results to technical on-site advice, from ventilation to technical building advice. New legislation such as ammonia emmisions, animal health and wellness and environmental regulations led to a rise in requests for advice.

Besides consultation services to farmers, manufacturers and builders could come to AgriCONSTRUCT for research and technical guidance on development of new techniques or materials. Research on damage to concrete in silos, hygiene on wall panels, ventilation techniques, matresses, moss growth, et cetera. We communicated this advice in popularised articles, seminars, courses and brochures.

11 Publications

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Animal Sciences Unit

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Delbeke P.-J. (2008) Bevraging van de Vlaamse varkenshouders over de castratietechniek en andere behandelingen rond castratie bij varkens. Master in de biowetenschappen: landbouwkunde, Hogeschool Gent, Promotor: De Brabander D. L.

De Pourcq S. (2008) Witte klaver in de melkveevoeding. Master in de biowetenschappen: landbouwkunde, Hogeschool Gent, Promotor: De Brabander D. L.

Dewicke W. (2008) Invloed van pensbestendige volvette sojabonen op de productieresultaten van melkvee. Master in de biowetenschappen: landbouwkunde, Hogeschool Gent, Promotor: De Brabander D. L.

Gielkens K. (2008) Castratie van biggen: Nutritionele implicaties., Universiteit Gent, Faculteit Diergeneeskunde, Promotoren: Millet S. en Janssens G. P. J.

Theeuwes B. (2008) Inductie van melkvetdepressie door supplementatie van DHA-aangerijkte micro-algen in relatie tot indicatoren voor negatieve energiebalans bij melkvee in het begin van de lactatie. Master in de biowetenschappen: landbouwkunde, Hogeschool Gent, Promotor: De Brabander D. L.

Van de Moortel L. (2008) Stage Biologisch Milieuonderzoek, 2de jaar MSc. Mariene en Lacustriene Wetenschappen, Universiteit Gent, Begeleiders: Hostens K. en Wittoeck J.

Verhille B. (2008) Bevraging van Vlaamse varkenshouders over hun houding t.o.v. chirurgische castratie zonder verdoving en zijn alternatieven. Master in de biowetenschappen: landbouwkunde, Hogeschool Gent, Promotoren: De Brabander D. L. & Tuyttens F.A.M.

Social Sciences Unit

Master

Bryon, K. (2008) Contribution of batch farrowing to more sustainable pig production. Master in de Toegepaste Economische Wetenschappen, Universiteit Gent, Faculteit Economie en Bedrijfskunde. Promotor: Lauwers L.

Buelens H. (2008) Integratie van de ecologische voetafdruk in levenscyclusanalyse: toepassing op een Vlaams gespecialiseerd melkveebedrijf. Bio-ingenieur in de landbouwkunde, Katholieke Universiteit Leuven. Begeleider: Defrijn S.

Schutte F. (2008) Een beoordelingsmethode voor biodiversiteit op Vlaamse landbouwbedrijven. Bio-ingenieur in de Landbouw, Universiteit Gent. Begeleider: Meul M.

Plant Sciences Unit

Bachelor

De Vriese B. (2008) Oogst van kuil- en korrelmaïs in de officiële rassenproeven voor Belgische Rassencatalogus. Bachelor Agro- en Biotechnologie, Hogeschool Gent, Departement Biowetenschappen en Landschapsarchitectuur. Begeleiders: Marynissen B., Chaves B.

Dusslier C. (2008) Optimalisatie van moleculaire detectiemethoden voor de belangrijkste virussen op courgette in Vlaanderen. Biomedische Laboratoriumtechnologie, KaHo Sint-Lieven - Departement Gent. Begeleider: De Jonghe K.

Rogge T. (2008) Bio-ethanol productie uit lignocellulose biomassa. Bachelor in de industriële wetenschappen: Biochemie, Hogeschool Gent : Departement Toegepaste Ingenieurswetenschappen. Begeleider: Muylle H.

Scheerlinck D. (2008) Identificatie en detectie van *Fusarium* spp. bij binnenrot van paprika's. Bachelor in de chemie, afstudeerrichting biochemie, Hogeschool Gent, Departement Technologie. Begeleider: Van Poucke K.

Van Elst V. (2008) Bepalen van respiratie, HWC en S/B-verhouding van bodems behandeld met enkele composttypes. - Bachelor Chemie (PBa), KAHO Sint-Lieven - Departement Gent. Begeleider: Vandecasteele B.

Van Malderghem C. (2008) Optimalisatie van een transformatieprotocol voor *Brachypodium distachyon*. Bachelor in de chemie, afstudeerrichting biochemie, Hogeschool Gent, Departement Technologie. Begeleider: Rohde A.

Verbist B. (2008) Genpolymorfisme voor identificatie van aardappelisolaten van *Erwinia chrysanthemi* (syn. *Dickeya* spp.). Bachelor in de chemie, afstudeerrichting biochemie, Hogeschool Gent, Departement Technologie. Begeleiders: Van Vaerenbergh J., De Paepe B. en Tahzima R.

Master

Bouly N. (2008) Studie van de genetische diversiteit van een *Miscanthus*-collectie. Master in de industriële wetenschappen: Biochemie, Hogeschool Gent, Departement Toegepaste Ingenieurswetenschappen. Begeleider: Muylle H.

Broeckx K. (2008) Duurzame melkveebedrijven. Katholieke Hogeschool der Kempen, Master in de Biowetenschappen, optie Landbouwkunde. Begeleider: Van Waes J.

Buyle H. (2008) Associatiestudie in azalea: hoe sterk is de koppeling tussen merkers en QTL's voor plantkwaliteitskenmerken? Master in de biowetenschappen: tuinbouwkunde, Hogeschool Gent Departement Biowetenschappen en Landschapsarchitectuur. Begeleider: De Keyser E.

De Schutter J. (2008) Efficiënt beweiden. Katholieke Hogeschool der Kempen, Master in de Biowetenschappen, optie Landbouwkunde. Begeleider: Van Waes J.

Fekrat F. (2008) Effects of root diffusates and nematode age on the attachment of the bacterial hyperparasite Pasteuria penetrans to the cuticle of *Meloidogyne chitwoodi*. Master of Science in Nematology, Universiteit Gent. Begeleider: Wesemael W.

Lagrou N. (2008) Genoomgroottebepalingen en inductie van ongereduceerde gameten in *Begonia*. Industrieel ingenieur optie biochemie van de HOGent. Begeleider: Dewitte A.

Shalet Tholath Lazar M. (2008) Induction of unreduced gametes in Begonia species. Institut Superieur d'Agriculture, Lille (FR), Master in Industrial Biotechnology Management. Begeleider: Dewitte A.

Shankar Lakshmanan P. (2008) Microcalli induction from protoplasts of *Spathiphyllum wallisii* and preparatory steps for asymmetric hybridization in Araceae and woody ornamentals. Institut Superieur d'Agriculture, Lille (FR), Master in Industrial Biotechnology Management. Begeleider: Eeckhaut T.

Van Doorslaer X. (2008) Efficiëntie van seleniumbemesting bij grasland en maïs. Bio-ingenieur in de Scheikunde UGent. Begeleider: Vandecasteele B.

Verhaeghe A. (2008) Chromosoomverdubbeling bij houtachtige sierteeltgewassen. Hogeschool Gent Departement Biowetenschappen en Landschapsarchitectuur optie tuinbouw. Begeleider: Van Laere K.

Vermoens S. (2008) Maïs als energiegewas voor biogasproductie in Vlaanderen. Katholieke Hogeschool der Kempen, Master in de Biowetenschappen, optie Landbouwkunde. Begeleider: Van Waes J.

Ydens E. (2008) Interspecifieke hybridisatie bij sierboomgewassen. Hogeschool Gent Departement Biowetenschappen en Landschapsarchitectuur optie tuinbouw. Begeleider: Van Laere K.

Technology & Food Science Unit

Bachelor

Backaert K. (2008) Startersgids voor hoevezuivelproducenten. Bachelor in agro- en biotechnologie minor landbouw, KaHo Sint Lieven Gent, Begeleider: De Boosere I.

Demaré H. (2008) Challengetest voor *Listeria monocytogenes* op hoevekazen. Bachelor Chemie (PBa) Biochemie, KaHo Sint Lieven Gent, Begeleiders: De Reu K. en De Boosere I.

De Latter E. (2008) Ontwikkeling van universele kwaliteitstesten voor DNA isolaten. Bachelor biomedische laboratoriumtechnologie (PBa), Katholieke Hogeschool Sint-Lieven, Begeleider: Ruttink T.

De Vloed F. (2008) Optimaliseren van detectiemethoden voor gene stacks in zaadmonsters. Bachelor biomedische laboratoriumtechnologie (PBa), Begeleider: Papazova N.

Dumouleijn E. (2008) Challenge testen voor *Listeria monocytogenes* op hoevezuivelproducten. Bachelor in de voedings- en dieetkunde, KHBO, Begeleiders: De Reu K. en De Boosere I.

Maes E. (2008) Antibiogrambepaling van MRSA isolaten afkomstig van Vlaamse varkensbedrijven. Bachelor Chemie, optie Biochemie, CVO-IVV de Avondschool, Gent, Begeleiders: Dewaele I. en Heyndrickx M.

Van Hyfte J. (2008) Bepaling van de kwaliteit van suikerbieten met nabij infrarood (NIR) spectroscopie. Bachelor in de chemie, optie chemie, Hogeschool Gent, Departement technologie, Begeleiders: De Ruyck H. en De Ridder H.

Van Laethem M. (2008) Effect van de verhitting van paardenmelk op de activiteit van alkalische fosfase. Bachelor Agro- en Biotechnologie, Hogeschool Gent, Departement Biowetenschappen en Landschapsarchitectuur, campus Melle, Begeleider: Coudijzer K.

Master

De Boevre M. (2008) Ontwikkeling en validatie van een vloeistofchromatografische massaspectrometrische methode voor de bepaling van fluoroquinolonen in eieren. Eerste master in de farmaceutische zorg, Universiteit Gent, Faculteit farmaceutische wetenschappen, Begeleider: Daeseleire E.

Panchanathan Deepak Jebaraj (2008) Development of strategies and tools to detect hazelnut and peanut allergens using polymerase chain reaction (PCR). Master in Biotechnology, Faculté Libre des Sciences et Technologies, Institut Supérieur d'Agriculture (ISA), Lille (F), 80p. Promotor: Taverniers I.

Joseph Tijl (2008) Ontwerp van een filterwisselaar en gebruik bij verbetering van beeldanalyse, Eindverhandeling tot het bekomen van de graad van Master in de Industriële Wetenschappen Elektromechanica (Industrieel Ingenieur) Katholieke Hogeschool Sint-Lieven, Begeleider: Baert J.

Uytterhoeven V. (2008) Identificatie van schimmelisolaten uit kuilvoeder met behulp van chemische en moleculaire analyse. Master in de biowetenschappen: voedingsindustrie, Hogeschool Gent, Departement Biowetenschappen en Landschapsarchitectuur, Begeleider: Daeseleire E.

Vereecken F. (2008) Evaluatie van A. thaliana en verwante soorten naar hun geschiktheid als productieplatform voor de aanmaak van recombinante eiwitten, Master in de biowetenschappen: voedingsindustrie, Departement Biowetenschappen en Landschapsarchitectuur, Hogeschool Gent, 140 p. Begeleider: Van Droogenbroeck B.

Vermeir T. & Walravens W. (2008) Ontwerpen en optimaliseren van een witloofsnijder, Eindverhandeling tot het bekomen van de graad van Master in de Industriële Wetenschappen Elektromechanica (Industrieel Ingenieur) Katholieke Hogeschool Sint-Lieven, Begeleider: Vangeyte J.

13. Communication

13.1 Press contacts and visits of Belgian and foreign delegations

Januari: Interview "Zet pesticiden alstublieft achter slot en grendel", VILT (Robin De Sutter)

29 januari : Van Bockstaele E. Reportage "Boerenstebuiten" Versnippering van de financiering van het landbouwkundig onderzoek.

6 februari: Persconferentie 'Vis Kwaliteit Integratie in de Visserij' (Sabrine Derveaux), Oostende (BE).

7 februari: Interview 'Vissers zien nauwer toe op de kwaliteit' (Karen Bekaert & Sabrine Derveaux). Het Laatste Nieuws, De Standaard, Metro.

8 februari: Interview 'Kwaliteitszorg voor vissers' (Sabrine Derveaux & Karen Bekaert). Focus TV en Krant van West-Vlaanderen.

19 februari: Interview 'Project Alternatieve Visserij' (Jochen Depestele). 4FM radio.

7 maart: Interview in programma 'Inspecteur Decaluwé' van Radio2 (VRT), pyrrozilidine alkaloïden in honing (Wim Reybroeck)

15 maart: Interview 'Garnaalvissers experimenteren met pulskor' (Bart Verschueren). Het Nieuwsblad.

17 maart: Interview 'Pulskor' (Bart Verschueren). Radio 2 West-Vlaanderen.

17-19 maart: Seminaries i.v.m. met het beëindigen van het project "Possibilities and chances of organic farming in Bulgaria" (BUL/001/04) in Sofia (BG).

25-28 maart : Seminaries i.v.m. met het beëindigen van het project "Possibilities and chances of organic farming in Romania" in Cluj Napoca (RO).

3 april : Bezoek Minister Patricia Ceyssens aan de proeffabriek van de Eenheid T&V te Melle (BE).

4 april: Ondertekening cryopreservatieproject KMLP door Minister-president Kris Peeters op de Eenheid Plant te Melle (BE).

7 april: Declercq J. Reportage "Boerenstebuiten " Gefilmd keuring Merelbeke, uitgezonden op AVS+TV-Oost+Internet. 10 min.

13 mei: Bezoek delegatie van de Belgische Federatie van de Belgische vleeswarenindustrie (Fenavian) i.v.m. castratie van beerbiggen (Frank Tuyttens).

15 mei: Artikel 'Débat "mangerons-nous encore du poisson demain?" dans le cadre de la Semaine de la Mer' (Kris Hostens). Le Phare : 17.

16 mei: Persconferentie 'Ontwikkeling en toepassing van logistiek met een toegevoegde waarde in de viskwaliteitsintegratie' (Karen Bekaert), Zeebrugge (BE).

17 mei: Interview 'Zeebrugse Visveiling vreest voor voortbestaan' (Karen Bekaert). Het Nieuwsblad.

22 mei: Bulgaarse delegatie ivm project "Mineral balance sheets" (BUL18/06/06) i.s.m. UGent, Faculteit Bio-ingenieurswetenschappen (Lucien Carlier).

23 mei: Bulgaarse delegatie ivm project "Setting up producer groups" (BUL/012/05) i.s.m. Boerenbond (Lucien Carlier).

24 mei: Persbericht rond *Globodera* in aardappel (VILT, diverse vakbladen). (Nicole Viaene).

30 mei: Interview 'Teruggooi in de boomkorvisserij' (Kelle Moreau). Radio 1, Radio 2, Klara, Donna, Studio Brussel.

11 juni: Demodag gemengd voederen: mengwagens door Praktijkcentrum Rundvee (Eenheid Dier te Melle).

13 juni: Bezoek delegatie van voorzitters van het Farm Bureau van verschillende staten van de USA (Daniël De Brabander).

26 juni: Bezoek Officiële Cultuur- en Gebruikswaardeproeven van vezelvlas te Houtem en Merelbeke (BE) (Barbara Chaves).

27 juni: artikel "Agriconstruct is niet meer", Landbouwleven, p.4 (Bart Sonck).

27 juni: artikel "Agriconstruct verdwijnt na 10 jaar - Technieken en materiaalkeuzes: uitdagingen blijven groot", Boer & Tuinder, p.36 (Bart Sonck)

4 juli: artikel "Crisis in de vleesveehouderij", Boer & Tuinder, p.8 (Leo Fiems).

4 juli: artikel "Groepshuisvesting van zeugen in Vlaanderen", Landbouwleven, p.18 (Nicoline Geverink)

16 juli: Interview 'Het is omschakelen of verdwijnen' (Kris Van Craeynest). De Tijd.

18 juli: Artikel "Vlaams Beleidsdomein Landbouw & Visserij zet wetenschappelijk onderzoek in de kijker", Landbouwleven, p.30 (Leo Fiems).

25-28 juli: Foire de Libramont (BE). Stand ILVO met thema's aardappelcysteaaltje, conditiescore rundvee, inuline uit cichorei.

4-6 augustus: Bezoek van Anne Fisher van Agri-Food & Biosciences Institute, Food Microbiology, Agriculture, Food and Environmental Science Division uit Belfast ivm opleiding microbiologie (Geertrui Vlaemynck), Eenheid Technologie & Voeding.

7 augustus: Interview naar aanleiding van de vermeende aanwezigheid van fytotoxines in mossel, gekweekt voor onze kust (Kris Cooreman). Focus TV.

7 augustus: Interview 'Invloed van toxisch fytoplankton op mossel en mens' (Kris Van Nieuwenhove). WTV/Focus-Nieuws.

8 augustus: Artikel ter gelegenheid van beurs te Libramont in Boer & Tuinder, p.20-21 (Leo Fiems).

8 augustus: Artikel "Vlaams landbouwkundig onderzoek in Libramont", Landbouwleven, p.4-5 (Leo Fiems).

15 augustus: Artikel "Reductie van ammoniakemissies door maatregelen via varkensvoeder", Veiligheid & Milieu, 15 (7): 1-2. (Daniël De Brabander).

25 augustus: Interview 'Witte haai in de Noordzee' (Daan Delbare). Studio Brussel.

11 september: Bezoek General Assembly Welfare Quality (EU-integrated project) (Frank Tuyttens)

11 september: Interview 'Pulskor' (Bart Verschueren). Radio 2 West-Vlaanderen.

12 september: Persconferentie WAFL-congres in Gent (Frank Tuyttens).

12 september: Artikel "Internationaal congres rond dierenwelzijn in Gent", VILT (Frank Tuyttens).

13 en 14 september: Artikel "Hoe meet je dierenwelzijn?", De Standaard, p.8. (Frank Tuyttens).

15 september: Bezoek Prof. Linda Keeling SLU (SE): Stocking density of broiler chickens and rabbits (doctoraat Stephanie Buijs).

15-20 september: Bulgaarse delegatie ivm project "Good Agricultural and Environmental Condition in Bulgaria" (BUL/001/07) (Lucien Carlier).

16 september: Bezoek Officiële Cultuur- en Gebruikwaardeproeven van silo- en korrelmaïs te Poperinge en Merelbeke (BE) (Barbara Chaves).

19 september: Artikel "Wetenschappelijk congres dierenwelzijn: streven naar objectieve indicatoren", Boer & Tuinder, p.15. (Frank Tuyttens).

19 september: Artikel "WAFL-congres in Gent – Dierenwelzijn wetenschappelijk bekeken", Landbouwleven, p.6 (Frank Tuyttens).

29 september: Interview "Hervorming landbouwbeleid niet diepgaand genoeg" (Ludwig Lauwers, Guido Van Huylenbroeck en Erik Mathijs). Vilt.

1 oktober: Interview "Ruimte voor glastuinbouw in de toekomst? Uw mening telt!" (Veerle Verguts). Verbondsnieuws.

15-18 oktober: Roemeense delegatie ivm project "Auction markets" (ROE/009/07), WUR (NL) en VLM over samenwerking ivm mineralenstromen in de land- en tuinbouw. Kick off meeting van het project "Good Agricultural and Environmental Condition in Bulgaria" (BUL/001/07) in Sofia (Lucien Carlier).

22 oktober: Artikel "Na 34 jaar opnieuw in Gent – Internationaal wetenschappelijk congres over het welzijn van landbouwhuisdieren", Het Dierenartsen Weekblad (Frank Tuyttens).

31 oktober: Artikel "Brave stieren zijn het gevaarlijkst", Boer & Tuinder (Robin De Sutter).

31 oktober : Van Bockstaele E. Reportage "Boerenstebuiten" Opwarming van de aarde.

30 november – 3 december: Stand ILVO met thema aardappelcysteaaltje op beurs Interpom.

19 december: Opnames AVS voor "Agriflanders special" (Katleen Coudijzer en Barbara Duquenne).

23 december: Artikel "En de boer, hij automatiseerde verder", De Standaard, p.29 (Bart Sonck).

31 december: Interview "In troebel water is het goed vissen" (Kris Cooreman). VILT.

13.2 Activities, workshops and courses organised by or in cooperation with ILVO

Animal Sciences Unit

5 februari: A future for fisheries? Towards effective strategies for sustainability, Leuven (BE) (Kris Hostens, medeorganisatie).

11-14 februari: ICES Workshop on Benthos Related Environment Metrics (WKBEMET), Oostende (BE) (Ine Moulaert, organisatie en chair).

20 maart: Maertens L., Huyghebaert G. & Lippens M. Overzicht van de proeven met gecoat calciumbutyraat op het ILVO. Geringere voederkosten door verbeterde darmfunctionaliteit en darmgezondheid, Zwijnaarde (BE).

7 mei: Week van de Zee, Oostende (BE) (Hans Polet, lid van discussiepanel).

15 mei: Conférence débat Bilinge "Quel(s) poisson(s) mangerons-nous demain?", Dunkerque (FR) (Kris Hostens, lid van discussiepanel).

30 mei: Infonamiddag 'Laat je niet vangen! Teruggooi en mogelijkheden tot reductie', Oostende (BE) (Sofie Vandendriessche, Kelle Moreau, Sofie Vandemaele, Dieter Anseeuw, organisatie en lid van discussiepanel).

17 juni: Sonck B. & Tuyttens F. Aandacht voor het welzijn van koeien op melkveebedrijven - een evidentie ? Slotdag "Sterk met Melk", Beernem (Oedelem) (BE).

19 juni: Sonck B. & Boussery K. Van pionier in de dienstverlening tot marktrijp advies. Workshop Agriconstruct, Merelbeke (BE).

19 juni: Geverink N. A. & Tuyttens F. Groepshuisvesting van zeugen in Vlaanderen. Studiedag Agriconstruct, Merelbeke (BE).

30 juni: De Sutter R. Risicoanalyse van een landbouwbedrijf. Eindwerk Preventie adviseur, BE-Consult, Geel, 42p.

13 september: Visserijfeesten, Oostende (BE) (Medewerking aan de stand van ILVO-Visserij).

26 september: De Sutter R. Ongevallen op het veebedrijf. Infodag ILVO-DIER, Melle (BE).

26 september: Fiems L. Gewenste ontwikkeling en na te streven gewicht bij de eerste kalving van Witblauwe dikbilvaarzen. Infodag ILVO-DIER, Melle (BE).

26 september: Tuyttens F. & Geverink N. A. Groepshuisvesting van drachtige zeugen: mening van zeugenhouders. Infodag ILVO-DIER, Melle (BE).

26 september: Millet S., Aluwe M., De Paepe M., De Brabander D. & Van Oeckel M. J. Optimale eiwit/aminozurenniveaus voor vleesvarkens. Infodag ILVO-DIER, Melle (BE).

26 september: Sprenger M. & Tuyttens F. Beoordelen en verbeteren van het welzijn van vleeskippen. Infodag ILVO-DIER, Melle (BE).

26 september en 19 december: Tuyttens F. Introductie van het Welfare Quality project. Infodag ILVO-DIER, Melle (BE).

26 september: Geverink N. A. & Tuyttens F. Groepshuisvesting van drachtige zeugen: resultaten van praktijkonderzoek. Infodag ILVO-DIER, Melle (BE).

9 oktober: De Brabander D. L., Huyghebaert G., Millet S., De Campeneere S., De Boever J. L. & Maertens L. Nutritionele karakterisatie en opportuniteit van alternatieve eiwitbronnen voor de veevoeding. Alternatieve eiwitbronnen, Brussel (BE).

17 oktober: Wetenschapsfeest, Mechelen (BE) (Medewerking aan de stand 'De Zee', gecoördineerd door VLIZ samen met 15 partner-instituten).

20 november: Maertens L. Verslag van reproductie- en voedingssessie van het 9de Wereldcongres van de WRSA. Merelbeke (BE).

1 december: Het onderzoek naar de kwaliteit van het bodemleven, Oostende (BE) (Film gemaakt door VLIZ over het onderzoek van ILVO-Visserij, groep Biologisch Milieuonderzoek).

9 december: CLIMAR workshop 'Crisis in de visserij: keert klimaat het tij?' Oostende (BE) (Els Vanderperren, organisatie).

19 december: Vanderhasselt R. Welfare Quality®: Beoordelen en verbeteren van het welzijn van kippen. Infodag ILVO-DIER, Melle (BE).

19 december: Millet S. Hoe doen we voederproeven bij varkens ? Infodag ILVO-DIER, Melle (BE).

19 december: Maertens L. Weetjes over de kleinveehouderij. Infodag ILVO-DIER, Melle (BE).

Diverse periodes (8 maal): 3-daagse opleiding cursus Viskwaliteit binnen het VKIV-FIOV-project, Oostende (BE) (Karen Bekaert & Sabrine Derveaux, organisatie en opleiding)

Social Sciences Unit

20 maart: Themadag Landbouw & Maatschappij voor Beleidsdomein L&V

23 april: Dessein J. (2008) Nationaal Platform Groene Zorg. Gent (BE).

26-29 augustus: XIIth Congress of the European Association of Agricultural Economists - EAAE2008 - People, food and environment: global trends and European strategies, Gent (BE).

13 november: Verguts V. Ruimte voor glastuinbouw in de toekomst? Uw mening telt! Studienamiddag ILVO en ADLO, Destelbergen (BE).

Plant Sciences Unit

13 maart: Van Vaerenbergh J., Inghelbrecht S. EPPO Workshop on Technical Requirements for Diagnostic Laboratories, Gent (BE).

17 april : Van Bockstaele E. Uitdagingen in de sierteeltsector en wat de wetenschap daartoe kan bijdragen. Lid van het organisatiecomité. Sierteeltcongres. Uitdagingen in de sierteeltsector en wat de wetenschap daartoe kan bijdragen, Koninklijke Maatschappij voor Landbouw en Plantkunde, Gent (BE).

22 april: Pyck N. & De Keyser E. Workshop: Ploïdie: vriend of vijand van de veredelaar. Melle (BE).

22 tot 25 april: Maes M. European Mycological Network. Edinburg (UK).

22 mei: De Vliegher A. Themadag "Fosfaat met beleid". Organisatie in samenwerking met Nederlandse vereniging voor weide en voederbouw. Heino (NL).

1-5 September: The 2nd ISHS International *Humulus* Symposium. Organisatie in samenwerking met: Universiteit Gent en KaHo Sint Lieven, Gent (BE).

18 september: De Vliegher A. Studienamiddag "Food, feed, fuel or forest?". Organisatie in samenwerking met Nederlandse vereniging voor weide en voederbouw. Beesd (NL).

24 september: Willekens K. & Vandecasteele B. Demonstratiemoment Project Kleinschalig Composteren van Beheerresten, Organisatie in samenwerking met Natuurpunt en Vlaco. Bree (BE).

29 september: Willekens K. & Vandecasteele B. Demonstratiemoment Project Kleinschalig Composteren van Beheerresten, Organisatie in samenwerking met Natuurpunt en Vlaco. Wingene (BE).

6 oktober: Euphresco-*Globodera* Start Meeting, Gent, BE.

27 en 28 oktober: Samenkomst European Association of Phytobacteriologists, Merelbeke, BE, Van Vaerenbergh J.

7 november:. Secondary metabolites and molecular farming georganiseerd door Belgian Plant Biotechnology Association (BPBA). Eeckhaut T.

18 november: *Meloidogyne* werkgroep: halfjaarlijkse bijeenkomst, Merelbeke, BE.

2 december: "Hout als biomassa voor hernieuwbare energie" Organisatie van ODE Vlaanderen met medewerking van ILVO, Melle, BE.

Technology & Food Science Unit

23 januari: Taverniers I., Papazova N., Ruttink T. & De Loose M. Organisatie, presentaties, en Conclusion document CoExtra Workshop: Reliability of reference endogenous systems for GMO quantification, Brussels (BE).

28 januari: Demeyer P. Half dagje energie - Situering energieonderzoek Agrotechniek.

28 januari: Bronchart F. & Demeyer P. Thermodynamica van de glastuinbouw in het licht van rationeel energiegebruik. Half dagje energie - Situering energieonderzoek Agrotechniek.

29 januari: De Loose M. & Taverniers I. Detectie en traceerbaarheid. Relevantie en haalbaarheid voor een principe/criterium rond 'niet-GGO grondstoffen' voor meer maatschappelijk verantwoorde diervoederstromen, Brussel (BE).

6 februari: Herman L. Organisatie en activiteiten van ILVO-Technologie en Voeding: overleg KUL –ILVO, Merelbeke (BE).

14, 25 februari en 8 mei: De Reu K. Samenstelling, eigenschappen en kwaliteit van rauwe melk. Les in BCZ-IPV Basiscursus zuiveltechnologie voor arbeiders, Langemark, Aalter en Kallo (BE).

20 februari: Braekman P. 1e Demodag 'Gebruik van gewasbeschermingsmidden en spuitapparatuur en -techniek in sierteeltgewassen'.

6 maart: Dekeyser D. Mogelijkheden voor driftreductie. Voordracht studienamiddag 'Water en gewasbeschermingsmiddelen' Melle (BE).

13 maart: Coudijzer K. Zuiveltechnologie: Kaasbereiding. Les in BCZ-IPV Basiscursus zuiveltechnologie voor arbeiders, Langemark (BE).

17 maart: Braekman P. Praktische demonstratie verschillende doptypes. PCLT-cursus 'Gewasbescherming' voor 'Vereniging van Noord-Belgische boomtelers'.

19 maart: De Loose M. & Taverniers I. Reglementering in verband met GGO's, de praktische implementatie en de gevolgen ervan. Avondcyclus GGO's in de landbouw, hemel of hel?, Gent (BE).

19 maart: De Boosere I. & Detelder A. Verpakking voor hoevezuivelproducenten, ILVO & Steunpunt Hoeveproducten, Stasegem (BE).

28 maart, 31 maart, 1 april, 3 april, 7 april: De Boosere I., Detelder A. & Claes J. Autocontrole voor hoevezuivelproducenten, ILVO, Steunpunt Hoeveproducten & Katholieke Hogeschool Kempen, Assenede, Houthulst, Aalter, Bever & Oostmalle (BE).

28 maart en 2 april: De Boosere I., Claes J. & Detelder A. Roomijsbereiding. IJs - berekening van mixen, ILVO & Steunpunt Hoeveproducten, Melle & Geel (BE).

9 april: Vlaemynck G. Sensorische evaluatie: de smaak van succes is kennis, ILVO & KVIV, Gent (BE).

10 april: Herman L. Beheersing van *Listeria monocytogenes* in levensmiddelen: een update, ILVO, FOD & UGent, Brussel (BE).

10 april: D'hoop M. & Demeyer P. Code van goede praktijk voor emissiearme stalsystemen. Projectgroep ADLO- project i.s.m. PIVAL.

23 april : Van Droogenbroeck B. & De Loose M. Teelt van GGO's voor non-food toepassingen. Studie-avond TI-KVIV: GGO's in de landbouw: Hemel of hel?, Universiteit Gent, Gent (BE).

6 mei: De Reu K. NRL Workshop 'Heat treatment of milk: from technology, impact of shelf life and microbiological safety to the analytical assessment', ILVO & FAVV, Melle (BE).

8 mei: Taverniers I., Van Droogenbroeck B. & De Loose M. Detection and traceability of genetically modified organisms (GMOs) in the feed chain. Bilaterale Overlegvergadering Dierenvoeding, Brussel (BE).

13 mei: Coudijzer K. (2008) Zuiveltechnologie: Melkpoederbereiding. Les in BCZ-IPV Basiscursus zuiveltechnologie voor arbeiders, Kallo (BE).

10 juni: De Reu K. Zuivelwetgeving - Microbiologische criteria. Les in BCZ-IPV Basiscursus zuivelwetgeving voor bedienden, Gent (BE).

11 juni: ILVO-T&V-AT & PCR Demodagen gemengd voederen: Mengwagens, Melle (BE).

12 juni: Taverniers I, Ruttink T. & De Loose M. Organisatie en presentaties NRL-GMO praktische vorming: Real-time PCR, Merelbeke (BE).

12 juni: De Boosere I. Innovatie in de voedingsindustrie: samen sterk! ILVO, Flanders Food, HeatedFoods, Innovatiecentrum West-Vlaanderen, IFF, Pack4Food, VCBT, VLAV & VLAZ, Affligem (BE).

13 juni: ILVO-T&V-AT, Demodag Vlaamse Overheid. Lierde (BE).

17 juni: Reybroeck W. Workshop 'Quality control of honey', Melle (BE).

19 juni: Demeyer P. AgriCONSTRUCT: Een blik op de toekomst. Milieubeveiliging en klimaatbeheersing bij stalsystemen. Studiedag, Merelbeke (BE).

25 juni: ILVO-T&V-AT, NPW & KBIVB Demodag 'Technieken voor een duurzame en een effficiënte onkruidbestrijding. Demodag 'Technieken voor een duurzame en een effficiënte onkruidbestrijding, Wolvertem (BE).

26 juni: ILVO-T&V-AT, POVLT & Landelijke Gilde Zwevegem Proefveldbezoek Spuittechniek in de akkerbouw. Proefveldbezoek Spuittechniek in de akkerbouw, Zwevegem - Sint-Denijs (BE).

2 juli: Braekman P. 2e Demodag 'Gebruik van gewasbeschermingsmidden en spuitapparatuur en -techniek in sierteeltgewassen'.

3 juli: ILVO-T&V-AT, POVLT, PCA & PCLT. Spuittechniek in de akkerbouw, Koksijde (BE).

11-12 september: Herman L.13th Conference on Food Microbiology, ILVO & UGent, Gent (BE).

30 september: Taverniers I. Stacked events and their detection: theoretical issues. NRL-GMO formation: Specific issues/problems in GMO analysis: botanical impurities and stacked GMOs, Brussels (BE).

30 september: Taverniers I. Report on the 1st Global Conference on GMO analysis. NRL-GMO Communication group session 2008, Brussels (BE).

24 oktober: Braekman P. Keuring van spuitmachines gebruikt in glastuinbouw. Demodag 'Spuitbomen in vruchtgewassen', Hoogstraten (BE).

5 november: De Loose M. COST Exploratory workshop. What role for GM technology in future competitiveness of European agri-food sector?, Ljubljana (SI).

6 november: Van Droogenbroeck B. GGO's voor de voedingsbiotechnologie. Flanders' Food Technology Day, De Montil, Affligem (BE).

7 november: Van Droogenbroeck B. Plants seeds as bioreactors for the production of high-value proteins. Belgian Plant Biotechnology association - Metabolic engineering & Molecular Farming, Archipel Business Center, Zwijnaarde (BE).

20 november: Daeseleire E. Food allergens: an emerging health safety issue, ILVO & KVCV, Tervuren (BE).

28 november: De Loose M. Genetisch gemodificeerde planten. Presentaties voor de vereniging voor nutriëntenanalyse.

28 november: Bernaert N. Innovatie in de preiteelt. Presentaties voor de vereniging voor nutriëntenanalyse.

28 november: Demeyer R. Planten als productieplatform voor waardevolle moleculen. Presentaties voor de vereniging voor nutriëntenanalyse.

2 december: Ooghe S., Reybroeck W. & De Reu K. Chemical residues in milk: from legislation to analytical techniques, ILVO & FAVV, Brussel (BE).

13.3 Lectures and information

Animal Sciences Unit

15 januari: Sonck B. Melkstallen en melkinstallaties in evolutie. Cursus voor opleiding melkers, Geel (BE).

23-24 januari: Schellekens A., Martens L., De Campeneere S. & Fremaut D. Valorisatie van koolzaadkoek in de dierlijke sector. Bocholt (BE), Kluisbergen (BE).

23-24 januari: De Campeneere S., Schellekens A., De Boever J. L. & De Brabander D. De gemiddelde samenstelling en de variatie in samenstelling van koolzaadkoek geproduceerd in Vlaanderen. Valorisatie van koolzaadkoek in de dierlijke sector, Bocholt (BE), Kluisbergen (BE).
23-24 januari: De Campeneere S., De Brabander D. & Aerts J. Maximale dosis koolzaadkoek in een melkveerantsoen en de invloed op de productie en melksamenstelling. Valorisatie van koolzaadkoek in de dierlijke sector, Bocholt (BE), Kluisbergen (BE).

29 januari: De Sutter R. Heeft u een ruggesteun ? Preventie van rugproblemen, Roeselare (BE).

6 februari: De Campeneere S. & De Brabander D. Krachtvoedervervangers bij melkvee. LCV studienamiddag, Hoogstraten (BE).

7 februari: De Sutter R. Veiligheid en gezondheid in de land- en tuinbouw. Minderhout (BE).

7 februari: De Sutter R. Persoonlijke veiligheid bij het spuiten van fytoproducten. Omgaan met fytoproducten, Minderhout (BE).

8 februari: De Sutter R. Persoonlijke beveiliging bij gebruik van fytoproducten. Bescherming van de toepasser, Destelbergen (BE).

11 februari: De Sutter R. Persoonlijke veiligheid bij het spuiten van fytoproducten. Omgaan met fytoproducten, Roeselare (BE).

20 februari: De Sutter R. Persoonlijke veiligheid bij het voorbereiden en uitvoeren van spuitwerk. Demodag Spuittechniek Sierteelt, Schelderode (BE).

21 februari: Fiems L. O. Voeding van dikbilkoeien en vleesstieren. Studieavond, Lovendegem (BE).

25 februari: De Brabander D. L. Kwaliteit van ruwvoeders voor melkvee. Ieper (BE).

26 februari: Moreau K., Vandendriessche S., Vandemaele S. , Anseeuw D. (2008) Teruggooi in de boomkorvisserij: Optimalisatie van het onderzoek, evaluatie van reducerende technische maatregelen en sensibilisering van de sector. Voordracht aan de visserijsector in IMARES, Ijmuiden (NL).

26 februari: Verhaeghe D. (2008) Passieve visserij in Vlaanderen. Voordracht aan de visserijsector in IMARES, Ijmuiden (NL).

28 februari en 18 maart: De Campeneere S. Actualiteiten melkvee: het aangepaste DVE systeem en krachtvoedervervangers voor melkvee. Studieavond Melkveekring Ieper / Studieavond Melkvee Optimalisatie Club Meetjesland, Poperinge (BE) / Maldegem (BE).

6 maart: Fiems L. O. Voeding van vleesvee. BIOT, Gent (BE).

7 maart: Van Nieuwenhove K. (2008) Offshore mosselkweek in België en de wereld', Gastlezing Schelpdierkweek voor Hoge School Zeeland (NL).

10 maart: De Sutter R. Persoonlijke veiligheid bij het uitvoeren van spuitwerk. ILVO – Merelbeke (BE).

12 maart: De Boever J. L. Voederwaarde van weidegras. Werkgroep Grasland, Merelbeke (BE).

12 maart: Millet S. Sturing van het speenproces. Infoavond, Roeselare (BE).

21 maart: Hostens K. (2008) Het onderzoek binnen ILVO-Visserij. Voordracht en rondleiding in het kader van de cursus Biologie binnen de Masters-opleiding van KULeuven, Oostende (BE).

3 april: Cooreman K. (2008) Links between the detoxification system EROD and environmental and physiological parameters. Lezing op de ICES Working Group meeting on biological effects of contaminants (WKIMON-IV), Kopenhagen (DK).

15 april: De Campeneere S. Mogelijkheden om perspulp te vervangen. Themagroep bijeenkomst rundveeconsulenten Boerenbond, Leuven (BE).

21 april: Bekaert K. (2008) Exporting fish and fishery products to the Eurpean Union. Presentatie op vraag van Flanders Investment en Trade voor een delegatie Vietnamezen, Zeebrugge (BE).

7 mei: Polet H. (2008) Een kink in de kabeljauw. Lezing in het kader van 'de Week van de Zee", Oostende (BE).

15 mei: De Sutter R. Bescherming van de toepasser. ILVO-Merelbeke (BE).

10 juni, 16 juni: Fiems L. Bijproducten in afmestrantsoen voor stieren. Riemst / Oosterzele (BE).

27 juni: Fiems L. Bijproducten in de rundvleesproductie. Drongen (BE).

2 juli: Demaré W., Torreele E., Moreau K. (2008) ICES adviezen – Visserijbeheer 2009. Infosessie ten behoeve van het Ministerie Landbouw en Visserij, de Dienst Zeevisserij en de Rederscentrale, Brussel (BE).

11-15 juli: Delezie E., Bruggeman V., Swennen Q., Decuypere E. & Huyghebaert G. The impact of qualitative feed restriction on broiler performance, metabolism and carcass composition. 9th International Symposium on Avian Endocrinology, Leuven (BE).

10-15 augustus: Delezie E., Aerts J.-M., Aluwé M. & Huyghebaert G. Effect of type of basal fat on meat composition and n-3 fatty acids deposition efficiency in turkeys. 54th ICOMST 2008, Role of Science in the growing demand for red meat, Cape Town (ZA).

13 augustus: Deloof D. (2008) The influence of fishing methods on fish quality. Presentatie op EU Network Meeting on fish quality and methods, Trondheim (NO).

19 augustus: Demaré W., Torreele E. (2008) ICES adviezen – Visserijbeheer 2009: herziening. Infosessie ten behoeve van de Quotacommissie, Oostende (BE).

3 september: Sonck B. Melkstallen en werking van melkinstallaties. Cursus voor opleiding melkmachinetechnici in het kader van Control, Fedagrim, Geel (BE).

8 september: De Campeneere S. Actualiteiten melkvee: Het aangepaste DVE/OEB systeem 2007 en de vervanging van perspulp. Eigen alternatieven voor krachtvoeder en perspulp, Brugge (BE).

17 september, 23 oktober, 4 november, 17 november: De Campeneere S. Actualiteiten melkvee: Het aangepaste DVE/OEB systeem 2007 en de vervanging van perspulp. Eigen alternatieven voor krachtvoeder en perspulp, Gistel / Ingelmunster / Diksmuide / Oudenaarde (BE).

25 september: Moreau K., Vanhee W. (2008)) ICES adviezen – Visserijbeheer 2009. Infosessie ten behoeve van de Centrale Raad voor het Bedrijfsleven en de visserijsector, Oostende (BE).

1 oktober: Torreele E. (2008) De strategische milieubeoordeling voor de Belgische Visserijsector: procedure en invloed op het nationaal operationeel programma voor de Belgische Visserijsector. Infosessie ten behoeve van de Vlaamse Regering ter ondersteuning van de goedkeuringsprocedure van het NOP, Brussel (BE).

24 oktober: De Campeneere S. Het aangepaste DVE/OEB systeem 2007 … wat moeten we er mee in de praktijk ? Enkele nieuwigheden in de melkveevoeding, Merelbeke (BE).

27 oktober: Tuyttens F. & Geverink N. A. Het houden van zeugen in groep: resultaten van een bevraging onder Vlaamse varkenshouders en van praktijkonderzoek. Merelbeke (BE).

30 oktober: Maertens L. Strategies to reduce the feed conversion ratio in rabbit meat production. XXXIII Symposium de Cunicultura., Calahorra (ES).

6 november: Depestele J. (2008) Technisch visserijonderzoek en alternatieven voor de boomkor. Rondleiding in het kader van de cursus Fisheries binnen de MARELAC-opleiding van UGent, Oostende (BE).

6 november: Hostens K. (2008) Effecten van menselijke activiteiten op het mariene bodemleven. Voordracht en rondleiding in het kader van de cursus Fisheries binnen de MARELAC-opleiding van UGent, Oostende (BE).

6 november: Moerman M., Torreele E. (2008) Otolieten onderzoek en datacollectie. Rondleiding in het kader van de cursus Fisheries binnen de MARELAC-opleiding van UGent, Oostende (BE).

6 november: Parmentier K. (2008) Het chemisch milieuonderzoek binnen ILVO-Visserij. Voordracht en rondleiding in het kader van de cursus Fisheries binnen de MARELAC-opleiding van UGent, Oostende (BE).

6 november: Van Nieuwenhove K. (2008) Het aquacultuuronderzoek binnen ILVO-Visserij. Voordracht en rondleiding in het kader van de cursus Fisheries binnen de MARELAC-opleiding van UGent, Oostende (BE).

12 november: Maertens L. Reductie medicijngebruik bij konijnen. Het gezond houden van het konijn., Utrecht (NL).

13 november: Maertens L. Strategieën om het antibioticagebruik in de konijnenhouderij terug te dringen. Studiedag WRSA., Utrecht (NL), 10.

14 november: Polet H. (2008) Visserij op zee. Noordzee, geen zee van tijd meer voor een zee vol leven en vissers. Voorstelling van de publicatie "Visserij en natuurgebieden op zee", Bredene (BE).

18-20-26 november: De Campeneere S. (2008) Theoretische achtergrond van het vet/eiwit gehalte in de melk. Demodagen naar aanleiding van ADLO-project: Vet/eiwit verhouding in de melk sturen vanuit het basisrantsoen - Beperkt Bewust Beweiden, Reninge / Zandhoven (Pulderbos) / Kaprijke (BE).

24 november: Sonck B. Design of animal houses with respect to the environment. Lessen "Duurzame veehouderij", Gent (BE).

24 november: Maertens L. Efficacité du Clinacox lors d'un essai comparatif récent avec la Robénidine et le Sacox. Réunion de lancement d'un nouveau coccidiostatique., Rennes (FR).

25 november: Maertens L. Efficacy of Clinacox® in a recent comparison: Clinacox vs Robenidin and Sacox. Meeting of the launch of a new anticoccidial., Bologna (IT).

4 december: De Campeneere S. Aanpassingen aan het DVE/OEB systeem en de praktische gevolgen voor melkveerantsoenen. Bocholt (BE).

5 december: De Sutter R. Veiligheid op het bedrijf. Melle (BE).

10 december: Vandemaele S. (2008) Stock assesment: van data tot quota. Lezing binnen de opleiding Masters Biologie van UA, Antwerpen (BE).

12 december: Hostens K., Vandendriessche S., Wittoeck J. & Hillewaert H. (2008) Monitoring the effects of an offshore windmill park on the epifauna and fish fauna of soft-bottom sediments on the Thorntonbank. Lezing voor een delegatie uit Frankrijk in het kader van 'Projet C-Power: Parc éolien sur le Thorntonbank', Oostende (BE).

16 december: De Campeneere S. Mogelijkheden om krachtvoeder en perspulp te vervangen in rantsoenen voor melkvee. Beauvoorde (BE).

Social Sciences Unit

28 februari: De Cock L. Kennisopbouw en-uitwisseling voor de biologische landbouw- en voedingsector in Vlaanderen: Focus op onderzoek. Dialoognamiddag: 'Kennis als hefboom voor de professionalisering van de (bio)landbouw. Wat is hiervoor nodig?', Antwerpen (BE).

3 maart: Rogge E. Assessing the perception of the impact of agricultural activities on landscapes. seminars spring 2008, Division Forest, Nature and Landscape, K.U.Leuven, Leuven (BE).

18 maart: Rogge E. Het inschakelen van belevingsonderzoek bij het zoeken naar nieuwe locaties voor beeldbepalende tuinbouwcomplexen. Plattelandsacademie van de Landelijke Gilden, Betekenis en waarde(n) van beeldbepalende elementen op het platteland, Leuven (BE).

20 maart: Claeys D. Rechten in de landbouw: mestafzet en derogatie. Themadag Landbouw en Maatschappij, Melle (BE).

20 maart: Dessein J., Meul M., Marchand F. & Lauwers L. Wat met toekomstig onderzoek? Themadag Landbouw en Maatschappij, Melle (BE).

20 maart: Dessers R. & Rogge E. Musical – lokale identiteit als driver voorplattelandsontwikkeling. Themadag Landbouw en Maatschappij, Melle (BE).

20 maart: Kerselaers E. & Rogge E. Planning en inrichting van de landbouwruimte. Themadag Landbouw en Maatschappij, Melle (BE).

20 maart: Lauwers L. & Dessein J. Visievorming in de varkenshouderij. Themadag Landbouw en Maatschappij, Melle (BE).

20 maart: Van Meensel J. & Vander Vennet B. Bedrijfstechnologieën identificeren en evalueren op sectorniveau. Themadag Landbouw en Maatschappij, Melle (BE).

17 april: Rogge E. Ruimtelijke ordening en inplanting van sierteeltbedrijven en para-agrarische bedrijven. Sierteeltcongres Gentse Floraliën 'Uitdagingen in de sierteeltsector en wat de wetenschap daartoe kan bijdragen', Gent (BE).

22 mei: Wustenberghs H. Kengetallen voor waterverbruik in de landbouw. Vervolmakingsdag Afdeling Operationeel Waterbeheer, VMM, Brussel (BE).

17 juni: De Mey K. Schitteren(d) op het erf: de duurzaamheidsster. Slotmoment Leader+ project Sterk met Melk!, Beernem (BE).

22 september: De Mey K. De duurzaamheidsster: concept en toepassingen. Infosessie voor Vlaams Agrarisch Centrum (VAC), Merelbeke (BE).

25 september: Dessein J. Groene Zorg in Vlaanderen: uitdagingen voor beleid en onderzoek'. Geraardsbergen (BE).

25 september: De Mey K. & D'Haene K. Gebruik van de duurzaamheidsster in bedrijfsleiderskringen. Bedrijfsleiderskring LIBA, Bocholt (BE).

6 oktober: Rogge E. Perceptie van landbouwlandschappen In Vlaanderen. GeLand, Gent (BE).

4 december: De Mey K. & D'Haene K. De duurzaamheidsster: ontwerp, toepassingen en ecologische indicatoren. Voordracht voor studenten 'Master in de Biowetenschappen', Katholieke Hogeschool Kempen, Geel (BE).

9 december: De Mey K. & D'Haene K. Gebruik van de duurzaamheidsster in bedrijfsleiderskringen. Bedrijfsleiderskring Boerenbond, Wuustwezel (BE).

Plant Sciences Unit

1 februari: Van Hemelrijck W., Debode J., Hauke K., Heungens K., Maes M. & Creemers P. (2008) Onderzoek naar het 'voorkomen' van *Colletotrichum acutatum* in de Belgische aardbeiteelt. studienamiddag aardbeien voor telers, Pcfruit Tongeren (BE).

4 februari: De Vliegher A. (2008) Voederbietenteelt anno 2008. Studieavond landbouwcomice Leuven, Bekkevoort (BE).

6 februari: De Vliegher A. (2008) Graslanduitbating en -vernieuwing. Studieavond Groene Kring, Destelbergen (BE).

7 februari: Maes M. ILVO - Research in plant health and regulated pests. ERAnet EUPHRESCO symposium, Brussel (BE).

16 februari: Muylle H. (2008) Moleculair genetische studies in de praktijk. Studiedag KUL en ILVO.

22 februari: De Vliegher A. (2008) Graslanduitbating en -vernieuwing. Studieavond Groene Kring, Velzeke (BE).

27 februari: Baert J. (2008) Voorstelling onderzoeksresultaten 2007: veredeling industriële cichorei aan Sensus. Warcoing, BE.

27 februari: De Vliegher A. (2008) Graslanduitbating en -vernieuwing. Studiedag PCLT, Sint Niklaas (BE).

27 februari: Wesemael W. (2008) Nematoden in de wortelteelt. studienamiddag vollegrondsgroenten: thema wortelen, Rumbeke-Beitem (BE).

28 februari: De Keyser E. (2008) Azalea's brengen ILVO de wereld rond. 16e studiedag azalea, Melle (BE).

10 maart: NRL & FAVV, vorming, Brussel (BE)
•Viaene N. (2008) Binnenbrengen van stalen voor onderzoek naar nematoden.
•Viaene N. (2008) Modalités de transmission des échantillons au laboratoire pour analyse sur nématodes.
•Casteels H. (2008) Richtlijnen voor het binnenbrengen van monsters voor onderzoek van Q-insecten/mijten.
•Casteels H. (2008) Modalités de transmission des échantillons au laboratoire pour analyse d'insectes/acariens de quarantaine.
•Heungens K. (2008) Binnenbrengen van monsters voor onderzoek van Q schimmels
•Van Vaerenbergh J. (2008) Richtlijnen voor het binnenbrengen van monsters voor onderzoek van Q-bacteriën
•Van Vaerenbergh J. (2008) Modalités de transmission d' échantillons destinés à la recherche d'une bactérie Q.
•Van Vaerenbergh J. (2008) Binnenbrengen van monsters: inleiding en algemene procedures.

26 maart: Baert J. (2008) Voorstelling onderzoeksresultaten 2007 veredeling industriële cichorei aan Orafti. Tienen, BE.

9 april: Viaene N. (2008) Root-knot nematodes (*Meloidogyne* spp.) with quarantine status in potato and vegetable culture. BeSCroP (Belgian Society of Crop Protection), Gembloux (BE).

18 april: Leus L. (2008) gecombineerde voorstelling op een sierteeltbedrijf - wetenschappelijk onderzoek. Sierteeltcongres Gentse Floraliën, Gent (BE).

22 april: De Witte A. (2008) Ploïdieveredeling aan de hand van ongereduceerde gameten in *Begonia*. Ploïdie: vriend of vijand van de veredelaar, Melle (BE).

22 april: Leus L. (2008) Chromosomen en ploïdie: basisbegrippen voor de veredelaar. Sietinet Workshop: Ploïdie vriend of vijand van de veredelaar, Melle (BE).

12 september: De Vliegher A. & Chaves B. (2008) Beproeving van de persistentie van Engels raaigras variëteiten onder begrazing. Proefplatform voedergewassen, Sint-Martens-Lennik (BE).

1 oktober: Van Huylenbroeck J. (2008) Azanova: vernieuwing in azalea. Bloemistengilde Lochristi, Lochristi (BE).

14 oktober: Willekens K., Ruysschaert G. & Carlier L. (2008) Koolstofmineralisatie versus koolstofopslag in relatie tot bodembeheer. Duurzaamheidscongres 'Landbouw vs. Klimaat', Leuven (BE).

23 en 24 oktober: NRL en FAVV, vorming, Brussel (BE)
•Casteels H. (2008) *Dryocosmus kuriphilus* de kastanjegalwesp.
•Heungens K. (2008) Workshop 'organismen uit de quarantaine & EPPO alert list' mycologie.
•Van Vaerenbergh J. (2008) Workshop Actuele Q-bacteriën (2000/29/CE & EPPO alert list).
•Viaene N. (2008) Nematoden en de EPPO Alert List: Heterodera glycines, *Meloidogyne enterolobii, M. minor*.
•23 oktober: Witters J. (2008) *Tetranychus evansi* spintmijt op tomaat.
•Casteels H. (2008) *Dryocosmus kuriphilus* le cynips du châtaignier.
•Van Vaerenbergh J. (2008) Atelier Bactéries de quarantaine actuelles (2000/29/CE & liste d'alerte de l'OEPP).
•Viaene N. (2008) Nematodes et la Liste Alerte de l'OEPP: *Heterodera glycines, Meloidogyne enterolobii, M. minor*.
•Witters J. (2008) *Tetranychus evansi* l'acarien rouge de la tomate.

27 oktober: Viaene N. (2008) Root-knot nematodes (*Meloidogyne* spp.) with quarantaine status in potato culture. FAVV, overleg met de gewesten, Brussel (BE).

7 november : Maloukh L., De Keukeleire J., Matousek J., Matthews P. D., Schwekendiek A., Heyerick A., De Keukeleire D., Van Bockstaele E. & Roldán-Ruiz I. (2008) Identification of full-length cDNA sequences of Hop (*Humulus lupulus* L.) candidate genes of the prenylflavonid pathway. Secondary Metabolites and Molecular Farming, Gent (BE).

18 november: Wesemael W. (2008) Bonen en wortelknobbelnematoden: een moeilijk verhaal. *Meloidogyne* werkgroep, Merelbeke (BE).

27 november: Workshop 'Quarantaine ziekten en plagen op aardappel', Merelbeke (BE).
•Heungens K. (2008) Workshop 'Detectie organismen uit de quarantaine lijst: partim mycologie'.
•Van Vaerenbergh J. (2008) Interactieve workshop 'Bacteriën in fytosanitaire controle van aardappelppootgoed'.
•Viaene N. (2008) Quarantaine nematoden op aardappel.

28 november: Workshop 'Quarantaine ziekten en plagen op aardappel', Gembloux (BE).
•Van Vaerenbergh J. (2008) Atelier interactif 'Bactéries dans le contrôle phytosanitaire des plants de pommes de terre'.
•Viaene N. (2008) Nématodes de quarantaine pour pommes de terre.

9 december: Vercauteren A., Heungens K. & Maes M. (2008) *Phytophthora ramorum* in de bosbouw. Workshop Euphresco, Brussel (BE).

10 december: Heungens K. (2008) Fysio's van Japanse roest: een nieuwe uitdaging? Studiedag Potchrysant, Destelbergen (BE).

Technology & Food Science Unit

15 januari: Workshop in het kader van Scientist@work voor middelbare school uit Kortrijk, Melle (BE).

- De Ville W. Technologisch proefwerk voor de zuivelindustrie.
- Hullebusch K. Antibioticabepaling en ATP-testen.
- Van Coillie E. Microbiologische analyse en toepassing van de microbiologie in de zuivel.

22 januari: Declercq J. Cursus "Spuittechniek in tuinbouw en sierteelt" veiling Borgloon (BE).

23 januari: Van Coillie E. Experience from other fields – reference endogene systems in microbiology. Workshop "Reliability of reference endogenous systems for GMO quantification"georganis eerd in het kader van het EU-project "Co-Extra", Brussel (BE).

7 februari: Declercq J. Cursus :"Spuittechniek in tuinbouw en sierteelt" PC Hoogstraten (BE).

10 februari: Reybroeck W. Analyse van Vlaamse Honing. Voordracht op vraag lokale imkersbond Schilde (BE).

21 februari: Declercq J. Cursus "Spuittechniek in tuinbouw en sierteelt".

3, 4, 6 en 10 maart: De Boosere I. & Vlaemynck G. Autocontrole: Basis microbiologie, goede hygiënepraktijken en inrichting verwerkingslokalen. Autocontrole voor hoevezuivelproducenten, Assenede, Houthulst, Aalter & Bever (BE).

6 maart: Declercq J. Voordracht "Spoelwatertankactie" CODA Tervuren (BE) in kader van TOPPS project.

17 maart: Braekman P. Onderhoud en afstellen van spuitmachines. PCLT-cursus 'Gewasbescherming' voor 'Vereniging van Noord-Belgische boomtelers'.

17 maart: Braekman P. Doptypes en hun voornaamste eigenschappen. PCLT-cursus 'Gewasbescherming' voor 'Vereniging van Noord-Belgische boomtelers'.

17 maart: Taverniers I. Introductie tot GGO analyse: detectie, identificatie, kwantificering. Les Toegepaste Plantenveredeling, 3de Ms Bio-Ingenieurswetenschappen.

17 maart: Van Droogenbroeck B. Planten als bioreactoren voor de aanmaak van waardevolle eiwitten. Les Toegepaste Plantenveredeling, 3de Ms Bio-Ingenieurswetenschappen.

17, 18, 20 en 25 maart: De Boosere I. Autocontrole: HACCP, versoepelingen, traceerbaarheid, meldingsplicht en autocontrole in de praktijk. Autocontrole voor hoevezuivelproducenten, Assenede, Houthulst, Aalter & Bever (BE).

19 maart: De Boosere I. & Vlaemynck G. Verpakking voor hoevezuivelproducenten, Stasegem (BE).

22 maart: Reybroeck W. Honing: definitie, kwaliteitscriteria en resultaten kwaliteitscontroles. Les in het kader van de lessenreeks 'Bijenproducten' PCLT, Roeselare (BE).

31 maart, 1, 3 en 7 april: De Boosere I., De Reu K. & Jacxsens L. Autocontrole: Sectorgids hoevezuivel (gevarenanalyses), hoe reageren op afwijkende analyseresultaten en non-conformiteitenregister. Autocontrole voor hoevezuivelproducenten, Assenede, Houthulst, Aalter & Bever (BE).

2 april: De Boosere I., De Block J. & Duquenne B. Roomijsbereiding: berekening van mixen. IJsbereiding en rol van ingrediënten. Suikerarm ijs: etikettering, ILVO & Steunpunt Hoeveproducten, Melle (BE).

3 april: De Boosere I., De Block J. & Duquenne B. Roomijsbereiding: berekening van mixen. Suikerarm ijs: etikettering, ILVO & Steunpunt Hoeveproducten, Geel (BE).

5 april: Reybroeck W. Honing: kristallisatieproces, enten/ verzorgen van honing en de bepaling van tetracyclineresiduen. Les in het kader van de lessenreeks 'Bijenproducten' PCLT, Roeselare (BE).

8 april: Van Royen G. Detection of hydroxyproline in chicken meat. Euro Food's Water- 5th conference on water in food, Stuttgart (DE).

10 april: Werbrouck H. Virulentie van *Listeria monocytogenes*. Beheersing van *Listeria monocytogenes* in levensmiddelen: een update, Brussel (BE).

10 april: Van Coillie E. Problematiek van *Listeria monocytogenes*. Beheersing van *Listeria monocytogenes* in levensmiddelen: een update, Brussel (BE).

10 april: De Reu K. Detectie van *Listeria monocytogenes* in levensmiddelen. Beheersing van *Listeria monocytogenes* in levensmiddelen: een update, Brussel (BE).

15 april: De Boosere I. & Dohogne G. Afvulmachines voor kleine zuivelproducenten en fruitsapbereiders. Demosessie kleinschalige afvulmachines, Geel (BE).

17 april: Van Coillie E. Toepassing van real-time PCR in het onderzoek van voedselpathogenen. Bezoek KATHO Roeselare, Melle (BE).

19 april: Reybroeck W. Producten van de bij. Les in het kader van de lessenreeks 'beginnend imker' PCLT, Roeselare (BE).

28-30 april: Van Pamel E., Daeseleire E., Herman L., Verbeken M. & Vlaemynck G. Detection and typing of fungi present in maize silage. 30th Mycotoxin Workshop, Utrecht (NL).

6 mei: NRL workshop - Milk and milkproducts: Heat treatment of milk: from technology, impact on shelf life and microbiological safety to the analytical assessment, Melle (BE).

- Coudijzer K.: Heat treatments of milk: principles and technology
- Heyndrickx M.: Impact of heat treatment of milk on bacterial sporeformers
- De Block J.: Intrinsic indicators for the heat treatment of milk.
- Vlaemynck E.: Impact of heat treatment of milk on shelf life and microbiological safety

7-10 mei: Leleu S. Eggshell factors influencing eggshell penetration and whole egg contamination by different bacteria, including *Salmonella Enteritidis*. 1st Mediterranean Summit of WPSA, Advances and Challenges in Poultry Science, Porto Carras (GL).

8 mei: Daeseleire E. Chemical contaminants and residues in feed: activities at ILVO-T&V, Brussel (BE).

14 mei: Marchand S., Heylen K., Coudijzer K., De Vos P., Dewettinck K., De Block J. & Heyndrickx M. Screening of the Proteolytic psychrotolerant raw milk microbiota: does the role of Pseudomonas fluorescens need revision? IDF dairy science and technology week, Québec City (CA).

16 mei: Viaene J., Gellynck X. & Messens W. Methodologie de l'analyse côuts-bénéfices en santé animale. Evaluation épidémiologique des pertes socio-économique liées aux maladies animales, Liège (BE).

3 juni: De Boosere I. Claims. Etikettering voor hoevezuivelproducenten, Assenede (BE).

19 juni: De Reu K. Activiteitenverslag 2007 en eerste halfjaar 2008, NRL Melk en Melkproducten, Communicatiegroep NRL - FAVV, Brussel (BE).

2 september: Van Coillie E. Quantification of *Campylobacter* spp. in chicken carcass rinse by real-time PCR. Food Micro 2008, Aberdeen (UK).

2 september: Van Coillie E. Influence of acid stress on survival, expression of virulence genes and invasion capacity into Caco-2 cells of *Listeria monocytogenes* strains of different origins. Food Micro 2008, Aberdeen (UK).

12 september: Van Coillie E. Coagulase-negatieve stafylokokken: opduikende mastitispathogenen. 13th Conference on Food Microbiology, Gent (BE).

20 september: Declercq J. Demo keuring vakbeurs aardbei Hoogstraten (BE).

27 september: Reybroeck W. Residuen in honing. Studiedag voor honingkeurmeesters, Eerbeek (NL).

28 september: Reybroeck W. Honingkwaliteit en honinganalyses. Cursus gespecialiseerd imker door koninklijke Oost-Vlaamse Imkersbond, Aalter (BE).

21, 23 en 27 oktober: De Boosere I. Nazorgsessies autocontrole voor hoevezuivelproducenten, Houthulst, Aalter en Bever (BE).

13 november: Declercq J. Demo+voordracht keuring tomatentelers Sint-Katelijne-Waver (BE).

13 november: Ooghe S. & Reybroeck W. The use of microbiological tests for monitoring of residues of antimicrobials in milk: the Belgian approach. Microbiological screening methods for antiomicrobial residues, Wageningen (NL).

18-21 november: Marchand S., Coudijzer K., Dewettinck K., Heyndrickx M. & De Block J.
- Methodologies in the identification of Pseudomonas sp. isolated from Belgian raw milk samples.
- Seasonal influence on heat-resistant proteolytic capacity of *Pseudomonas ludensis* and *Pseudomonas fragi*, predominant milk spoilers isolated from Belgian raw milk samples.
- Conservation of the aprX gene within *Pseudomonas* milk isolates.

Pseudomonas Workshop NZMS conference 2008, Germs and Genomes in the Garden City, Christchurch (NZ).

2 december: Coudijzer K. & Vlaemynck G. Autocontrole: Basis microbiologie, goede hygiënepraktijken en inrichting verwerkingslokalen. Autocontrole voor hoevezuivelproducenten, Nieuwkerken (BE).

2 december: NRL Melk en Melkproducten, Communicatiegroep NRL - FAVV, Brussel (BE).
- De Reu K.: Activiteitenverslag tweede halfjaar 2008.
- Marchand S., Coudijzer K., De Ruyck H. & De Block J.: Bepaling van de inactivatiekinetiek van alkalisch fosfatase in rauwe paardenmelk.

2 december: NRL Workshop – Milk and Milk products: Chemical residues in milk: from legislation to analytical techniques, Brussel (BE).
- Ooghe S. & Reybroeck W.: Validation of Beta-s.t.a.r. 1+1 for the detection of beta-lactams in milk.
- Ooghe S. & Reybroeck W.: Validation of the Charm MRL-3 for the detection of Beta-lactams in milk.

3 december: Piessens V. Coagulase-negative staphylococci - contagious or environmental? Outline of two ongoing studies. Dutch Mastitis Research Workers meeting 2008, Deventer (NL).

4 december: Studienamiddag voor de Belgische zuivelindustrie, Melle (BE).
- Van Royen G.: Wetenschappelijke begeleiding voor de zuivelindustrie.
- Reybroeck W. & Ooghe S.: Validatie van de Beta-s.t.a.r. 1+1 voor de detectie van beta-lactamantibiotica in melk.
- Reybroeck W. & Ooghe S.: Validatie van de Charm MRL-3 voor de detectie van beta-lactamantibiotica in milk.
- Ooghe S. & Reybroeck W.: Bespreking resultaten ringonderzoeken.

4 december: Vlaemynck G. & Coudijzer K. Autocontrole: Basis microbiologie, goede hygiënepraktijken en inrichting verwerkingslokalen. Autocontrole voor hoevezuivelproducenten, Grimbergen (BE).

9 december: Coudijzer K. & Vlaemynck G. Autocontrole: HACCP, versoepelingen, traceerbaarheid, meldingsplicht en autocontrole in de praktijk. Autocontrole voor hoevezuivelproducenten, Nieuwkerken (BE).

11 december: Vlaemynck G. & Coudijzer K. Autocontrole: HACCP, versoepelingen, traceerbaarheid, meldingsplicht en autocontrole in de praktijk. Autocontrole voor hoevezuivelproducenten, Grimbergen (BE).

11 december: Coudijzer K. Pilootonderzoek voor de voedingsindustrie aan het ILVO. Verwerking en valorisatie van waterige processtromen, Mol (BE).

16 december: Coudijzer K., De Reu K. & Jacxsens L. Autocontrole: Sectorgids hoevezuivel (gevarenanalyses), hoe reageren op afwijkende analyseresultaten en non-conformiteitenregister. Autocontrole voor hoevezuivelproducenten, Nieuwkerken (BE).

18 december: Vlaemynck G., De Reu K. & Jacxsens L. Autocontrole: Sectorgids hoevezuivel (gevarenanalyses), hoe reageren op afwijkende analyseresultaten en non-conformiteitenregister. Autocontrole voor hoevezuivelproducenten, Grimbergen (BE).

18 december: Heyndrickx M. Sporenvomers met bijzondere eigenschappen: hooghitteresistente sporen en alicyclobacillen. Wraak van de microben, Wageningen (NL).