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This annual report describes the results of ILVO's two joined legal entities:

- ✓ The Internally Autonomous Agency (IAA) of the Flemish Government
- ✓ ILVO Own Capital (ILVO-OC)

### **ILVO's Mission**

ILVO's mission is to perform and coordinate policy-supportive scientific research and related services. Our ultimate goal is to contribute to economically, ecologically and socially sustainable agriculture and fisheries.

ILVO therefore acquires the knowledge needed to improve products and production methods, to guarantee the quality and the safety of the end-products and to improve the policy instruments as the basis of development of the agriculture industry and rural policy.

Knowledge only becomes valuable once it is shared. Therefore ILVO strives to inform policymakers, the various industrial sectors and the general public about our projects, future plans, and results.

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Dear reader,

With no small pride and enthusiasm, the nearly 600 employees of ILVO present this 2012 annual report. We are proud to report on our research efforts to support sustainable and productive agriculture and fisheries in a healthy and diverse ecosystem.

The past year has been filled with remarkable events at ILVO. First of all, more than 6300 visitors attended our successful open house in October. This event, part of the national Open Enterprise Day, presented ILVO's diverse research activities in a clear and engaging way. In 2012, we also started the first Coordinated Action within ILVO2020. This in-depth study of a current problem in the agriculture and fisheries sectors is funded by ILVO's Own Capital. This financial commitment illustrates our belief in a future-thinking, multidisciplinary and sustainable food production sector, and also how we provide the resources to make it happen.

The increase in quantitative and qualitative scientific output, the choice of research themes that respond to the needs of the sectors and society, and an optimized internal organization have enabled us to achieve high marks for our performance indicators and achievement of our operational goals. We have also basked in the appreciation and attention from our Flemish policy minister, Minister-President Kris Peeters, during his several visits to the research facilities and experimental fields at ILVO. And we enjoyed the attention of European President Herman Van Rompuy, whose name is borne by the Aiko® azaleas bred at ILVO.

I am happy to say that the large majority of ILVO's research projects are done in collaboration with colleagues from universities, university colleges, research institutes, research stations, the agriculture and fisheries sectors, and industry. We see this collaboration as a recognition of ILVO's expertise and capacities. These collaborations have also resulted in success in competitive research and we have thus expanded the funding of research by ILVO's Own Capital. In this way, we have been able to expand our research programme despite the financial constraints of the Flemish Government.

I would like to congratulate all of our personnel for making 2012 a successful year, because they are the ones who made this a very positive 80-year birthday of the first predecessor of ILVO (the Station for Plant Breeding). I would also like to express our gratitude for our stakeholders – we thank you for making our work possible.

With my best regards,

Erik Van Bockstaele  
Administrator General



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- Bart Sonck,  
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Representative of the Flemish Minister of Science and Technology:

Kathleen D'Hondt

Representative of SALV (Strategic Advisory Council for Agriculture and Fisheries):

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## From boars to sea breezes

At the Animal Sciences Unit, 2012 was a year to say goodbye to a long-term colleague, start new research themes and start building the cubicle loose house for dairy cows.

By organizing an academic symposium with more than 200 attendees, we paid tribute to our Scientific Director Daniël De Brabander. Daniël retired after 41 years of research on the optimization of feed rations for dairy cows. We thank him for his achievements at ILVO and in particular for his contributions to the dairy sector.

One major research focus this year was the problem of boar taint. Two doctoral students defended their PhD theses on this theme. Members of the pork industry and policy-makers got the latest information on boar taint through brochures and the seminar 'Producing acceptable pork in a European context' and the CASPRAK seminar entitled 'A comparative study of alternatives to surgical castration without anesthetic of piglets on commercial pig farms'. An outline of research on the remaining issues has already been plotted: which nutritional strategies can help to manage boar taint in a sustainable way and what are the remaining difficulties for implementing measures against boar taint on farms?

The ILVO Animal Sciences Unit proved its competence in 2012 as a professional organizer of the 'Pig Window' '*Varkensloket*', a collection of instruments to translate, integrate and disseminate research results into clear and accessible information (e.g. via a website). We continue our unit's tradition of strong partnerships with fellow researchers, the agriculture and fisheries industries and interest groups. In particular we signed an agreement on the 'Technology Pool for Poultry' ('*Technopool pluimvee*') with Ghent University, *Katholieke Universiteit Leuven*, and the Experimental Poultry Farm (located in Geel) and the Farmer's Union ('*Boerenbond*'). We also participate in the agreement between *Boerenbond* and Gaia concerning developments in animal-friendly rabbit husbandry. In that context, ILVO has started new research on group housing systems for dams and meat rabbits.

We continue to renew and expand our infrastructure. The reinforced concrete foundations have been cast of the new dairy cow house, which can house up to 150 cows. By early 2014, this cubicle loose house will be available for research purposes. The planning stage for building the new pig complex (an experimental farm with sow, piglet and fattening pig compartments) is finished. We hope, in

collaboration with the University College Ghent and Ghent University, to start this building project in 2013.

ILVO's Fisheries research area has expanded its international research contacts and contracts. ILVO coordinated the MEMO project, part of the INTERREG IVA 2 Seas initiative. In our research package of that project, ILVO has provided evidence that the American comb jelly *Mnemiopsis leidyi* is advancing in our waters, but is mainly found in sheltered and transitional waters. We also started a second prestigious European project where ILVO, together with 20 other institutes, will study the problem of microplastics in water, on the seabed, and in marine life.

We have gathered knowledge about the foraging behaviour of sea bass. Using these data, the feasibility of open sea farming in offshore wind farms and passive fishing near the windmills comes more clearly into focus. The effect of chemical pollutants on marine life was clearly illustrated in PhD research on the shrimp population. Their population was pressured by hormonal disturbances caused by TBT (tributyltin), an anti-fouling treatment of hulls of ships which is now banned worldwide.

The Fisheries group also contributed innovations to, and intensified their contacts with, the fishing sector. Four commercial vessels chose to install the Hovercran pulse fishing system for shrimp, a technique developed by ILVO. The results do not lie: this fishing system can catch shrimp with 50 % less seabed disturbance and a marked decrease in the number of discards. Two Flemish vessels also received a license to install the Hovercran.

The well-attended workshop on Flemish lobster fishing, a CIVIS-project workshop on the Common Fisheries Policy (CFP), technical innovations, selectivity and fish resources and quotas, and the contributions to the discard atlas and the 'Shrimp Book - *Gernoars*' all show how the research at ILVO Fisheries responds to the real needs of the fishing sector.

The 77 researchers of the Animal Sciences Unit perform scientific research on sustainable livestock farming (cattle, pigs and small husbandry) and the exploitation of marine resources, the protection of the continental and marine environment, the promotion of animal welfare and the provision of high-quality, safe animal products. We also provide specific services for government and the agriculture and fisheries sectors. Services and advice provided by the Animal Sciences Unit happen in large part via ANIMALAB. This reference laboratory carries out research on animal feedstuffs and the nutritional value of animal products. In addition, we measure the quality of fish, crustaceans and molluscs, determine contaminants in environmental samples and the fat of fishery products, and we carry out biological environmental studies. The specialized technical advice and services such as *Varkensloket*, PreventAgri, ADVIS and CIVIS as well as other projects, are all supported by research done in service of the agricultural and fisheries industries.

## Stinky pork?

### Humane alternatives for non-anesthetized surgical castration of male piglets

#### Objectives

In this study we tested several pig farmers' evaluation of four alternatives for surgical castration of male piglets without anaesthesia. In addition, we explored how boar taint can be detected in a reliable way. For each of the four alternatives to surgical castration, the practicality, economic feasibility, potential for animal welfare and the final meat quality were evaluated. In addition to these factors, certain limiting conditions such as legislation, market acceptance and risk for boar taint should be taken into account for some of these alternatives. In a second study, we validated the detection of boar taint using sensory and chemical analysis.

#### Methods

Five treatments were evaluated for each of the stipulated criteria on 20 farms and with 120 male animals per treatment group. Pain due to castration can be reduced or eliminated in several ways: either by using anaesthesia or analgesia, or by not castrating the animals. Therefore, treatments consisted of castration without anaesthesia as a control treatment and four alternatives: (1) castration with analgesia (Metacam® injection 10 to 15 minutes before castration), (2) surgical castration with general anaesthesia (inhalation of 100% CO<sub>2</sub> (not yet legally accepted)), (3) vaccination against boar taint (two injection with Improvac®) and (4) production of entire male pigs.

A U-HPLC-HR-Orbitrap-MS analysis method for the simultaneous quantification of the three boar taint compounds (androstenone, skatole, indole) was developed and validated. This method was further used to search for unknown compounds which may contribute to boar taint. Several aspects of the singeing method were evaluated (methodology used by experts to detect boar taint): technical aspects of the singeing method, habituation, effect of cleaning the hot iron method and singeing at the same spot.

#### Results

This research has revealed several stumbling blocks, opportunities and challenges. If the necessary support is provided (mainly when switching to a new alternative), all alternatives seem to be practically feasible on farm. However, the market potential of entire male pigs and immunocastrates is still small. The main limiting factor for the production of entire male pigs is (the lack of) an objective, at-slaughter-line boar



taint detection method. Observations of behaviour at the end of the fattening period confirmed earlier finding about increased sexual and aggressive behaviour of entire male pigs compared to barrows, but skin lesions and leg problems due to this behaviour were found to be mild rather than severe. Three percent of the entire male pigs were identified as having strong boar taint. Percentages varied between farms from 0 % to 14 %.

For boar taint detection, heating the meat in a microwave oven as well as using a hot iron, pyropen and a pyropen fit with a with plate all seemed to be appropriate. The risk for contamination from not cleaning the hot iron, singeing the fat twice at the same place, and the effect of habituation should be taken into account when evaluating boar taint with a singeing method.

**Title 1:** Onfarm comparison of different alternatives for surgical castration of male piglets

**Funding:** ILVO, Flemish Government, Boerenbond, VLAM, Belpork

**Duration:** 2008 - 2012

**Collaboration:** ILVO, K.U.Leuven (Zootechnical Centre)

**Title 2:** Detectie en valorisatie van vlees met berengeur ("Detection and valorization of meat with boar taint")

**Funding:** IWT

**Duration:** 2009 - 2012

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## Can animal welfare be measured objectively?

Broiler chicken welfare: searching for an animal-based indicator of thirst and evaluating an automated method for scoring footpad dermatitis

### Objectives

To improve the welfare status of broiler chickens, we need objective and reliable methods for assessing animal welfare. The goal of this project is to improve existing broiler welfare assessment protocols, particularly with regard to the measurement of (prolonged) thirst and of footpad lesions.

### Methods

We developed and tested animal-based indicators of thirst. We evaluated the performance of a recently developed prototype system for the automatic assessment of footpad lesions at the slaughter line.

### Results

We tested several blood parameters. Of these, the sodium concentration appeared to have most promise as an indicator of thirst. This parameter showed a steady incremental change along with increasing duration of water deprivation. Other blood parameters showed some promise as thirst indicators as well, albeit being restricted to the identification of a certain level of thirst. Plasma creatine concentrations, for example, allow differentiation between short-term (6 h) and long-term (>24 h) water deprivation, and the chloride concentration increases after 6 h of water withdrawal but does not rise further with longer withdrawal. These blood parameters could be determined during the slaughter process.

We also developed a non-invasive, animal-based test for assessing thirst on-farm. This test is based on the voluntary water consumption rate from an easy-to-access open drinker. This test appeared sufficiently sensitive to discriminate between non-deprived control groups and groups that had been water-deprived for 12 hours. Some risk factors related to the management and indoor climate were identified that affected the test outcome. The genotype and the indoor climate may need to be taken into account for determining the range of normal water consumption level in commercially-housed chickens.

In order to evaluate, the performance of the automatic scoring system for assessing footpad lesions was compared with the scores given by an expert. Because the severity of lesions can differ between the left and right footpad, it is important that



both footpads are scored. The automatic system managed to do so for 43.7 % of the chickens only. Moreover, the assessment by the automatic system was often based on an incorrectly identified area of the footpad that was supposed to be affected. The agreement between the automatic and experts scores improved considerably when the dataset was restricted to chickens who had both footpads assessed and with the correctly located areas of dermatitis.

**Title:** Improving the assessment of thirst and footpad dermatitis in broiler chicken welfare monitoring schemes (doctoral research)

**Funding:** ILVO, Federal Service for Public Health and Safety of the Food Chain and Environment

**Timing:** 2008 - 2012

**Collaboration:** Ghent University (Faculty of Veterinary Medicine), K.U.Leuven (Division of Livestock Nutrition Quality), Proefbedrijf Pluimveehouderij, UR Wageningen (Animal Science Group), the Netherlands

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## Can food additives deflate ruminants' methane emissions?

Technological platform to develop nutritional additives to reduce methane emissions from ruminants

### Objectives

Feed additives may reduce methane production in ruminants, but small and medium-sized enterprises confront barriers when developing these additives. ILVO, along with four other European research institutes, therefore offers a technology platform to test the effectiveness of these additives. The purpose of the platform is to study how these products work, both in vitro and in vivo and in different production systems around the world. In particular the project addresses: 1) the need to standardize and report the concentration of the active component in the additive; 2) the demand for monitoring the stability of the compounds under practical conditions; 3) the question of persistent effects/adaptation of the rumen ecosystem; 4) the lack of in vivo data on livestock production systems; 5) the need to know the effects of the extracts on the perceived quality of dairy products; and 6) the lack of production data on which to base calculations of market prices.

### Methods

The European technological platform is able to adapt the methodology according to the specific questions or development phase in which an additive is situated. ILVO is specialized in the study of long-term effect of the additives. To do so, we place a number of cows (dairy and beef) individually in a high-tech (and comfortable for the animal) open-circuit chamber. After an adaptation period, we carry out a feeding trial which consists of a control period of 2 weeks and a treatment period of 6 weeks. We measure the methane production from each animal for three days at the end of every two weeks. Starting on the first day of the treatment period, the additive under study is mixed into the feed. We then compare the methane emissions during the treatment period with that of the control period, and we record parameters such as feed intake, milk production, milk composition, etc.

### Results

ILVO has screened five plant-based additives of four European SME's under different conditions (species, ration). One of these additives shows potential for reducing methane production in cattle.



**Title:** SMethane ([www.smethane.eu](http://www.smethane.eu))

**Funding:** EU-FP7

**Collaboration:** Ghent University (Lanupro), INRA (France), CSIC (Spain), Aberystwyth University (Wales)

**Duration:** 2010 - 2012

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## Grass silage with higher nutritional value?

The effect of a mixture of lactic acid bacteria on silage quality and feeding value of grass silage and on the performances of dairy cattle

### Objectives

The company Pioneer commercializes a silage additive for grass which consists of a mixture of 3 strains of living lactic acid bacteria. One of these strains, *Lactobacillus buchneri*, not only produces lactic acid but also acetic acid, which is known to improve the aerobic stability of the silage. In addition, these bacteria are able to produce ferulate-esterase, an enzyme capable of cleaving the cross-links between cellulose and lignin. Theoretically, this additive would not only improve silage quality, but also cell wall degradability in the rumen. The latter should then logically result in a higher milk production of cows. Further, the product would allow to postpone grass harvest in case of bad weather conditions without much loss of feeding quality.

### Methods

The silage additive was tested with a first cut wilted English ryegrass, which was harvested in 4 growth stages (from 18 to 29 % of crude fibre (CF) on dry matter). The effects on the silage characteristics, the chemical composition and the digestibility of the organic matter (OM) and of the cell walls (CW) were investigated. In addition, we looked at the effect of adding the product to wilted grass silage with 27 % CF on the performances of dairy cows.

### Results

Compared with the control grass without additive, more sugars were fermented to lactic and acetic acid during the ensiling process of the treated grass, resulting in a lower pH of the silage. Other favourable effects found for the treated silage were the lower dry matter losses, less protein degradation and a better aerobic stability. Through the treatment, the cell walls of grass harvested at the first two growth stages were partly degraded to complex sugars. However, no effect of the additive on CW-digestibility was observed, whereas OM-digestibility tended to improve. In the experiment with dairy cows we found no difference between the control and the treated silage in feed intake nor in milk production or milk composition. Hence, the silage additive offers no flexibility to the farmer to postpone harvest without loss of quality.



**Title:** Ferulate-esterase-producing *L. buchneri* strains: a new revolutionary concept for ensiling forages

**Funding:** University College Ghent & Pioneer Hi-Bred

**Duration:** 2010 - 2013

**Collaboration:** University College Ghent (Departement Biowetenschappen and Landschapsarchitectuur)

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## No calving = no profit

### Factors affecting the calving interval of Belgian Blue double-musled cows

#### Objectives

The calving interval (CI) is of great economic importance in beef cows: a longer CI means a lower income via the calf crop. Because there is no direct sale of milk, the calf is the only source of income. In case of double-musled heifers calving at a young age, there is an increase in value through the body weight gain of the dam.

#### Methods

Factors affecting the CI were investigated based on a data set of 834 CIs from Belgian Blue double-musled cows:

- ♦ animal-related factors: age/parity, body condition at calving, factors dealing with calving ease (gender of the calf, the ratio of calf weight over dam post-partum weight (BWb/BWpp; %), the use of caesarean section)
- ♦ factors related to management and environment: season of calving, calf suckling by their dams or rearing, the use of artificial insemination (AI) or natural service (NS). Besides the factors affecting the CI, the effect of CI on BW gain was also studied.

#### Results

CI averaged 403.9 days. A tendency was observed for a shorter CI in primiparous than in multiparous cows: 400.1 vs. 406.9 days ( $P = 0.071$ ). The gender of the calf and its BWb did not exert a clear effect on CI. The application of caesarean section only resulted in a nominal increase of CI from 393.4 to 404.7 d ( $P = 0.178$ ). There was a clear effect of BWb/BWpp on CI ( $P = 0.020$ ), where a higher as well as a lower value resulted in a longer CI. The different BWb/BWpp ratios coincided with a different body condition at calving. Nevertheless, there was no clear impact of body condition on CI.

CI was het longest for autumn calvings and shortest for spring calvings ( $P < 0.001$ ). Suckling increased CI ( $P < 0.001$ ). AI resulted in a longer CI, but there was also a difference in body condition between AI and NS. A statistical analysis with body condition as covariate only revealed a nominal effect of the breeding system.



**Title:** Fertility and natural calvings in Belgian Blue double-musled cows

**Funding:** ILVO, Flemish Government

**Duration:** 2005 - 2012

**Contact:** leo.fiems@ilvo.vlaanderen.be

## Offshore windmill parks and life on the sea bed

The effects of offshore windmill parks on the demersal fish and epibenthos of soft substrates

### Objectives

Ninety wind turbines have already been constructed in the Belgian part of the North Sea. The effects of these turbines on the surrounding environment is being intensively monitored by a consortium of scientific institutes. Within that consortium, ILVO is focusing on the effects on fish and invertebrates living on the sandy substrates between the turbines.

### Methods

Since 2005, the benthic life was within the windmill parks and within adjoining reference areas sampled every spring and autumn. Data on animal densities, biomass, length distributions and even feeding habits allowed us to trace positive or negative changes due to the presence of windmills.

### Results

The results show that an enrichment of the environment is now detectable up to more than 50m of the turbines. On the sandy seafloor around and between the turbines, higher numbers of sea stars (*Asterias rubens*) and sea urchins (*Psammechinus miliaris*) were observed, while the lesser weever (*Echiichthys vipera*) appears to avoid the windmill parks. It remains difficult to unequivocally trace changes in diversity and numbers of larger benthic fauna, including fish. The size of the animals, however, seems to be increasing within the windmill parks. Commercially important species such as the brown shrimp (*Crangon crangon*), plaice (*Pleuronectes platessa*) and turbot (*Psetta maxima*) seem to be larger within the windmill park area. This can be attributed to the absence of fisheries and to a changing food web within the area. Stomach analyses of fish have shown that some species have fuller stomachs within the parks, and that they partly feed on the animals living on the turbines.

All these effects, and especially the effect of size, are expected to become more pronounced as the populations further develop within the unique environment constituted by the windmill parks.



*Psammechinus miliaris*

Title: Windmills

Funding: BMM

Duration: 2005 to present

Collaboration: BMM, Ghent University (Marine Biology section and Acoustics department), INBO

Contact: sofie.vandendriessche@ilvo.vlaanderen.be

## A bit of phage today

ILVO contributes to rapid detection of chemical substances in the sea

### Objectives

The aim of this research is the development of a biosensor for the detection of contaminants in the environment and fishery products. A biosensor is a rapid method to detect and identify chemical pollutants.

### Methods

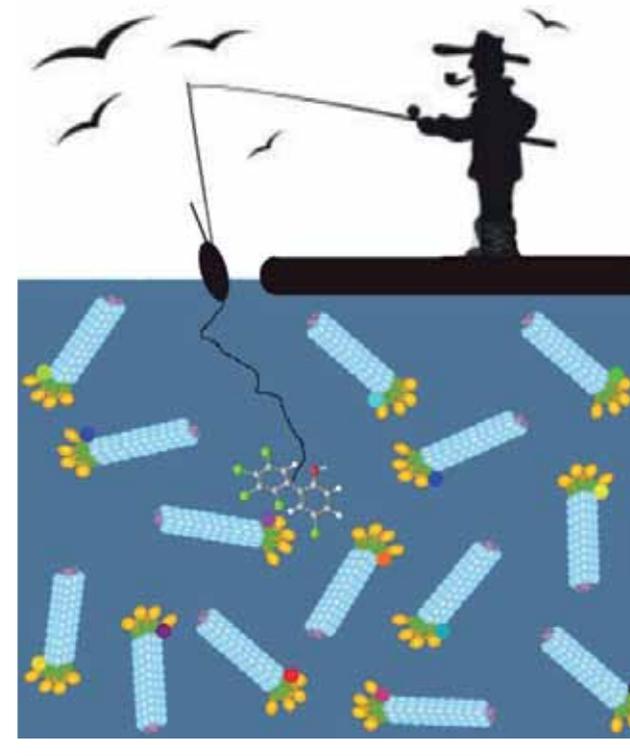
Determination of pollutants in environmental or food samples is usually done using analytical methods (GC-MS LC-MS). A major recent trend is the use of rapid detection methods or biosensors. The first biosensors were based on the specific recognition of antibodies. However, it is not easy to develop antibodies against all possible contaminants. This requires the use of laboratory animals, and in addition these pollutants are often toxic for these test animals.

Moreover, large quantities of these antibodies are not easy to produce. Therefore we investigated whether recognition molecules could be developed as an alternative to the antibody technology. In this study specific aptamers and phages were evaluated. Aptamers are short fragments of single-stranded DNA, which by their typical three-dimensional structure can recognize all kinds of different molecules. Phages are bacterial viruses, and using the phage display technique it is possible to display peptides as well as proteins on the phage membrane and further to select for phages that bind specifically to the pollutant. These alternative recognition molecules are perfect for cost-effective development of a specific biosensor.

### Results

Several aptamers were isolated using Selex-selection against a number of toxins and contaminants (PCBs, Antibiotic, Mycotoxins, etc.). Via SPR (Surface Plasma Resonance) the binding properties were determined. The aptamers were able to bind several contaminants with a high affinity and specificity, thus making them a good alternative to the classical antibodies. These aptamers have been used for the development of a (simple) sensitive colour test and an advanced electrochemical sensor.

Also phages were isolated for a variety of pollutants (PCB, bisphenol, estradiol). Via SPR, the affinity and specificity of these phages evaluated, and these phages could be used as a fast detection system.



In short, the alternative binding molecules are a good alternative to conventional antibodies. We want this approach to be further applied in our further work for rapid detection of contaminants in environmental samples and food.

**Title:** PhD study 'The use of phage display as an innovative approach in environmental science', Bieke van Dorst

PhD study 'Potential biorecognition elements for food and environmental sensors: selection and characterization of aptamers', Jaytry Mehta

**Funding:** ILVO, Federal Service for Public Health and Safety of the Food Chain and Environment

**Duration:** 2005 - 2012

**Collaboration:** University of Antwerp - Lab Sphere (Systemic Physiological and Ecotoxicological Research)

**Contact:** johan.robbens@ilvo.vlaanderen.be

## Bridging the gap between science and fisheries

### Data for the fisheries industry

#### Objectives

ILVO delivers scientific advice to support the development, implementation and monitoring of the European Common Fisheries Policy (CFP) and where possible, to provide information about the implementation of Marine Strategic Framework Directive.

#### Methods

Through commercial and non-commercial surveys, biological, technical, socio-economic and ecosystem-related data are collected. Based on these data advice is given about the state and management of the Belgian and European fisheries. Data on the economic situation of the processing industry and aquaculture in Belgium are collected on an annual basis under the NDGP (Belgian National Data Gathering Programme in support of the European Common Fisheries Policy) as well. As such, the full economic picture of the Belgian fisheries sector can be described.

To realize the general objectives of the NDGP, our researchers concentrate on collecting data regarding the status of the fish stocks, the exploitation pattern of the commercially important species and VMS data (vessel monitoring system - satellite tracking).

Within the NDGP project, several multilateral "age-reading" workshops are organized. The objective of these is to read the same otoliths (structures in the inner ear of fish) by various (international) labs to provide a uniform age reading protocol (quality). This is a top priority for providing reliable assessments and the associated recommendations. Currently, otoliths are read at ILVO for plaice, sole, cod, whiting, hake, dab, lemon sole, flounder, turbot and brill.

Based on the accumulated time series of discard data, technical data and the VMS data within the NDGP, a Belgian Discard Atlas is prepared. This atlas will identify and visualize the discard behavior and the extent of discards by the Belgian fisheries. The Belgian discards atlas is modelled on the Irish discard atlas, but will be a "living" document. Each year, the new data collected are to be added to the series already used and an updated picture of the discard situation will become available.



#### Results

We support the research of the biology, stock assessment methods, the dynamics of marine ecosystems and the potential impacts of fisheries on stocks and the fisheries themselves. This leads to scientific advice to support the development and implementation of the European Common Fisheries Policy (CFP) and Marine Strategic Framework Directive.

Based on the results presented in the Belgian Discard Atlas, some mitigation measures may be formulated to avoid and reduce discards. This represents an important step towards sustainable fisheries. The annual update of the Belgian Discard Atlas will also serve as a tool to follow and to steer the discard behavior of Belgian fishermen. The Discard Atlas is directed to policymakers, the scientists and the fishermen themselves.

**Title:** National Data Collection Program

**Funding:** ILVO, EU

**Duration:** 2011 - 2013 (part of continuous project started in 2002)

**Collaboration:** Dienst Zeevisserij, Rederscentrale, BMM, VISEO (ILVO Fisheries, ILVO Social Sciences)

**Contact:** els.torreele@ilvo.vlaanderen.be

A selection of current projects in the Animal Sciences Unit



**What is the impact of electric shrimp fishing on fish and invertebrate species in the North Sea?**

Title: Evaluation of the impact of electric-pulse shrimp fishing on a selection of marine fish and invertebrate species in the North Sea  
 Funding: IWT  
 Duration: 2012 - 2015  
 Collaboration: Ghent University  
 marieke.desender@ugent.be

**How can scientifically-based animal-friendly production be included in marketing strategies?**

Title: MELKWEL (Animal welfare monitoring in Flemish dairy cattle, consumers and cattle husbandry research including stakeholder participation)  
 Funding: ILVO, Ghent University  
 Duration: 2012 - 2015  
 Collaboration: Ghent University, ILVO Social Sciences  
 sophie.degraaf@ilvo.vlaanderen.be

**What is the effect of marine biotoxins on molluscs and shellfish?**

Title: MARBITOX (Influence of processing on marine biotoxins and risk assessment of marine biotoxins in bivalve molluscs and shellfish)  
 Funding: Federal Service for Public Health and Safety of the Food Chain and Environment  
 Duration: 2012 - 2013  
 Collaboration: WIV  
 johan.robbens@ilvo.vlaanderen.be



**How can fisheries by-products become better valorized?**

Title: GENESYS PhD3 (Use of by-products as system innovation)  
 Funding: ILVO - Coordinated Actions  
 Duration: 2012 - 2016  
 emely.hanseeuw@ilvo.vlaanderen.be



**What are the safety margins for marine organisms and the optimal pulse for catching sole?**

Title: Pulse fisheries: determination of the safety margins for marine organisms and the optimal pulse for catching sole (*Solea solea* L.)  
 Funding: IWT  
 Duration: 2012 - 2015  
 Collaboration: Ghent University  
 maarten.soetaert@ugent.be

**What are the effects of the beam trawl fishery on the benthic ecosystem, and are there the possibilities to reduce these effects in cooperation with the fisheries industry?**

Title: BENTHIS (Benthic ecosystem fisheries impact study)  
 Funding: EU  
 Duration: 2012 - 2017  
 Collaboration: several international partners  
 hans.polet@ilvo.vlaanderen.be

**A selection of current projects in the Animal Sciences Unit**



**What is the impact of plastic and microplastics on our marine ecosystem?**

Title: MICRO (MicroPlastics - Is it a threat for the 2 Seas Area?)  
 Funding: EU-Interreg 2Seas  
 Duration: 2012 - 2014  
 Collaboration: Deltares, CEFAS, IFREMER, CNRS (Université Brest)  
 johan.robbens@ilvo.vlaanderen.be

**How can we improve the welfare of laying hens in organic production systems?**

Title: Promoting health and welfare in European organic laying hens  
 Funding: EU (Core Organic II)  
 Duration: 2011 - 2014  
 Collaboration: eight international partners  
 frank.tuytens@ilvo.vlaanderen.be

**How can we improve the knowledge of the various fish species via hotel schools?**

Title: FISH2KNOW  
 Funding: EVF-AS4  
 Duration: 2012 - 2014  
 Collaboration: Vlaamse Visveiling  
 johan.robbens@ilvo.vlaanderen.be

**Special management of young double-muscle cattle during the summer: is indoor feeding better than grazing?**

Title: JONGSTRA (Opfokstrategie bij jongvee)  
 Funding: ILVO, Flemish Government  
 Duration: 2012 - 2014  
 leo.fiems@ilvo.vlaanderen.be



**Can rabbits be housed in group?**

Title: RABBITRY (Research on animal-friendly housing systems for rabbits)  
 Funding: Federal Service for Public Health and Safety of the Food Chain and Environment  
 Duration: 2012 - 2015  
 Collaboration: Ghent University  
 luc.maertens@ilvo.vlaanderen.be

**How can we feed meat pigs with maximal efficiency using local sources of protein?**

Title: Precision feed for meat pigs: multi-phase feeding on the basis of home-grown protein sources  
 Funding: ADLO  
 Duration: 2012 - 2016  
 Collaboration: University College Ghent, Proef- en vormingscentrum voor de landbouw, Thomas More hogeschool  
 sam.millet@ilvo.vlaanderen.be

**Do omega-3 fatty acids in the mother hen have an effect on progeny?**

Title: Influence of maternal transition of omega-3 fatty acids on hatching, chick quality and performance at slaughter age  
 Funding: ILVO, K.U.Leuven  
 Duration: 2010 - 2014  
 Collaboration: K.U.Leuven  
 evelyne.delezie@ilvo.vlaanderen.be

**What is the feed value of wheat-yeast concentrate, a fluid by-product of bioethanol production for both cattle and pigs?**

Title: Feed evaluation of DDGS as a by-product of bioethanol production for cattle, pigs and poultry  
 Funding: IWV  
 Duration: 2009 - 2013  
 johan.deboever@ilvo.vlaanderen.be

**How can we contribute to the re-launch of the lucrative lobster fishery in Ostend?**

Title: OOLAVIS (Oostendse Langoustinevisserij)  
 Funding: EVF As 4  
 Duration: 2012 - 2014  
 Collaboration: Vlaamse Visveiling, VLAM  
 dirk.verhaeghe@ilvo.vlaanderen.be



**How can science help to valorize sustainable, fresh-caught fish?**

Title: VALDUVIS (Valorization of sustainable, fresh-caught fish)  
 Funding: EVF As 4, Flemish Government, Provincie West-Vlaanderen  
 Collaboration: ILVO Social Sciences, Vlaamse Visveiling  
 Duration: 2012 - 2014  
 kim.sys@ilvo.vlaanderen.be

A selection of current projects in the Animal Sciences Unit



**Safety** versus life on the seabed: the impact of sand supplementation offshore close to Ameland?

Title: Epibenthos and sampling of juvenile fish in Ameland 2012  
 Funding: Deltares (NL)  
 Duration: 2012 - 2013  
 Collaboration: Deltares, E-Coast, Field working company  
 annelies.debacker@ilvo.vlaanderen.be

Is there interest in a standardized information system for sustainably caught fish in fish harbours around the North Sea?

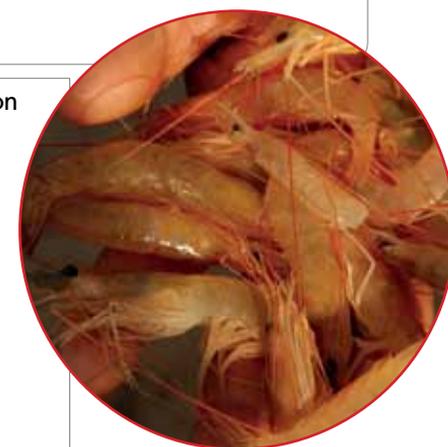
Title: NSF (FISS - Fishery Information System on Sustainability)  
 Funding: EU (Interreg)  
 Collaboration: De Marne the Netherlands), Harlingen (the Netherlands), University of Hull (UK), Sluis (the Netherlands), Harbour of Hanstholm (Denmark)  
 Duration: 2012 - 2014  
 arne.kinds@ilvo.vlaanderen.be

How can the welfare of laying hens in non-cage systems be improved?

Title: LAYERHOUSE (Research to improve non-cage poultry housing systems)  
 Funding: Federal Service for Public Health and Safety of the Food Chain and Environment  
 Duration: 2012 - 2015  
 Collaboration: Proefbedrijf Pluimveehouderij - Geel  
 evelyne.delezie@ilvo.vlaanderen.be

How sustainable are the MSC-certified fisheries on seabob shrimp in the coastal region of Surinam?

Title: Towards sustainable management of the seabob fisheries (*Xiphopenaeus kroyeri*) in the coastal zone of Surinam  
 Funding: VLIR  
 Duration: 2012 - 2016  
 Collaboration: Ghent University, ADeKus (Surinam), Heiploeg (België and Surinam)  
 tomas.willems@ilvo.vlaanderen.be



Can reliable NIRS calibrations be developed to estimate the cell wall digestibility and starch breakdown of silage maize varieties?

Title: Feed value estimation of silage maize on the basis of cell wall digestibility and starch breakdown  
 Funding: Fund for Agriculture and Fisheries  
 Duration: 2011 - 2013  
 Collaboration: University College Ghent, CRA, CIPF  
 johan.deboever@ilvo.vlaanderen.be



Can we, as an alternative for the castration of piglets, reduce boar taint through genetic selection without trade-offs on zootechnical results, carcass and meat quality, and animal welfare?

Title: CASSEL (Selection against boar taint as sustainable alternative for castration of piglets)  
 Funding: IWT  
 Duration: 2012 - 2013  
 Collaboration: K.U.Leuven  
 alice.vandenbroeke@ilvo.vlaanderen.be

Can we quantitatively analyze glucocorticoids in hair and can we link these levels to periods of stress in the animal?

Title: Development and validation of a long-term indicator for animal welfare: accumulation of physiological stress indicators in non-invasively sampled matrices  
 Funding: Flemish Government  
 Duration: ongoing since 2010  
 Collaboration: Ghent University  
 johan.aerts@ilvo.vlaanderen.be



KRISTIAAN VAN LAECKE,  
Plant Sciences Unit Head  
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## Innovation for optimal protection and production

In 2012 Minister-President Kris Peeters visited the first promising experiments with soybean and sorghum. The Plant Sciences Unit is investigating whether these subtropical crops can flourish in our climate and obtain a sufficiently high yield. The study of these new crops reflects the decision to diversify crops according to the Common Agricultural Policy (CAP) of the European Union and the demand for domestically-grown alternative protein crops. Soybean cultivation in Flanders could make us less dependent on imports and may contribute to a more sustainable livestock production with fewer price fluctuations. Sorghum has potential as alternative to very late sown maize. Given its drought resistance, it can be used as a response to climate change.

The number of projects concerning soil and soil quality within the Plant Sciences Unit has increased. In the framework of the implementation of MAP4 and preparing for MAP5, ILVO established and coordinated the 'Sustainable Fertilization' research platform. In the search for how to improve soil quality and long-term carbon storage in agricultural soils, Plant Sciences organized a workshop on the Interreg project on biochar. Also in the FP7 project 'Catch C', ILVO is collaborating with several European partners to find the best agricultural practices for carbon storage, quality and healthy soils and optimum crop production.

During the past three years, we have participated in the major European DNA barcoding programme for quarantine organisms. Barcode identification is currently used mainly for the diagnosis of bacteria and insects. Plant Sciences conducted research into the leaf spot disease of strawberries under Flemish growing conditions. The strawberry growers and the policy-makers have been informed about the implications for strawberry cultivation and the quarantine status of this bacterial disease. Based on the results and together with our Dutch colleagues, we have prepared a Pest Risk Analysis for the EU.

The Growth and Development research area, together with the MRP consortium Ghent Bio-Economy of Ghent, organized the Ghent Bio-Economy Summer School in August. More than 50 participants during five days learned about the latest global developments in the whole process of converting biomass to bioproduct.

Is all the international research on nursery stock aiming for the same objectives? Yes. Optimal production with fewer inputs of water, fertilizers and pesticides, climate change impact, custom cultivars and monitoring of new pests and diseases: everybody studies these themes. This was the conclusion of the big 'Woody Ornamentals' congress that ILVO organized for 160 researchers from 30 countries.

Many years of genetic selection by our breeders resulted in many promising cultivars. Therefore we invested in December 2012 in no less than 16 new applications of mainly grasses in Belgium, the Netherlands, Germany, France, England and Switzerland. Hopefully within a few years this will result in the successful registration of new varieties with improved yield and disease resistance.

We have now completed the new greenhouse complex with a section for quarantine organisms and growth chambers. This enables a very wide range of experiments to be performed under highly controlled conditions.

The 75 researchers in the Plant Sciences Unit study and identify bacteria, fungi, viruses, insects, mites and nematodes that can negatively affect plants, together with sustainable ways to combat these diseases and pests. In the Applied Genetics and Breeding research area, we are working on the genetic improvement of disease resistance, and optimal nutrient and water utilization. The researchers at Growth and Development strive to decipher the fundamental processes of a crop, and the researchers in Crop Husbandry and Environment Research area are involved compare farming systems and their impact on the crop, the soil quality and the environment.

The separate Plant Sciences Business Unit is responsible for the development and marketing of high-quality starting plant material (seeds, cuttings), for the diagnosis of plant diseases and pests, for the detection and management of quarantine organisms and for chemical analyses of forage, soil and substrates.

## Better flowering of the azalea in your living room

### Research on flowering regulation and quality

#### Objectives

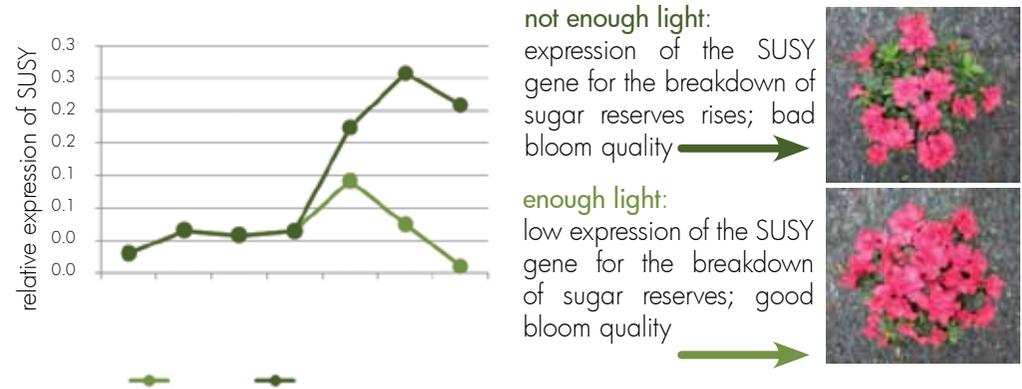
Azaleas have a good reputation as being a high-quality pot plant that can flower for several weeks. But if their flowers do not open equally, or if the flowers remain closed after sale, azalea sales could start to drop. In 2008, the azalea growers and retailers were having increasing problems related to flowering quality. The goal of this project was to determine the causal factors of this problem. Did the altered growth conditions of the last decade have an impact on this problem? Could we propose a way to guarantee high-quality growth, thereby ensuring higher flowering quality?

#### Methods

In several experiments, we grew azaleas under different conditions. Each experiment stressed a specific growth phase (bud initiation, dormancy, anthesis). Test objects were studied using a multi-disciplinary approach. Flowering of the plants was evaluated by counting the number of flower buds. The physiological condition of the plants was also compared during different growth stages, e.g. by determining the amount of carbohydrates stored. Finally, the expression of a set of key genes was measured in the different growth stages. The combination of all of these data demonstrated how specific growth manipulations influenced flowering of the plants.

#### Results

Two factors were found to have a major impact on flowering quality. First, it is extremely important that plants are stored in the cold chamber at 7 °C for dormancy release. The exact timing for storing the plants has to be determined based on the stage of flower differentiation. Depending on the cultivar, 4 to 10 weeks of cold temperatures are needed for dormancy release. Second, carbohydrate metabolism plays an important role. Plants need a certain amount of starch to stimulate the opening of the flowers. During forcing, starch is accumulated, which allows flowering later on in (relatively dark) living areas. Providing sufficient light during forcing is crucial because this helps the plant accumulate enough starch to bloom properly. Researchers in another ILVO study calculated exactly how much light is needed (see next page). Genetically and physiologically, this project demonstrates the need for the right growing conditions. These results tell the grower how to alter the growth



of their azaleas in order to assure optimal flowering after sale of the plant. We concluded from a survey that flowering quality has improved by 95 % in the period of the year that was most problematic in the past!

**Title:** Flowering quality and regulation in azalea: interaction between genetic, physiological and growth specific factors

**Funding:** IWT

**Duration:** 2008 - 2012

**Collaboration:** Ghent University (Department of Plant Production – In vitro biology and horticulture – Faculty of Bioscience Engineering), Ornamental Research Station (project coordinator)

**Contact:** ellen.dekeyser@ilvo.vlaanderen.be

## Light leads to flowers

### Minimum light requirements for good flowering in azalea

#### Objectives

We investigated how to guarantee the customer a better flowering azalea at the lowest possible cost for the grower. Forcing an azalea to flower is a short but decisive phase for the quality and therefore the economic value of the plant. A flower bud will only grow into a beautiful and flourishing flower if sufficient sugar stocks are available in the plant. After cold storage however, the plant has lost a large proportion of the sugar reserves due to respiration. If these reserves are not replenished during forcing, the flowering quality in the living room is compromised.

#### Methods

Forcing occurs in greenhouses at approximately 21 °C, starting from September to May depending on the earliness of the cultivar. Especially during the months of November to February, natural light is lacking. Light is necessary for photosynthesis in the plant; this is the way it replenishes its sugar reserves. Therefore, during this period, assimilation lighting with SON-T lamps is used to stimulate extra photosynthesis. However, this represents a significant energy cost for azalea cultivation. To minimize the energy cost of this additional light exposure, we have determined the minimum daily light integral (DLI) based on plant photosynthesis measurements in growth chambers. This minimum DLI is achieved when the respiration losses on a daily basis are compensated by photosynthesis. During the night, the net photosynthesis is negative. In other words, only respiration is happening. By respiration the plant consumes sugars and starch for growth and maintenance. During the day - when sufficient light is present - the plant can carry out photosynthesis and will thus create new sugars.

#### Results

In a growth chamber, the plant photosynthesis at different temperatures and light intensities were determined for two cultivars: 'Nordlicht' and 'Thesla'. For this, whole plants were placed in plexiglas cuvettes. The results showed that the minimum of DLI for 'Nordlicht' and 'Thesla' was 2.10 mol m<sup>2</sup> d<sup>-1</sup> and 1.66 mol m<sup>2</sup> d<sup>-1</sup>, respectively. The development phase of the plants did not affect the minimum DLI, suggesting that daily light sum should not to be changed during forcing. A higher temperature resulted in a higher minimum DLI, due to the increased respiration in the dark. Meeting the



minimum DLI does not guarantee good flowering, but it does keep the plant's sugar reserves in balance. Extra light is needed for sugar reserves to build up. How much extra light above the minimum DLI is needed to achieve a qualitative flowering will be determined in future research.

**Title:** FENOMOD flowering regulation and quality in azalea: interaction between genetic, physiologic and culture-related factors

**Funding:** ILVO, IWT

**Duration:** 2011 - 2013

**Collaboration:** Ghent University (Department of Plant Production – In vitro biology and horticulture – Faculty of Bioscience Engineering), Ornamental Research Station (project coordinator)

**Contact:** peter.lootens@ilvo.vlaanderen.be

## A rose by any other name...would be as resistant to powdery mildew?

Markers for powdery mildew resistance found on the rose genetic map

### Objectives

Better disease resistance is one of the main goals in rose breeding. ILVO researchers study resistance towards powdery mildew (*Podosphaera pannosa*). Powdery mildew is a fungal disease occurring on cut roses in greenhouses and on garden roses. A diploid rose population (hybrids of *Rosa wichurana* and 'Yesterday') is used to gain insight into pathotype specific resistance to powdery mildew.

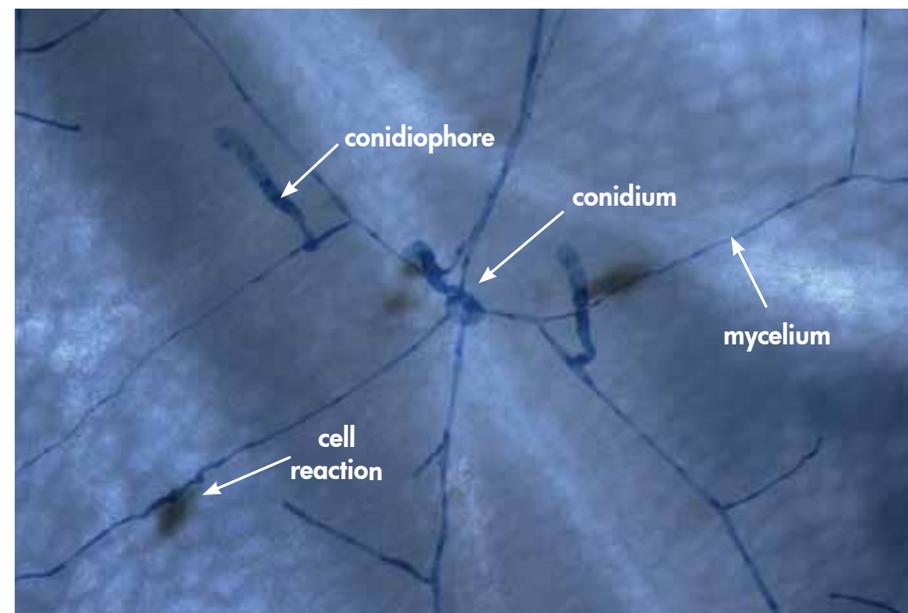
### Methods

Previous work at ILVO demonstrated that different pathotypes of powdery mildew occur on roses.

Two well characterized pathotypes (R-E and R-P) were selected for a more detailed study. Previous results also showed that roses exhibit different resistance mechanisms to respond to powdery mildew. Inoculation experiments could now show that both parent plants 'Yesterday' and *R. wichurana* respond differently to both powdery mildew pathotypes. Cell reactions developed as a response to R-P on 'Yesterday' and *R. wichurana*. Inoculation of 'Yesterday' with R-E results only in germination of the conidia; further development of the fungus is stopped. Nevertheless R-E develops in a normal way on *R. wichurana* and cell reactions develop. The inheritance of the resistance was studied in the hybrid plants. For the population tested a genetic map was constructed based on AFLP and microsatellite markers. The segregation of resistances in the offspring plants was used to look for specific locations (Quantitative Trait Loci – QTL) on the genetic map related to powdery mildew resistance.

### Results

The genetic map consists of seven linkage groups, the same number as there are chromosomes in the monoploid rose genome. Pathotype-specific markers are found on the map. For pathotype R-P five QTLs are selected; for R-E there are four QTLs. A better understanding of the genetic background of mildew resistance in roses allows for breeding aimed at disease resistance. The combination of different resistance mechanisms can lead to roses with enhanced resistance.



Development of powdery mildew on the leaf of *Rosa wichurana* and plant response via cell reactions

Title: Quantitative trait loci mapping of pathotype-specific powdery mildew resistance in a diploid rose population

Funding: ILVO

Duration: 2005 - 2012

Contact: leen.leus@ilvo.vlaanderen.be

## Strategies for combatting angular leaf spot disease in strawberry

### Characteristics and impact of the bacterium *Xanthomonas fragariae*

#### Objectives

Angular leaf spot has the potential to cause great damage to Belgian strawberry production in the future. It is caused by the quarantine bacterium *Xanthomonas fragariae* (Xf). How can we correctly identify and reliably detect Xf in the plants for planting or during production of the fruit? Which factors (weather conditions, phytotechnical methods, etc.) have an effect on the development of disease symptoms? Which measures are effective in controlling the disease? Strawberry growers were unclear about the symptoms caused by Xf and there was also little information on how Xf infects and spreads inside the plants. The quarantine measures for Xf focus on the trade of pest-free planting material, but new introductions frequently occur because infested plants do not always show disease symptoms.

#### Methods

During the entire project period, plants with suspicious symptoms were sampled and analyzed using different diagnostic methods. Parameters on weather and specific culture conditions were registered. We developed a molecular detection method (Q-PCR) for Xf and also a fluorescent Xf mutant strain to study its occurrence in badges of planting material and localize it inside the plants. The total genome of Xf was sequenced and analyzed.

#### Results

We now have a clear view on the symptoms caused by Xf and on the symptoms that have been erroneously attributed to Xf. Xf is a typical leaf pathogen and the angular leaf spots are nearly the only symptoms. Endophytic spread can occur sporadically, but it is not efficient. Therefore, the plant runners and daughter plants have little opportunity to become internally infested by the mother plant. Xf is a mild pathogen and mostly stays unnoticed inside the plant. It only grows and induces symptoms when the climate or culture environment is wet and relatively warm. Some technical interventions can clearly limit the development of the disease.

Our study has provided new information on the strategy of the bacterium to either survive symptomless in the plant or behave as a pathogen. This discovery is also



supported by specific characteristics identified in the Xf genome. Strawberry plant and fruit growers and the phytosanitary authorities have been informed of the conclusions and implications of our results for the culture and for the quarantine status of Xf. For instance, it is nearly impossible to prevent the introduction of Xf. Plantlets without symptoms can harbor very low Xf concentrations, which stay undetectable, even with the best-performing test methods. Also, systematic monitoring of all traded plants for planting is practically and financially not feasible. Aspects of this Xf research have been incorporated in a Pest Risk Analysis for the EU region.

**Title:** Diagnostics and prevention of *Xanthomonas fragariae* in strawberry cultivation

**Funding:** IWT, Vlaamse tuinbouwveilingen

**Duration:** 2008 - 2012

**Collaboration:** Proefcentrum Hoogstraten, Proefcentrum Fruitteelt and Ghent University (Laboratorium voor Microbiologie)

**Contact:** martine.maes@ilvo.vlaanderen.be

## Nematodes vs. aphids: who will win?

Can entomopathogenic nematodes suppress woolly aphids in apple orchards?

### Objectives

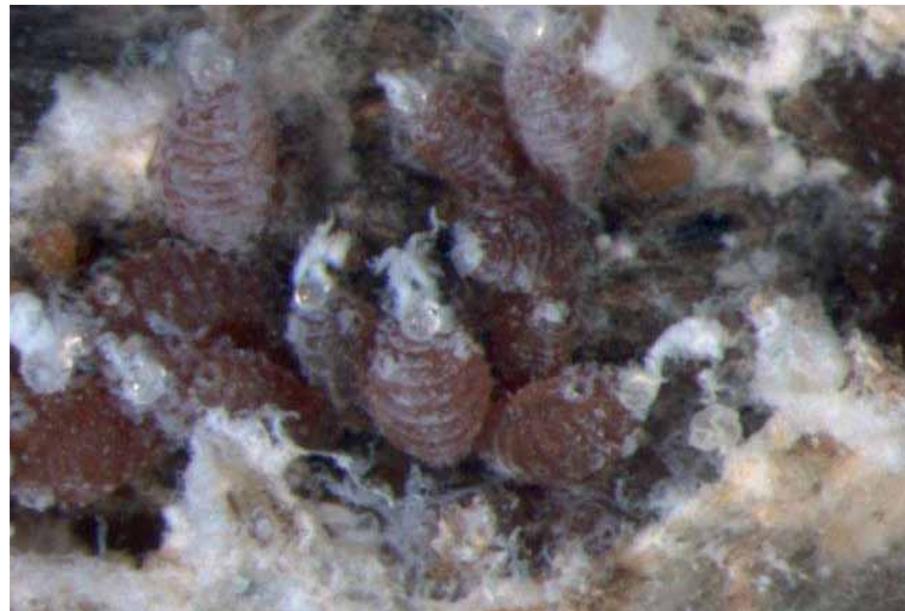
We have investigated how entomopathogenic nematodes (EPN) can be used against the woolly apple aphid (*Eriosoma lanigerum*) both above and below ground. An infestation by these aphids in apple orchards causes stained, small fruits, canker tissue and can weaken trees in the long term. Integrated pest management, which is based on minimizing insecticide applications and using natural enemies, does not protect the orchard during the entire production period. Applying EPN to bridge these gaps is one possible solution. EPN are the most successful group of natural enemies for underground pests in biological control practices. According to international research, the woolly apple aphids form dense colonies on twigs and bark, but migrate to the roots to overwinter.

### Methods

Thousands of aphids were placed separately on moist filter paper in mini cells in the lab and drenched with many different solutions, each containing about 150 nematodes. The effect of all EPN species (*Steinernema* and *Heterorhabditis*) available in our country was examined. We meticulously recorded the death rate of the woolly aphids as well as the extent to which they were parasitized. A variety of parameters were evaluated: incubation time, wetting agents, observation time, and developmental stage. Using a backpack sprayer, the best-performing EPN species were applied onto the twigs and the soil of potted young apple trees infested with aphid colonies.

### Results

Only one species, *Steinernema carpocapsae*, caused more mortality of woolly apple aphids than water (control), with an average of 30 % inactivation. However, we found that many parasitized aphids did not die within the normally expected 24-hour period. The mortal effect of EPN is caused by symbiotic bacteria that massively reproduce in the insect's body. We were surprised to see that the woolly aphids were able to inhibit this bacterial growth. In addition, as many woolly apple aphids died after the application of a non-parasitic nematode as when *S. carpocapsae* was applied. We concluded that aphid mortality must be caused solely by the stress of having large numbers of nematodes on the aphids' body. The semi-orchard test did not result in any mortality due to EPN, but the aphid colonies expanded more slowly,



probably because of the adverse effect of the presence of hundreds of EPN. A stress effect like this one does not justify the use of EPN, which are relatively expensive to use. Our partner, *pctruit*, also discovered that woolly apple aphids rarely overwinter below the ground in Belgium. The management of woolly apple aphid infestations in apple orchards therefore remains an unsolved challenge. The aphids' ability to restrict bacterial growth was an interesting discovery, however, which opens new research avenues.

**Title:** Suppressing the woolly aphid and other apple plagues with entomopathogenic nematodes to support sustainable production of Flemish pome fruits

**Funding:** IWT

**Duration:** 2010 - 2012

**Contact:** nicole.viaene@ilvo.vlaanderen.be

## A knotty problem...

Root-knot nematodes (*Meloidogyne* spp.) in the production of potatoes and vegetables

### Objectives

Root-knot nematodes (*Meloidogyne*) are the most important group of plant-parasitic nematodes worldwide. In Flanders they threaten economically important crops such as potatoes, carrots and salsify. The aim of this research project is to build a broad base of knowledge about the biology and population dynamics of *Meloidogyne*. The goal is to ensure timely detection, accurate identification, appropriate crop rotations and management.

### Methods

This project focused mainly on *Meloidogyne chitwoodi* and *M. fallax*. Together with *M. hapla*, these quarantine organisms are the main species in Flanders. *M. minor* was also studied. Quantitative molecular techniques (q-PCR) were tested. With a study of the population dynamics in crop rotations, biology, life cycle, and survival without a host plant, we have optimized the timing of the sampling and our knowledge of the host status of different crops.

### Results

To detect and quantify *M. chitwoodi*, *M. fallax* and *M. minor* when two or more root-knot nematodes are present in a sample, quantitative PCR methods can be used. We also found that black fallow during the warmer periods of the year would be the most difficult for the nematodes to survive.

*Meloidogyne chitwoodi* and *M. fallax* need 550-740 degree-days (base 5°C) to complete the first generation on potato cv. Bintje. For *M. minor*, 605-727 degree-days were needed. This implies that two to three generations may be generated per growing season. The potato cultivars Asterix, Nicola, Lady Rosetta, Bintje and Premiere were good to very good hosts for *M. chitwoodi*, *M. fallax* and *M. minor*. For *M. minor* the damage threshold (number of nematodes needed to cause damage) on potato cv. Bintje was 41 juveniles (J2) per 100 cm<sup>3</sup> soil. At an initial population (Pi) of 100 second-stage juveniles (J2), serious galling was observed on 50 % of the tubers. From these results, it is clear that the presence of *M. chitwoodi*, *M. fallax* and *M. minor* can seriously affect potato quality.



Survival of *M. hapla* in the absence of a host was greatest at 10°C (> 87 % after 12 weeks). *Meloidogyne chitwoodi* and *M. fallax* survived longer at 4 and 10 °C (> 60 % after 12 weeks) than at 20°C (0 % after 12 to 14 weeks). For *M. minor* up to 30 % survival was observed at 4°C after 14 weeks. At 10°C, this was 21 % and at 20°C 11 %. This indicates that a black fallow will be more effective during the warmer periods of the year.

**Title:** MELOIDOGYNE (Spread and epidemiology of knot-root nematodes of the *Meloidogyne* species and measures to take against them in field production of potatoes, vegetables and sod)

**Funding:** Federal Service for Public Health and Safety of the Food Chain and Environment

**Duration:** 2010 - 2012

**Contact:** wim.wesemael@ilvo.vlaanderen.be

## Protoplast fusion and chicory breeding

Hybridizing industrial chicory and other *Cichorium* species as a strategy to introduce CMS and genetic variation

### Objectives

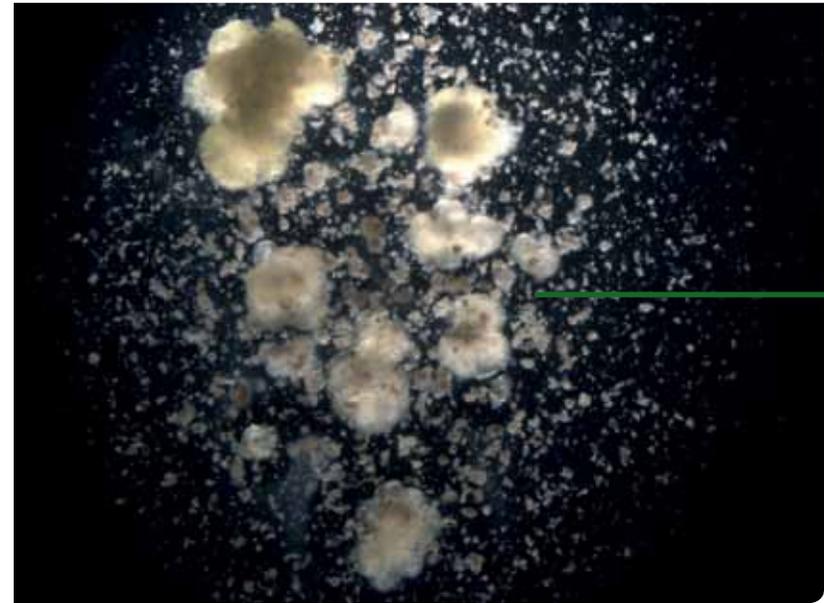
Industrial chicory is grown for the inulin contained in its roots. Inulin is used as a probiotic fibre. Crosses between different chicory genotypes have shown that hybrid development can increase the inulin content. The aim of this project is to support chicory breeding and enhance inulin yield in two ways: 1) by introducing cytoplasmic male sterility (CMS) into industrial chicory to obtain good seed production of hybrid races; and 2) to increase the genetic variation within industrial chicory to broaden the current gene pool. The latter is done by introducing desired traits from wild and cultivated *Cichorium* species and leaving out the undesired characteristics.

### Methods

Asymmetric protoplast fusion between protoplasts of industrial chicory (*Cichorium intybus*) and other *Cichorium* species protoplasts enables us to combine nuclear and cytoplasmic DNA of different parents. Through this protoplast fusion technique we try to introduce CMS in industrial chicory. Other genetic variation was introduced by combining nuclear DNA of different species. Various parameters, such as protoplast isolation, fusion and regeneration, needed to be optimized for this process. We also designed an effective screening method to track desired protoplast fusion products. Chemicals and UV irradiation were used to achieve asymmetric fusions.

### Results

Chemical fusion resulted in more viable fusion products than electrical fusion. Protoplast regeneration of different genotypes and fusion products was enabled by developing a protocol based on agarose beads in which protoplasts could divide; shoot formation was possible because of appropriate use of phytohormones. Somatic hybrids were developed this way, as well as after asymmetric fusions. A new technique was implemented to screen these products of fusion. Mitochondrial or chloroplast DNA fragment analysis allows unambiguous confirmation of cybrid development (a cybrid contains a chicory nucleus and donor cytoplasm). The formation of somatic hybrids and cybrids can result in the development of new cultivars. The profound knowledge of chicory genetics acquired during this project may also be beneficial for future breeding.



Cichory protoplast dividing into microcalli (undifferentiated tissue) in an agarose bead. Per bead, dozens of microcalli can develop from separate protoplasts (both fused and unfused)

Title: Introducing CMS and genetic variation enlargement in industrial chicory (*Cichorium intybus*) through asymmetric protoplast fusion

Funding: Cosucra - Groupe Warcoing

Duration: 2008 - 2012

Collaboration: Cosucra – Groupe Warcoing

Contact: tom.eeckhaut@ilvo.vlaanderen.be

## Plant architecture of red clover

### Underlying processes of branching diversity

#### Objectives

In this project, we gained insight into the genetic regulation of plant architecture and the branching of red clover in particular. Using a number of plants differing in their branching, a thorough analysis of their branching patterns and the underlying molecular processes was performed. The influence of differences in plant architecture on the main agronomic characteristics yield and re-growth was investigated both in the field and in controlled conditions.

#### Methods

In the first phase, the branching of red clover plants with contrasting branching patterns was thoroughly characterized. In this way, we gained insight into the nature of the signals involved in bud formation and outgrowth. Also, the growth of the plants under controlled conditions was compared with that under field conditions. In addition, the role of plant hormones such as auxin and strigolactones in branching was investigated. In a second step, the molecular regulation of branching was studied. These expression analyses allow us to identify the role of known branching genes in red clover.

#### Results

Red clover is used in Flanders because of its relatively fast growth, its ability to fix nitrogen and its high nutritional value. One problem with the current red clover cultivars is their low persistence. A thorough morphological characterization and analysis of the physiological and molecular processes that determine the architecture of red clover will provide a basis for the selection of high-quality varieties. From a morphological analysis of plants with contrasting branching patterns, we could already conclude that both bud formation and outgrowth are important for determining the enormous diversity of branching types available in red clover. Another conclusion is that the strigolactone genes are good candidates to explain the variation in plant architecture in red clover. Further study of the role of strigolactones in branching of red clover can help to improve agronomic characteristics. This and the molecular and physiological analyses will allow us to identify ideotypes that can be used in various applications in agriculture, namely an improved, more erect cutting type and a rather prostrate meadow type that would tolerate limited grazing.



Title: Morphological and genetic variation of plant architecture in *Trifolium pratense* (red clover)

Funding: ILVO

Duration: 2010 - 2013

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gerda.cnops@ilvo.vlaanderen.be

## Harvesting corn stover as biomass

What is the nitrogen, carbon and phosphorus content in corn stover?

### Objectives

We have assessed the possibilities for harvesting corn stover biomass to be used as a substrate for anaerobic digestion and the consequences of doing so. Corn stover is the aboveground biomass left on the field after harvesting the corn. The potential residual plant fraction was measured for 20 corn maize varieties tested on four locations. Substantial differences in earliness, grain yield and corn stover dry matter yield were observed between the varieties. Farmers choose varieties mainly based on grain yield, moisture content at harvest, but companies focusing on corn stover collection choose varieties with a high residual plant biomass and rachis yield. It is not easy to find a variety that satisfies these divergent requirements.

### Methods

By removing the biomass, carbon and nutrients are also removed and should be compensated for. The carbon, nitrogen and phosphorus content was measured for a selection of corn maize varieties on four locations. The average removal of organic matter by corn stover was 8800 kg OM/ha. The nutrient export for phosphorus and nitrogen with the total residual corn stover averaged over the four locations was 20 kg P<sub>2</sub>O<sub>5</sub>/ha and 71 kg N/ha.

The biomass removal efficiency during collection of the stover from the field was rather low, especially for a site at Neerpelt, which was harvested in the second half of November. This site had a lower soil particle load than the fields at Zaffelare. We concluded that better-adapted equipment is required for corn stover collection.

### Results

We tested if the collected biomass could be stored as silage. After three months of silage, only the bales which were subjected to extra shredding had an sufficient degree of acidity, measured as a pH lower than 5. This indicates a positive effect of shredding before ensiling. The silage additive did not affect silage pH. The carbon to nitrogen ratio was in the expected range for corn stover. The bales have good quality based on ammonia to nitrogen ratio and fatty acid spectra. After 12 months of silage, the pH and ammonia to nitrogen ratio decreased even further.



Title: Using energy and food production for healthier soil

Funding: MIP project

Duration: 2010 - 2012

Collaboration: OWS, Ecopower, Nyrstar, UHasselt

Contact: bart.vandecasteele@ilvo.vlaanderen.be

alex.devliegheer@ilvo.vlaanderen.be

## Cattle farming and support for organic agriculture in Macedonia

### Forage quality of lucerne and the development of organic farming

#### Objectives

In Macedonia, agriculture is dominated by small-scale, low input farming. Legumes are of major importance in the crop rotation because of their N fixation capacity. Lucerne is the most adapted and common used forage legume because it is well adapted to the dry weather conditions.

The conversion into organic farming is rather easy, but much more information about organic cultivation of a range of crops, regulation, sets of specifications and labelling as organic farmers should reach the candidate organic farmers.

#### Methods

ILVO coordinated this project; co-partners were Agrobiointitute (Sofia, Bulgaria), RIMSA (Troyan, Bulgaria) and the Institute of Agriculture in Zagreb (Macedoniaë). First, knowledge and experience of the partners about lucerne, organic farming and forage quality determination was summarized in brochures that were written in the Macedonian language. Then this knowledge was disseminated to farmers and advisors via winter meetings and demonstration plots with lucerne.

#### Results

- ♦ Dissemination of a brochure entitled 'Guidelines for growing leguminous crops in Macedonia and Bulgaria' including meetings with farmers in the different regions
- ♦ Organization of training sessions about organic farming in Flanders and Bulgaria for advisors and Macedonian farmers
- ♦ A SWOT analysis of organic farming in Macedonia
- ♦ Set-up and follow-up of 10 demonstration fields with lucerne all over Macedonia
- ♦ Edition of a handbook entitled 'Methodology for determination of the feeding value of leguminous crops'
- ♦ Determination of forage quality in relation to growth stage (e.g. by the NIRS technique)
- ♦ Organization of meetings in East and West Macedonia concerning the accreditation of organic production methods and certification of organic production.



Title: Leguminous crops as basis for organic farming in Macedonia

Funding: Departement Flanders International

Duration: 2010 - 2012

Contact: alex.devlieghe@ilvo.vlaanderen.be

**A selection of current projects in the Plant Sciences Unit**

**How can we valorize by-products from the agricultural, horticultural and fisheries sector through composting?**

Title: GeNeSys: System innovation for the valorization of agro-food and fisheries by-products. PhD4: Closing cycles through composting  
 Funding: ILVO - Coordinated Actions  
 Duration: 2012 - 2016  
 Collaboration: Ghent University  
 jarinda.viaene@ilvo.vlaanderen.be



**Climate change: just let the grass grow?**

Title: Development of grasses with a higher tolerance for abiotic stress  
 Funding: ILVO, EU  
 Duration: continuous  
 Collaboration: IUNG-PIB (Poland)  
 jan.deriek@ilvo.vlaanderen.be

**Which measures can be taken to prevent or minimize wildlife damage? What is the effectiveness, cost and effort of each of these measures?**

Title: Wildlife damage: Publishing a scientific report and guidance for making informational brochures and a handbook on preventive measures for wildlife damage by protected species and game species  
 Funding: Agency for Nature and Forests (ANB)  
 Duration: 2012 - 2013  
 Collaboration: ANB, communicatiebureau JusBox  
 bert.vangils@ilvo.vlaanderen.be



**To what extent do green manures and cut and carry fertilizers deliver nutrients to a following crop, and what is the impact of different types of soil management in the context of an organic farming system?**

Title: TILMAN-ORG (Reduced tillage and green manures for sustainable organic cropping systems - www.tilman-org.net)  
 Funding: ADLO  
 Duration: 2011 - 2014  
 Collaboration: Inagro, Louis Bolk Instituut, Core organic II project consortium  
 koen.willekens@ilvo.vlaanderen.be



**Which management strategies for reducing nitrogen losses from crop residues in horticulture are economically and technically feasible?**

Title: Management of vegetable crop residues for reducing nitrate leaching losses in intensive vegetable rotations  
 Funding: TWOL VLM  
 Duration: 2012 - 2014  
 Collaboration: Ghent University, BDB, PCG, PSKW, Inagro  
 bart.vandecasteele@ilvo.vlaanderen.be

**Which "best agricultural practices" lead to improved soil quality, prevention of climate change, and high productivity? How applicable are these 'best practices' in actual practice on-farm?**

Title: CATCH-C (Applicability of agricultural practices on various types of agriculture farms in the EU, with the goal of improving soil quality and combatting climate change)  
 Funding: EU  
 Duration: 2012 - 2014  
 Collaboration: ILVO Plant Sciences and ILVO Social Sciences, several European partners  
 greet.ruyschaert@ilvo.vlaanderen.be

A selection of current projects in the Plant Sciences Unit



**What** is the effect of harvest time, incubation time, and drought on digestibility of silage maize under the Flemish climate and operating conditions?

Title: Quality of maize in the context of variety admission  
Funding: ILVO, Ghent University  
Duration: 2012 - 2016  
Collaboration: Ghent University  
jolien.swanckaert@ilvo.vlaanderen.be

**How** can the compost industry optimally apply the available biomass resources for producing green energy and high quality soil improvers?

Title: New dynamics for the compost industry due to synergy between green energy and high quality compost  
Funding: IWT VIS-trajectory  
Duration: 2012 - 2014  
Collaboration: VLACO, K.U.Leuven, OWS  
bart.vandecasteele@ilvo.vlaanderen.be

The phosphorus cycle in agricultural soils: how does it work? **Can** this knowledge contribute to adjusted management to realize both agricultural and environmental goals?

Title: Literature study about the phosphorus cycle in agricultural soils  
Duration: 2012 - 2014  
fien.amery@ilvo.vlaanderen.be

**Which** current challenges are being addressed in order to create new breeding material (prebreeding and cultivars)?

Title: Breeding of agricultural and horticultural crops  
Funding: ILVO  
Duration: continuous  
Collaboration: various partners  
joost.baert@ilvo.vlaanderen.be



**What** are the threats and opportunities of different bioenergy production systems for soil organic carbon stocks in agricultural soils in Flanders?

Title: Threats and opportunities of different bioenergy production systems for soil organic carbon stocks in agricultural soils in Flanders  
Funding: TWOL LNE  
Duration: 2012 - 2013  
Collaboration: VITO, Alterra  
bart.vandecasteele@ilvo.vlaanderen.be



**How** can we exploit the genetic knowledge about biomass production and cell wall composition obtained in the model plant *Arabidopsis* and translate it to a monocot model (*Brachypodium*) and a monocot crop (maize)? Do monocot genes that are similar to those identified in *Arabidopsis* also have similar effects?

Title: Improvement of biomass production and cell wall saccharification in *Brachypodium distachyon* as model crop and *Zea Mays* as crop  
Funding: IWT  
Duration: 2009 - 2013  
Collaboration: Ghent University, VIB-PSB  
hilde.muylle@ilvo.vlaanderen.be

A selection of current projects in the Plant Sciences Unit



**Which genes control the creation and growth of shoots? How can we implement this knowledge to improve yield and persistence in ryegrass and clover?**

Title: Use of plant architecture traits in ryegrass and red clover  
 Funding: ILVO, EU, IWT  
 Duration: continuous  
 Collaboration: K.U.Leuven  
 gerda.cnops@ilvo.vlaanderen.be

**Ploughing down grassland... Is it possible to combine good yields and minimum impact on environment by timing sward destruction, sowing the right crop type and correct fertilization?**

Title: Ploughing down grassland according to environment  
 Funding: ADLO  
 Duration: 2012 - 2014  
 Collaboration: Agricultural Centre of Forage Crops, PVL Bocholt  
 alex.devlieghe@ilvo.vlaanderen.be

**How can we reduce the practical seed losses of Italian ryegrass at harvest? Does harvest at optimum seed moisture content, adapting swath mowers and / or application of adhesives reduce seed loss?**

Title: LCG project grass seed: seed harvest optimization technique of Italian ryegrass  
 Funding: ILVO, LCG Flanders, Agrisemza, Nufarm  
 Duration: 2012 - 2013  
 Collaboration: Inagro  
 georges.rijckaert@ilvo.vlaanderen.be

**How can we protect genetic diversity in natural populations and to exploit this variation in breeding?**

Title: Population genetics in wild species and wild crop relatives  
 Funding: FWO, VLIR  
 Duration: continuous  
 Collaboration: K.U.Leuven, VLIR-partners  
 isabel.roldan-ruiz@ilvo.vlaanderen.be



**Diseases and plagues: which genotypes are resilient and allow development of more resistant cultivars, in turn leading to less pesticide use?**

Title: Breeding for better disease and plague resistance  
 Funding: ILVO  
 Duration: continuous  
 joost.baert@ilvo.vlaanderen.be



**Which *Miscanthus* genotypes can resist low temperatures and can be exploited to develop cold tolerant cultivars? Does a link exist between cold tolerance and biomass quality?**

Title: OPTIMISC (Optimizing *Miscanthus* Biomass Production)  
 Funding: ILVO, EU  
 Duration: tot 2016  
 Collaboration: diverse Europese partners, Ghent University  
 peter.lootens@ilvo.vlaanderen.be

**How can we adapt cultivation and fertigation techniques to reduce nutrient losses in horticulture?**

Title: International benchmark and European conference on nutrient legislation and innovative techniques for nutrient management in horticulture  
 Funding: TWOL VLM  
 Duration: 2012 - 2013  
 Collaboration: Ghent University, PCS, PCG, PSKW, Inagro  
 bart.vandecasteele@ilvo.vlaanderen.be

A selection of current projects in the Plant Sciences Unit



**What is the most effective control strategy for viral diseases in zucchini?**

Title: Ecology of zucchini viruses in Flanders – the way to a durable integrated control strategy  
Funding: IWT  
Duration: 2011 - 2015  
Collaboration: Proefstation voor de Groenteteelt, Inagro  
kris.dejonghe@ilvo.vlaanderen.be

**How can we analyze genomes of crops using the latest generation of sequencing technology? Can we translate and apply fundamental knowledge about genes and their function that was gained in model species in ryegrass and clover breeding?**

Title: Translational research: translating knowledge from model species to crops  
Funding: ILVO, IWT  
Duration: continuous  
Collaboration: Ghent University, PSB-VIB  
tom.ruttink@ilvo.vlaanderen.be

**Does bacterial contamination during the cultivation of young plants account for the introduction and proliferation of disease in cabbage and leek crops?**

Title: Management of bacterial pathogens during the cultivation of cabbage and leek  
Funding: ILVO, IWT  
Duration: 2011 - 2015  
Collaboration: Inagro, PCG, PSKW, K.U.Leuven  
johan.vanvaerenbergh@ilvo.vlaanderen.be

**Can a combination of nursery hygiene, biological control and use of less sensitive cultivars result in integrated control of internal fruit rot in bell pepper?**

Title: *Fusarium* in bell pepper  
Funding: ILVO, IWT  
Duration: 2011 - 2014  
Collaboration: Thomas More, PSKW, PCH  
kurt.heungens@ilvo.vlaanderen.be



**Is *Phytophthora ramorum* present in Belgian larch stands? What is the risk of infection of our conifers?**

Title: CONPHYR (*Phytophthora ramorum* in conifers)  
Funding: ILVO, Federal Service for Public Health and Safety of the Food Chain and Environment  
Duration: 2011 - 2013  
Collaboration: PCS, CRA-W  
kurt.heungens@ilvo.vlaanderen.be

**What is the role of energy crops in Flanders? What is the energy balance of these crops and can they be used on marginal land?**

Title: Evaluation and genetic improvement of grasses as biomass feedstock in second generation bio-energy in Flanders  
Funding: ILVO, Ghent University, EU  
Duration: continuous  
Collaboration: University College Ghent, Ghent University, various Flemish Research Centres, various European partners  
hilde.muylle@ilvo.vlaanderen.be

A selection of current projects in the Plant Sciences Unit



**How can we isolate genes of interest and localize them in crops in order to collect information about genetic background and for breeding purposes?**

Title: Development and application of genomic and cytogenetic techniques for better use of the potential of plant genetic resources  
 Funding: ILVO  
 Duration: continuous  
 jan.deriek@ilvo.vlaanderen.be

**How can the leaf miner *Tuta absoluta* be controlled in tomato cultivation in Flanders in a biological and sustainable way?**

Title: Control of *Tuta absoluta* in tomato cultivation in Flanders  
 Funding: IWT  
 Duration: 2011 - 2015  
 Collaboration: ILVO, Ghent University, PSKW, Research Centre Hoogstraten  
 veerle.vandamme@ilvo.vlaanderen.be

**Can we direct plant physiological processes using light and plant hormones?**

Title: Knowledge-based direction of plant physiological processes in the ornamental sector in order to improve plant quality  
 Funding: IWT  
 Duration: 2012 - 2018  
 Collaboration: PCS, Ghent University  
 johan.vanhuylbroeck@ilvo.vlaanderen.be



**What is the extent of variation of cell wall digestibility in perennial ryegrass? What is the genetic control of this trait and how can we apply this knowledge to optimize animal feeding in Flemish dairy farming?**

Title: Cell wall digestibility in perennial ryegrass: a strategy to improve feeding quality and to lower the environmental impact  
 Funding: ILVO  
 Duration: 2011 - 2015  
 Collaboration: Ghent University  
 hilde.muylle@ilvo.vlaanderen.be



**What are the explicit biological and genetic qualities of the actual blackleg and stem rot bacteria in seed potatoes and which sustainable strategies should be implemented to safeguard the potato industry?**

Title: Ectinolytic enterobacteria in seed potatoes  
 Funding: ILVO, Fund for Agriculture and Fisheries, Federal Service for Public Health and Safety of the Food Chain and Environment  
 Duration: continuous  
 Collaboration: Ghent University, Inagro, K.U.Leuven, James Hutton Institute Dundee, Plant Research International Wageningen  
 johan.vanvaerenbergh@ilvo.vlaanderen.be

**How can we measure physiological and morphological changes in a plant due to changes in the environment in a quick and objective way? How can we implement this information in genetic research and breeding?**

Title: Development of medium-throughput phenotyping techniques and modelling of plant growth  
 Funding: IWT, EU, various private companies  
 Duration: continuous  
 Collaboration: various European partners  
 peter.lootens@ilvo.vlaanderen.be



LIEVE HERMAN,  
Technology & Food Science Unit Head  
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## A big return on heavy investments

The staff of the Technology and Food Science Unit look back with satisfaction on our achievements during 2012. The Food Pilot food processing plant became operational with the help of Flanders' FOOD and doubled its turnover in one year's time. Moreover, it created many new opportunities for contract research with various industrial partners including SME's. The Food Pilot personnel also appreciated their fully renovated office space. It was a pleasure to use the new meeting rooms of the Food Pilot to welcome the Milk and Dairy Products contact group. The Technology and Food Science Unit is planning to organize contact group meetings with different food industrial sectors every two years as a way of further strengthening its ties to the food processing industry.

The reference work of this unit expanded greatly in 2012 and we achieved notable results. This reference work is commissioned by the Flemish Government's Environment, Nature and Energy Policy Area. Our unit now provides scientific support for the directives of minister Schauvliege, including mitigating measures for odour hindrance from poultry and pig houses. The new odour lab, which officially opened in 2012, will make a major contribution to the objectification of the odour problems in livestock farming. Also the operation of the Control project, which is responsible for the control measurement of 11,000 milking installations and milk cooling tanks per year, was thoroughly renewed. On July, 1, 2012 Fedagrim gave the administration and coordination of the project to ILVO. Furthermore, ILVO has developed a software package to digitize the input of 11,000 annual measurement reports starting from 2013. The Federal Agency for the Safety of the Food Chain (FASFC) awarded ILVO (in collaboration with the Centre d'Economie Rurale (CER)) the national reference lab responsibility for the analysis of veterinary drug residues and other forbidden substances in food of animal origin. We also established the scientific basis for the introduction of a renewed and more sensitive test to detect antibiotic residues in milk for the national milk control centres. The new test has been used for the official milk quality control system in Belgium.

In scientific research, the unit also earned its stripes. Six researchers obtained their PhD, three on food safety and three on agricultural engineering. One of our students received a doctorate in Dijon as the result of a collaboration with Agrosup on the

characterization of centrifugal fertilizer spreaders. In 2012 the first BOF sandwich grant started in cooperation with Prof. Eveline Volcke of Ghent University. The subject of the grant was research on design and control of air scrubbers for stable systems. In preparation for the future, ILVO invested heavily in chemical analysis equipment: GC-MS, LC-MS/MS and a high resolution mass spectrometer. With this equipment, ILVO will further distinguish itself through excellent research on the chemical and biochemical composition of agricultural and food products and bioactive components found in those products.

Last, the Technology and Food Science Unit also actively contributed to the establishment of two strategic research agendas by participating in the ERA-Net projects on sustainable food production and consumption (SUSFOOD) and ICT and robotics in agriculture (ICT-Agri). In December 2012, ICT-Agri presented its strategic research agenda in the plenary meeting of the Standing Committee on Agricultural Research (SCAR).

The Technology and Food Science Unit performs research and provides services in three areas: agricultural mechanization, food safety, and food products. The Agricultural Engineering research group comprises 64 researchers who primarily focus on mechanization. Their research combines technical competence with modern mathematical and IT-based methods. The Food Safety research group studies the microbial and chemical safety of plant- and animal-based food products. Product Quality and Innovation examines the authenticity of vegetable and animal products, including GMO's and allergens, and works to improve the functional quality and valorization of food.

This unit's service package consists of accredited laboratory analyses on food authenticity and food safety (including GMO analyses). We serve as the national reference lab for Milk and Dairy Products, for determination of water content in poultry meat, for allergens, and for GMOs. We also fulfill a reference task for the Milk Control Centre of Flanders (MCC). An accredited laboratory for spray application technique and the accredited inspection of sprayer equipment and certified milk and cooling tank technicians (CONTROL) are also part of our service package. Clients from either industry or research institutions can test new food and feed processing techniques in the renovated and expanded Food Pilot food processing plant. The Technology and Food Science Unit also offers a certified service for the measurement of air emissions of animal houses and a service for tuning sprayer equipment. Finally, we also provide advice on new technologies and new practices in dairy farms, for (farm) dairy producers (TAD Dairy) and SMEs.

## Are medications from chicken feed getting into our food? Cross-contamination levels of active substances in poultry feed

### Objectives

In the feed preparation process, leftover active components (coccidiostats, antibiotics, anthelmintics and other additives) can contaminate consequent batches ('cross contamination'). To what degree is such cross contamination important for the transfer of these compounds into poultry products such as meat and eggs? Based on already known data and data obtained from the RESPOUL project, is it possible to construct a mathematical model that predicts whether (and to what degree) a veterinary drug or additive will be present in eggs or chicken meat in the event this active component was present at an undesired concentration in the chicken feed?

### Methods

First, a database of chemical compounds with several physicochemical and pharmacokinetic properties was constructed. After a literature search (what experiments have already been conducted in this research area?), we conducted *in vivo* animal trials with both laying hens and broilers. After a 10-day (laying hens) or 12-day (broilers) pre-period in which the animals received blank feed, the animals received experimental feed during 14 days that contained concentrations of an active component corresponding to 2.5 %, 5 % and 10 % cross contamination. Afterwards, the animals were fed blank feed again during a 16-day depletion period. Based on the results obtained in the animal trials, the transfer of a molecule from the feed into several poultry matrices (muscle, liver and egg) could be determined. In addition, we looked for a correlation between the residue concentrations measured and certain qualities of the active compound such as fat solubility and parameters that determine how the active substance is taken up, distributed and eliminated in the body. Finally, we constructed a predictive mathematical model for the prediction of the transfer of a molecule into egg matrices.

### Results

In general, it could be stated that – depending on the active component – transfer occurred from veterinary drugs/feed additives from the feed into eggs, chicken meat and liver. The degree to which transfer occurred from the feed into animal-derived products depended on the amount of the component present in the feed and the affinity of the component for each of the products. In some cases (e.g. sulfadiazine in eggs



and meat) this lead to concentrations higher than the legally allowed concentrations. Generalizations or predictions concerning the transfer and distribution across the tissues were not possible. Mostly, a higher transfer was observed for liver compared to meat. For egg, we noticed that the distribution between the yolk and the egg white cannot be predicted, but that this distribution determined the time during which the active component could be detected in the egg. Indeed, the more the substance was present in the egg yolk, the longer it lasted in the animal trial before all residues were eliminated from the egg. For the construction of the mathematical model, some equations resulted from the experiments, but these need to be refined and are not yet applicable in practice. The feed industry has already made a concerted effort to avoid cross contamination, for example by adding the active component at the end of the production process, thereby avoiding contamination of the production lines. Contamination during transport or on the farm is harder to exclude.

**Title:** RESPOUL (Development of a mathematical model for the determination of carry-over factors of residues in poultry)

**Funding:** ILVO, Federal Service for Public Health and Safety of the Food Chain and Environment

**Duration:** 2008 - 2012

**Collaboration:** ILVO Animal Sciences, CER (Laboratoire d'hormonologie), Ghent University (Faculty Veterinary Sciences, Department of Pharmacology, Toxicology and Biochemistry)

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## Taking EHEC by the horns

### New insights for prevention of Enterohaemorrhagic *E. coli* (EHEC) infection of humans

#### Objectives

What is the prevalence of Enterohaemorrhagic *E. coli* (EHEC) in meat cattle? How is the contamination maintained on the cattle farm? How important is the role of super-shedders (animals with high numbers of EHEC in their faeces)? How can we quickly screen for risk farms? Is the contamination caused by persistent strains? Answers to all of these research questions may further contribute to insights about how to help prevent the transfer of EHEC to humans. EHEC, including *E. coli* O157:H7, are a subgroup within the Shiga-producing pathogenic *E. coli* (STEC). They are the fifth most common food-related group of zoonoses (infectious diseases transferrable from animals to humans) in Belgium. Given the severity of the human symptoms, they are one of the most dreaded food pathogens. Cattle are the main reservoir for these pathogens. Transfer to humans occurs after faecal contamination.

#### Methods

By sampling cattle that enter the slaughterhouse, we traced EHEC-positive (5 main serotypes) farms. This screening gave us information about the prevalence of EHEC sero- and virulence types in Belgian cattle. In a second phase we studied the excretion profile on a selection of EHEC-positive cattle farms. We were looking for a relation between the quantitative EHEC excretion by super-shedders, the contamination of other animals and the maintenance of contamination cycles on the cattle farm.

#### Results

This research has provided important knowledge about the prevalence of EHEC in Belgium. The prevalence of most important EHEC serogroups (O157, O26, O103, O111, O145) is known. The non-O157 EHEC prevalence of 248 bovine animals, before slaughter, is 7 % and the EHEC O157 prevalence is 10 %. At animal level, this study revealed a link between bacteriologically positive animals and the immunological response in blood. The serological response against EspB is therefore useful to screen cattle farms that are possibly infected with EHEC O157, O26 and O103. The developed qPCR quantification method for *stx* genes in cattle faeces is a suitable method to screen for putative EHEC-infected farms. This method of identifying risk farms can be a first step, followed by on-farm interventions to reduce the presence



of EHEC. Our study denies the great importance of super-shedders: their presence is low in our study. We also found no increased farm prevalence of EHEC when super-shedders were present on the farm. Finally, the results indicate that the population of strains varies in time regardless the temporary dominance of some strains.

**Title:** Prevention of the transmission of EHEC from the reservoir of meat cattle to humans

**Funding:** Federal Service for Public Health and Safety of the Food Chain and Environment

**Duration:** 2008 - 2012

**Collaboration:** Ghent University (Faculty of veterinary medicine, Department of Veterinary Public Health and Food Safety, Department of Parasitology, Virology and Immunology)

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karen.verstraete@ilvo.vlaanderen.be

## Which microscopic villains give us diarrhea?

### A study on toxin production and strains of *Bacillus cereus*

#### Objectives

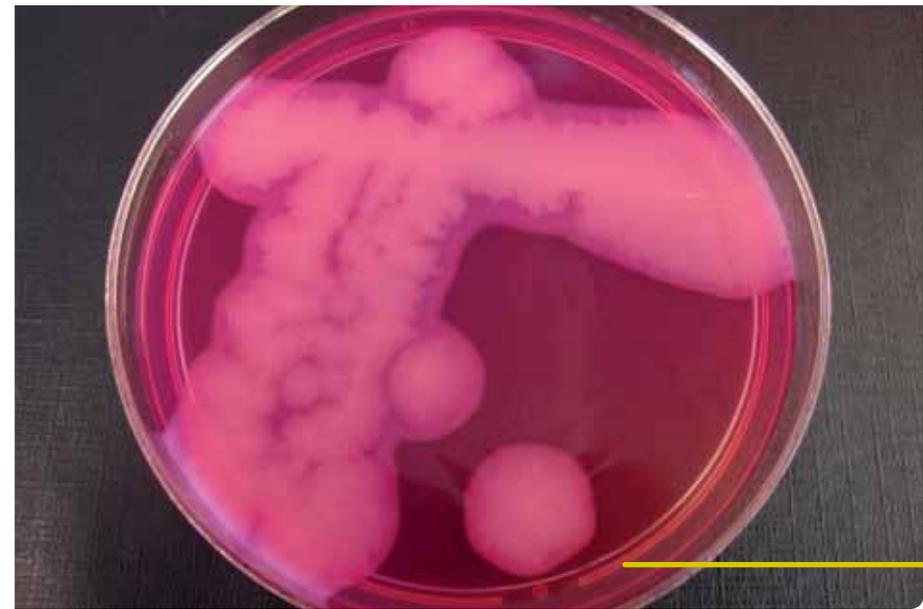
*Bacillus cereus* is a spore-forming food pathogen which can cause either vomiting or diarrhea in humans. The frequency of these infections are increasing, probably because we are eating more ready-to-eat or ready-to-cook foods which are stored under chilled conditions. A research project on the diarrheal type has been finished by a large research consortium consisting of ILVO (as coordinator), Ghent University, WIV and UCL. Our aim was to characterize in more detail the potentially most dangerous strains and conditions (especially in the human small intestine).

#### Methods

First we developed mass spectrometric methods for the enterotoxins on the basis of pure cultures. The growth kinetics and enterotoxin production of *B. cereus* were investigated in a dynamic simulation model of the human gastrointestinal system, the SHIME reactor (this system consists of five compartments which simulate the different parts of the human gut). Next, the genetic and genomic diversity of a collection of diarrhea causing *B. cereus* strains was characterized. Finally, the hazardous contamination levels in food products relevant to human health were identified via retrospective analysis, predictive modelling and synthesis of all project data.

#### Results

A method has been developed based on MALDI-TOF to detect the enterotoxins Nhe and CytK; for CytK (with 2 variants) this is currently the only available detection method. In addition, marker peptides have been selected for future research in quantifying these two enterotoxins by LC-MS. Probably this mass spectrometric approach will be restricted to pure cultures (collections of micro-organisms which descent from a single cell). With the SHIME simulation model, a good survival and even germination of *B. cereus* spores, administered through food, was observed in the small intestinal environment, but no further outgrowth to vegetative cells; administered vegetative cells, on the contrary, did not survive well and enterotoxin production was never observed. The hypothesis was formulated that a local growth and enterotoxin production only occurs in the vicinity of mucus and/or intestinal epithelium of the host. On the basis of the cytK sequence, *B. cereus* strains with cytK1 can be clearly distinguished from strains with cytK2; cytK2 occurs rather frequently and is probably not uniquely



associated with toxico-infection. On the basis of genetic and genomic data as well as a retrospective analysis of recent foodborne outbreaks, no indications were found for the existence of specific diarrheic pathotypes. Although the retrospective analysis showed that mixed meals were mostly implicated with diarrheal outbreaks of *B. cereus*, it is currently not possible to indicate a more specific food type and to have more certainty on risky contamination levels. The story about diarrhea caused by *B. cereus* seems to be more complicated than anticipated, but important tools have been developed for further research.

**Title:** Investigation of toxin production of *B. cereus*, characterization and detection of strains responsible for food poisoning

**Funding:** Federal Service for Public Health and Safety of the Food Chain and Environment

**Duration:** 2009 - 2012

**Collaboration:** Ghent University (Faculty of Bio-Engineering, Department of Food Safety and Quality, Lab of Food Microbiology and Conservation, Department of Biochemical and Microbial Technology, Lab of Microbial Ecology and Technology, Faculty of Sciences, Department of Biochemistry and Microbiology, Lab of Protein Biochemistry and Biomolecular Engineering), Université Catholique de Louvain (UCL, Lab of Food and Environmental Microbiology, Scientific Institute of Public Health (WIV-ISP, Department Bacteriology)

**Contact:** marc.heyndrickx@ilvo.vlaanderen.be

## Yumm...meat?

### An objective model to evaluate cold cuts

#### Objectives

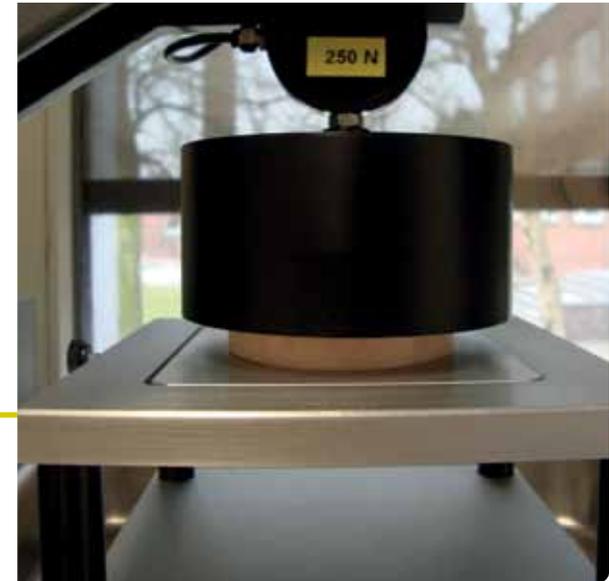
ILVO has developed an objective model for the quality assessment of cold cuts or "charcuterie" (cooked and dried ham, salami, liver pâté, cooked sausage, aspic and chicken products). To develop this model, ILVO searched for correlations between scores for a number of physico-chemical properties and a visual and sensorial evaluation by an untrained consumer panel. The charcuterie industry can then predict, via lab analyses, how consumers will appreciate the meat product. Used the other way round, the model can also be used to inspire recipe changes.

#### Methods

ILVO, together with VG-Sensory, used 30 Flemish and 30 Walloon consumers to form an untrained Belgian evaluation panel. They tasted and visually and sensorially scored the various charcuterie products. ILVO determined uniform descriptors for the sensorial assessment of the selected product groups. The same products were tested in the lab on an extensive list of physico-chemical parameters. The consumers scores were based on colour, smell, juiciness, taste, salinity, mouth feel, marbling, texture, etc. The list of physico-chemical properties, determined through laboratory analysis, included hardness, resilience, texture, content of protein, fat and fatty acids, collagen, lactose, glucose, nitrate, nitrite, phosphate, etc. Through statistical processing techniques, we search for the correlation between both score sets. For these correlations limit values were calculated and a model was developed.

#### Results

This research was carried out in cooperation with the charcuterie-producing industry in Belgium (Fenavian). The results give the sector a reliable and fast way, via the right selection of physico-chemical tests, to predict the favorable sensorial assessment of a meat product by the Belgian consumer, without (expensive and time-consuming) taste panels. Further, this gives the industry an objective sensory and physico-chemical evaluation of the charcuterie products. The results are then shared with the relevant industry sectors.



**Title:** KWALICHARC (Objectification of the quality assessment of Belgian cold cuts)

**Funding:** Flanders' FOOD

**Duration:** 2011 - 2013

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## Leek-ing healthy compounds – new vitality for an old standby? Influence of genetic diversity, time of harvest and processing on health promoting compounds

### Objectives

Leek (*Allium ampeloprasum* var. *porrum*) is one of the most important field vegetable crops in Belgium. It is currently cultivated on 4800 ha. Leek is a product with a rather traditional image, both for marketing and for use. The *Allium* genus, which includes about 700 species such as garlic and onion, has been recognized as a rich source of health promoting compounds. Scientific knowledge concerning flavour and health promoting compounds in leek is rather limited, however.

This project identified and quantified these compounds in fresh leek for a range of current commercial and older, less common leek cultivars. These studies were done for both the white shaft and green leaves of the leek plant. The researchers will also evaluate the influence of processing techniques (e.g., storage, cooking, drying and fermentation) on the content of health promoting compounds in leek.

### Methods

The most important health promoting compounds in leek are flavonoids, organosulfur compounds, vitamin C and fructans. In addition to these specific compounds, the global antioxidant capacity was determined of the leek samples using different assays (ORAC, DPPH and FRAP). The total content of polyphenols was determined using the Folin-Ciocalteu method. Furthermore, individual polyphenols were identified and quantified using the UPLC-am-MS technique. These analyses were performed as a function of leek cultivar, leek type (summer, autumn or winter), plant tissue (white vs. green part), time of harvest and processing technique.

### Results

This study identified the leek cultivars with a high antioxidant capacity, while others were rich in polyphenols, vitamin C, organosulfur compounds and fructans. Furthermore, the study included the identification of 13 individual polyphenols in leek. Six of these identified compounds including kaempferol/querceetin 3-O-sophoroside, kaempferol 3-O-gentiobioside, kaempferol 3,7-O-diglucoside, kaempferol 4'-methylether and ferulic acid 4-O-glucoside were identified for the first time in leek. Concerning leek type, the white shaft of the summer cultivars were high in fructans and quercetin 3,4'-O-diglucoside, while the white shaft of half of the autumn cultivars were rich in kaempferol and kaempferol 3-O-glucoside. The white shaft of the winter cultivars and



the other half of the autumn cultivars contained the highest amount of organosulfur compounds, vitamin C, total phenolics and antioxidant capacity. A distinction between the green leaves of the different types could be made as well. Concerning processing, the influence of refrigerated storage for 13 days was limited, while type and duration of cooking had significant effects on the health promoting compounds. Fermentation, a potentially low-cost and value-added stabilization technique, was also evaluated. Spontaneous fermentation for 3 weeks at 18 °C resulted in an increase of polyphenols. Furthermore, new polyphenolic compounds were generated upon fermentation.

We expect that the results obtained in this study will create opportunities in selection and breeding towards 'healthier' leek, and for the optimization of the use of leek and development of new application possibilities.

**Title:** Bioactive compounds in leek (*Allium ampeloprasum* var. *porrum*) as a function of genetic diversity, harvest time and processing techniques

**Funding:** IWT

**Duration:** 2008 - 2012

**Collaboration:** University College Ghent, VUB (IMDO: Research Group of Industrial Microbiology and Food Biotechnology), James Hutton Institute

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## Is she an A-cup or a C-cup? Teats in the picture

### Measuring teats for udderly healthy cows

#### Objectives

Mastitis is one of the most important diseases threatening the sustainability of dairy farms. The cow itself, the pathogens, the environment, and all interactions in between determine whether a quarter will become infected. Studies indicate that teat dimensions, and especially the combination with teatcup liners, affect udder health. To improve herd management with regard to teat dimensions (e.g. teatcup liner choice, selection of cows), we need insight into the existing variation in teat dimensions. The aim of this project was to gain insight into this variation and in the relation between teat dimensions and udder health using a newly developed objective, accurate, and precise measuring method based on image analysis.

#### Methods

The first step in this project was the development and validation of a measuring device that measures teat length and diameter at different heights of the teat. This device uses image analysis to acquire fast, objective and accurate measurements. These measurements were then used to determine the variation in teat dimensions and the factors associated with teat dimensions, using both a cross-sectional and longitudinal study. In the last part of this project, we examined the relation between teat dimensions, the short term milking-induced changes, and udder health.

#### Results

The newly developed measuring device was capable of accurately measuring teat length and diameter at different heights of the teat. Errors were generally less than 5%. Measurements with the device were also repeatable and reproducible.

Most variation in teat dimensions was present between cows or within cows, and only little between herds. Large differences were found between cows of the same herd and between teats of the same cow, whereas the teat dimensions on the various dairy farms did not differ greatly. This indicates that choosing one identical teatcup liner for all cows in a herd is far from optimal. Quarter position (front versus hind), parity and lactation stage were identified as factors that contribute to the variation. Quarters with broader teats and teats which are broader after milking compared to before milking had higher milk somatic cell counts. The somatic cell count is an indicator for mastitis.



**Title:** Teat dimensions of dairy cows and their relation with udder health as assessed using a novel 2D-vision-based device

**Funding:** ILVO, IWV, Ghent University

**Duration:** 2008 - 2012

**Collaboration:** Ghent University (Faculty of Veterinary Medicine, Department of Reproduction, Obstetrics, and Herd Health)

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## Precision fertilization now showing in 3-D

Can the spreading pattern of a centrifugal spreader be adjusted in real time?

### Objectives

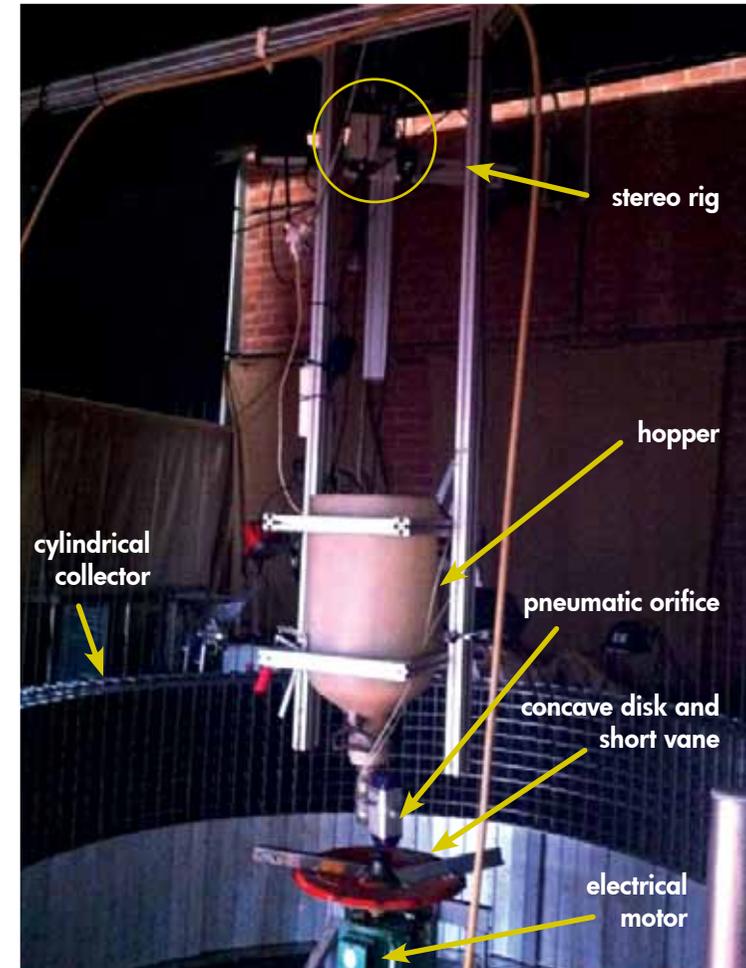
Centrifugal spreaders are used to distribute fertilizer grains as correctly and precisely as possible in the field. This limits losses, which spares the environment and enhances the production efficiency. But delivering the exact quantity at the desired location is still a challenge. The farmer does not have a tool to accurately measure the spreading pattern in a quick and simple way. Even with a properly-adjusted spreader, a perfect spreading pattern is not guaranteed: differences in the properties of the fertilizer grains, wearing of the spreader, the operator, or even external factors like wind or the ruggedness of the terrain can influence the result. The aim of this research was to measure the spreading pattern of the spreaders during operation in real time to enable adjustments to the spreader and thus achieve a better result.

### Methods

When ejected from the spreader, fertilizer grains can be considered as projectiles. To research their spreading pattern on the ground, we made a ballistic flight model. The speed of the grains and their trajectories were estimated to calculate their final destination. Both parameters (speed and trajectory) were estimated in two ways. The first method, using 2D camera images and a motion estimation algorithm, did not seem suitable for spreaders with a concave disc. The second method used 3D stereovision and a zone-based matching algorithm, combined with an additional algorithm where movements were estimated based on 3D images. This seemed appropriate for any type of spreader. The efficiency of the developed algorithms was validated based on the real spreading pattern that was measured using a collector specially developed for this purpose.

### Results

In this project a technique was designed to measure the spreading pattern during spreading with high precision. In the next phase, the pattern could be adjusted in real time. In that way the farmer would have an extra tool at his disposal for optimal fertilization of his crops. This would not only improve production efficiency, but it would also take better care of the environment.



**Title:** Development of 3D image acquisition system and image processing algorithms for the characterization of the ejection parameters of fertilizer granules

**Funding:** ILVO, Région de Bourgogne

**Duration:** 2009 - 2013

**Collaboration:** Ghent University - Agrosup Dijon - Université de Bourgogne

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## Improved screening for antibiotics in raw milk

### A new, improved procedure for detecting inhibitory substances

#### Objectives

In Belgium, each delivery of farm milk to the dairy is tested for residues of antibiotics by professional monitoring agencies (called "IOs" in Dutch). This testing is done in the context of payment for the raw milk. For the screening, a microbiological inhibitor test is used. Two tests (Copan Milk Test and Delvotest MCS) were approved for that purpose by the FASFC. However, due to tightened acceptance criteria, their approval expired on August 31, 2012. At ILVO, validation studies were carried out on different screening tests to see whether they met the stricter criteria. In these studies, we examined the tests' detection capability and robustness.

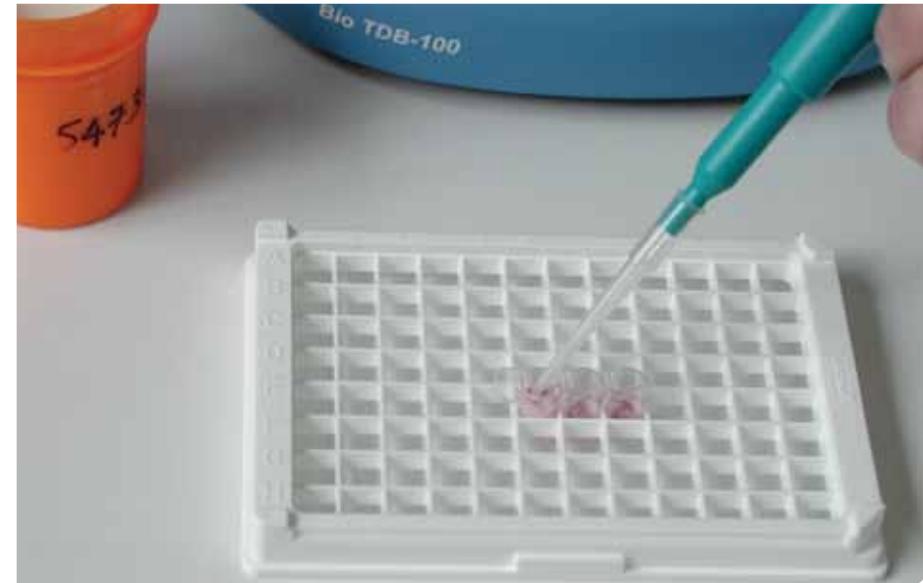
#### Methods

During the robustness study of the microbiological inhibitor tests, we observed that matrix effects such as a high somatic cell count and a high fat content influenced this new generation of tests in such a way that false positive results cannot be excluded. Finally, three tests were accepted for use as official screening test: Charm Blue Yellow II, Eclipse 3G and Delvotest T. The IOs finally opted for the Delvotest T.

To avoid penalization based on a false positive result, ILVO developed an adapted post-screening procedure. Now, a battery of group specific rapid tests ( $\beta$ ta-s.t.a.r. 25, Trisensor Milk, 4-Aminosensor Milk, Tylosensor Milk en Quinosensor Milk) is used. A penalty can only be imposed in case of a positive screening result for a specific family of antibiotics. These rapid tests, which are based on a different test principle than the Delvotest T, are more robust. All of the above-listed rapid tests were also validated at ILVO.

#### Results

The test procedure, in use since September 1, 2012, has a good robustness and improved detection capabilities. Another important advantage is that it indicates which family of antibiotics the residues belong to.



**Title:** Development and validation of new methods

**Funding:** NRL Milk and Milk Products

**Duration:** continuous

**Collaboration:** FASFC

**Contact:** wim.reybroeck@ilvo.vlaanderen.be

**A selection of current projects in the Technology & Food Sciences Unit**

**How does the ammonia emission process in the slurry pit develop?**

Title: Modelling air flows and ammonia behaviour in and around naturally ventilated animal housing systems  
Funding: ILVO  
Duration: 2009 - 2013  
Collaboration: Ghent University  
peter.demeyer@ilvo.vlaanderen.be



**How can we use computer modelling to optimize air scrubbers for animal houses?**

Title: Design and control of air scrubbers for animal houses  
Funding: ILVO, Ghent University  
Duration: 2012 - 2016  
Collaboration: Ghent University  
peter.demeyer@ilvo.vlaanderen.be



**What is the impact of lameness on the fertility of group-housed sows throughout the reproduction cycle?**

Title: Detection, importance and prevention of lameness in group-housed sows  
Funding: IWT  
Duration: 2010 - 2014  
Collaboration: Ghent University (Faculty of Veterinary Medicine)  
annelies.vannuffel@ilvo.vlaanderen.be

**How can we optimize cleaning and disinfection in cattle husbandry?**

Title: CLEANDESOPT (Optimization of cleaning and disinfection in animal husbandry)  
Funding: Federal Service for Public Health and Safety of the Food Chain and Environment  
Duration: 2012 - 2015  
Collaboration: Ghent University, Proefbedrijf Pluimveehouderij Geel  
koen.dereu@ilvo.vlaanderen.be

**A selection of current projects in the Technology & Food Sciences Unit**



**Can we improve the quality of cold cuts (paté and/or bologna) through adding bioactive components from apple or leek which have antioxidant effects?**

Title: Oxidation of proteins in production of cold cuts: effects of naturally bioactive components from fruit and vegetable by-products on quality and health  
 Funding: ILVO Scholarship  
 Duration: 2012 - 2016  
 Collaboration: Ghent University  
 geert.vanroyen@ilvo.vlaanderen.be

**How much diesel is used on average in agricultural activities and what is the related environmental impact?**

Title: OFFREM (Refining the agriculture category in the emission model for off-road mobile machinery)  
 Funding: LNE  
 Duration: 2012 - 2013  
 Collaboration: VITO NV  
 veerle.vanlinden@ilvo.vlaanderen.be



**Are certain potential innovations also feasible in organic food processing?**



Title: Feasibility study on various innovation possibilities in organic food processing  
 Funding: IWT  
 Duration: 2012 - 2013  
 Collaboration: Bioforum  
 katleen.coudijzer@ilvo.vlaanderen.be

**How can shrimp be landed live and processed in an innovative fashion?**

Title: Creating a livable shrimp fishery by creating a surplus value via improved quality  
 Funding: EVF (European Fishery Fund)  
 Duration: 2012 - 2014  
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**A selection of current projects in the Technology & Food Sciences Unit**

**How can we further manage the human pathogen Shiga-toxin producing *E. coli*?**

Title: IDESTEC (Thorough identification of STEC pathogenic for humans)  
Funding: Federal Service for Public Health and Safety of the Food Chain and Environment  
Duration: 2012 - 2015  
Collaboration: Ghent University, WIV-ISP  
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**How can fat-containing food be made healthier?**

Title: NUTRIFAT (Improving food products by using nutritionally responsible fats)  
Funding: Flanders' FOOD  
Duration: 2012 - 2013  
Collaboration: KAHO, HOWEST, K.U.Leuven  
jan.deblock@ilvo.vlaanderen.be

**To which extent can a vapour heat pump contribute to the development of an energy efficient glasshouse?**

Title: Development of a dehumidification technique for glasshouse systems based on a heat mass exchanger and mechanical vapour recompression  
Funding: ILVO  
Duration: 2009 - 2014  
Collaboration: Ghent University  
peter.demeyer@ilvo.vlaanderen.be

**How can product and process innovation in the food industry be encouraged by stimulating an open pilot infrastructure?**

Title: FOODINOFRA (Product and process innovation in the food industry through stimulating an open pilot structure)  
Funding: Flemish Government - Agentschap Ondernemen  
Duration: 2012 - 2014  
Collaboration: FEVIA, Flanders' FOOD  
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## Renewing networks

Scientific networks are key to the transdisciplinary research performed by the Social Sciences Unit. They include not only the traditional research networks, where researchers from the same discipline connect with each other, but networks across research disciplines as well as networks across scientific borders. Capturing and combining the knowledge of relevant stakeholders/actors, and the co-creative search for solutions, imply a minimal level of institutionalized networking. Networks help to capture research questions more easily, contribute to finding adequate solutions, and they also help in establishing trust between different stakeholders.

For that reason, we permanently strive to expand, support and renew such networks. The Social Sciences Unit has renewed its engagement in the International Farm Comparison Network (IFCN). This is a worldwide network of actors from dairy farming and the dairy industry that produces and exchanges knowledge, methods, data and tools useful for the dairy sector. The Social Sciences Unit also plays an active part in the European Research Area (ERA) Networks for organic farming and rural development, and in a COST (European Cooperation in Science and Technology) action on cultural sustainability. In addition to these, our unit also actively participates in various national and international organizations and think tanks on open space, integrated sustainability, rural landscapes, regional identity, organic farming and agricultural and horticultural economies.

'Renewing networks' is not only about innovating and renewing the networks, but also about the innovative and renewing effect these networks have on our research. In collaboration with the Department of Agricultural Economics at Ghent University (prof. Gellynck) the relationship between networks and innovation is being investigated from an economic, institutional and sociological perspective (IWT research project 'Networks as catalysts for innovation in agriculture and horticulture'). This project is now at its halfway point, and has investigated the attitude of farmers towards innovation, how they network, and what the focus is of existing networks.

In 2012 we performed a self-reflection study on the ongoing sustainability research at our unit. Based on our experience in the research on indicators and learning processes in farm networks (for instance in the European projects Dairyman, SOLID, and INEMAD), we clarified the role of researchers in such a process. This specification of the researchers' role is a precursor for novel ways of cooperating, such as the cooperation with farmers' unions, to support their learning process towards increasing sustainability.

One of our 2012 doctoral projects, a study of the development of a land value assessment tool, is worth noting because of its particular approach. The research was performed upon explicit demand of the Agriculture and Fisheries Policy Area, and was performed in a participatory way, with close interaction between the researchers and the intended users of the tool. This approach has led to both a practical tool and valuable scientific output.

The 30 researchers of the Social Sciences Unit are responsible for the socio-economic research at ILVO. Our research is based on both quantitative and qualitative research principles and tools, action research and participatory methods. We strive to act as a driving force for transdisciplinary, prospective and systemic research. In this way, we anticipate and fulfill our stakeholders' needs (i.e. government, agriculture and research).

Our research takes place in the field of farm management, collaboration in the agro-food chain, resilience, learning processes, sustainability assessments, spatial transformations, regional development, governance and multi-stakeholder processes. Our research is grouped into two research domains: (i) Agricultural and Farm Development and (ii) Rural Development. In the first, we study the dynamic change processes terms of competitiveness and sustainability of the agricultural sector. The latter studies change processes and the governance of these processes on the countryside.

## Experience is the best teacher

### Sustainable agriculture as a learning process

#### Objectives

In recent years, numerous assessment tools were developed to support decisions toward sustainable developments in agriculture. ILVO is also experienced in the development and application of such tools. Over the past ten years we worked on MOTIFS (Monitoring Tool for Integrated Farm Sustainability), an assessment tool for dairy farmers in Flanders (Meul *et al.*, 2008). The intended purpose was not quite met, as an overall application of the tool was not achieved in practice.

For this reason, we analyzed the research and development trajectory of MOTIFS of the past ten years and on this basis identified 'lessons learnt' for future research. These lessons learnt result in useful information for starting future sustainability trajectories.

#### Methods

The reconstruction and analysis of the research process started from scientific literature and reports on the subject and interviews with people involved in the process. The data from interviews and documents are structured according to a contextual framework by Burgess & Chilvers (2006). Various elements were distinguished: the context in which the research process took place, the initial principles and decision situation, the strategy or goal, the actual course of the research process, and the final result, i.e. the sustainability assessment tool itself.

#### Results

The study demonstrates the importance of a strong connection with agricultural practice. Close involvement of the different stakeholders and the end user create a sense of ownership, which is necessary for a successful sustainability research process.

The analysis shows the variety of application types of MOTIFS: monitoring, communication and management support. Each of these applications has a number of preconditions and limitations, requiring a judicious use of the tool. After all, there is no such thing as a tool that can do everything.

Finally, the loss or discontinuous involvement of expertise and actors is problematic due to the context and value sensitivity of sustainability research. Content leadership and coaching, and a minimal level of institutional embeddedness, is needed to safeguard the research process.



Title: Sustainable agriculture: A learning process  
Funding: Basic financing for sustainable agriculture  
Duration: 2012  
Contact: [laure.triste@ilvo.vlaanderen.be](mailto:laure.triste@ilvo.vlaanderen.be)

## Which farmland should stay farmland?

A tool to support rural planning processes in Flanders

### Objectives

Due to urban sprawl and new expectations for agriculture and open space, rural areas in densely populated regions face an increasing competition for land. Agriculture, which has historically been the main user of rural land, now has to compete for land with other activities, such as housing, commercial activities, nature, woods and recreational areas. This is often a source of conflict. Farmers don't like to lose farmland but farmland is often the only possible location where other goals can be realized. The aim of this doctoral research is to contribute a constructive approach for this difficult situation.

How do the actors involved perceive the rural planning processes in Flanders? How can we develop a tool to support rural planning processes? How can the tool we developed be used in the planning processes? The objective of this research is to scientifically improve an existing land suitability analysis tool that had been developed to support rural planning processes in Flanders. The land value assessment tool (LVA) differentiates the value of farmland and allows for setting priorities concerning preservation of land for agricultural use. The research results should facilitate the decision making processes concerning rural land use and the communication between the various actors in the countryside.

### Methods

A key aspect in the tool development process was participation of the intended users of the tool, with a close interaction between the researchers and the users. We used participatory research methods such as focus groups, discussion moments and interviews. The tool is based on two existing tools, the agricultural impact study ('landbouwimpactstudie') of the Agriculture Policy Area (Afdeling Duurzame Landbouwontwikkeling, ADLO) and the agricultural vulnerability analysis ('landbouwgevoeligheidsanalyse') of the Flemish Land Agency (Vlaamse Landmaatschappij, VLM). For the research step on the tool's applicability in rural planning processes, the following stakeholders were involved: farmers, representatives of farmers' unions and nature preservation organizations, provincial and municipal employees and employees of the policy areas involved (agriculture, spatial planning, nature and heritage). The land value assessment tool is a GIS tool that aggregates



various data and maps and visualizes them in a map. The theoretical basis for the data aggregation is multicriteria analysis.

### Results

The research provides insight into the difficulties of rural planning processes in Flanders. It also results in a number of concrete proposals for improvement of the existing tools. Furthermore, it shows how the tool can be applied to support these processes. The stakeholder involvement initiated a learning process within the stakeholders group. For example, it increased the stakeholders' knowledge on the rural planning processes and their own position in this. Finally, the research contributes to the knowledge on participatory tool development.

Title: Participatory development of a land value assessment tool for agriculture to support rural planning in Flanders

Funding: Sustainable Agriculture basic financing

Duration: 2007 - 2012

Collaboration: Afdeling Duurzame Landbouwontwikkeling (ADLO) en Vlaamse Landmaatschappij (VLM)

Contact: [eva.kerselaers@ilvo.vlaanderen.be](mailto:eva.kerselaers@ilvo.vlaanderen.be)

## Sows on a schedule

Does a four-week batch farrowing system increase profits?

### Objectives

The pig sector in Flanders is faced with decreasing profit margins. Pig farmers need to make the right decisions to remain competitive. An example of such a decision is the choice of sow management system. This research makes an economic evaluation of converting from a one-week to a four-week system. The one-week system implies that insemination, farrowing and weaning occur every week. This results in 20 or 21 groups of sows. The four-week system implies that these activities are carried out only once in four weeks. As a result, there are only 5 synchronous groups of sows on the farm.

### Methods

The economic analysis was based on literature information on the conversion to a four-week system, then linked to farm-specific data from two pig farms. Farm A is a closed-circuit farm with more than 400 sows, while farm B accommodates 200 sows. Literature indicates that the conversion to a four-week system results in a higher productivity (more piglets weaned per sow, better growth, lower feed conversion and a lower mortality rate), but that additional investments are necessary in order to accommodate sows in larger groups.

### Results

For the two farms, a four-week system leads to better economic results compared to a one-week system. Labour income increases due to a higher productivity, despite the fact that operational costs as well as capital costs increase. A four-week system also leads to decreased labour requirements, in spite of the labour peaks that occur. The economic effect appears to be highly farm-specific. In absolute terms, the required amount of labour reduces more on farm B, despite the fact that farm A accommodates almost twice as many sows. This is because farm B spends much more time on activities that yield the highest labour savings, such as cleaning the stables. Also the price conditions determine the economic effect of converting to a four-week system. Farm A, for example, receives a higher pig price compared to farm B. This means that farm A can sell the additional slaughter pigs due to the conversion to the four-week system at a higher price. As a result, the economic effect is more pronounced for this farm.



Conversion from a one-week to a four-week system may increase labour income. This requires that the additional capital costs are compensated by an increased productivity and a possible increase of the pig price.

Title: Farm management research

Funding: Sustainable Agriculture basic financing

Collaboration: KaHo Sint-Lieven (Departement Sint-Niklaas), Ghent University (Faculteit Economie en Bedrijfskunde – Vakgroep Accountancy en Bedrijfsfinanciering)

Contact: [jef.vanmeensel@ilvo.vlaanderen.be](mailto:jef.vanmeensel@ilvo.vlaanderen.be)

## Keeping the farm tidy

Farmers' perception is relevant to blue and green services from agriculture

### Objectives

This research sheds light on the cultural value of agricultural land – an aspect that gets insufficient attention in the system of management agreements. Agricultural land certainly has cultural significance for farmers, land is not only financial or functional for them. A lack of attention for this cultural significance in the approach of management agreements (agreements on the supply of blue and green services of agriculture) can become an obstacle for the effectiveness and willingness of farmers to cooperate.

'Land' obviously is an economic resource in the eyes of the farmer. But there is more. It is also a source of pride and an indicator of status. The state (tidy, healthy, productive, etc.) of his land illustrates the knowledge and skills of the farmer. In a manner of speaking, farmers 'read' each other's expertise of the land. Maintaining their land well – or in their own terms, 'keeping it tidy' – partly explains why this is so important for farmers.

### Methods

In this research project, three innovative Flemish projects were investigated: *Beekrandenbeheer Dommelgebied*, *Buffering in de Gentse Kanaalzone*, *B. akkerbrood*. Using a context-dependent approach, farmers were stimulated to deliver blue and green services. Interviews with the farmers involved, project staff and other stakeholders were conducted.

In addition, the management agreements were thoroughly studied. In these management agreements, specific conditions that farmers must meet in order to receive subsidies are elaborated. By deconstructing the agreements, we noticed the implicit assumption that farmers decide mainly for economic reasons whether or not to deliver blue and green services. Moreover mainly outsiders, not the farmers, are the ones who decide what the requirements are for good delivery of blue and green services. The prescribed conditions are thus mainly situated outside of farming culture. Management agreements therefore tend to suggest that farming is not inherently compatible with the delivery of green and blue services. The question of whether farmers can keep their land tidy is often overlooked by policy-makers. This increases the chance that farmers will choose not to prolong their management agreement, because the delivery of blue and green services is not integrated thoroughly in their farm culture.

### Results

According to the findings of the researchers, this situation can improve. Accounting for the cultural context in which agricultural land is embedded can help to prevent farmers from quitting. This requires a willingness to enter the farmers' world of sense-making, and to adapt the agreements to this world of sense-making. This could be done for example by involving farmers in how management objectives have to be met and also involving other stakeholders, with whom farmers – through the state of their farmland - wish to communicate. These 'others' are not only other farmers. An important motivation for farmers to cooperate in management agreements appeared to be the willingness to build a better relationship with people such as inhabitants of the rural area and nature conservation organizations, among others. Involving these stakeholders in the process can ensure that the message farmers want to deliver actually connects with the experience world of these groups. In summary, the conclusion is that the projects in question should not be seen as radical alternatives for conventional management agreements. The interviewees often used the projects under study to point out problems and areas of improvement for the existing management agreements.

Title: Strategies and instruments for remuneration of public services from agriculture

Funding: IWV

Duration: 2010 - 2012

Collaboration: Ghent University (Vakgroep Landbouweconomie)

Contact: joost.dessein@ilvo.vlaanderen.be

A selection of current projects in the Social Sciences Unit

How can we organize social learning processes so that farmers can produce sustainably while staying competitive in the current social and market context?

Title: Researchers and farmers: learning together to increase sustainability  
Funding: ILVO  
Duration: 2012 - 2016  
laure.triste@ilvo.vlaanderen.be



Which aspects of agrarian architecture do the largest user groups in the countryside (residents and visitors) experience as being pleasant in the landscape?

Title: Study of the experience of agrarian architecture  
Funding: Provincie West-Vlaanderen  
Duration: 2012  
Collaboration: Inagro  
elke.rogge@ilvo.vlaanderen.be

How can a company scan for sustainability both show and become the basis of increased sustainability on an individual farm?

Title: A company scan as part of sustainability trajectory in agricultural businesses  
Funding: ILVO, Boerenbond  
Duration: 2012 - 2014  
Collaboration: Boerenbond  
jo.bijttebier@ilvo.vlaanderen.be

Which innovative methods and facilities should be developed to re-link agricultural systems for animal and crop production, for more efficient use of energy and nutrients?

Title: INEMAD (Improved Nutrient and Energy Management through Anaerobic Digestion)  
Funding: EU  
Duration: 2012 - 2016  
Collaboration: International research consortium (coordinator Ghent University)  
fleur.marchand@ilvo.vlaanderen.be

What are the possibilities for collaboration between local farmers and activities related to tourism and and nature?

Title: Quality of life in Landen  
Funding: Gemeente Landen  
Duration: 2012  
Collaboration: Plus Office  
elke.rogge@ilvo.vlaanderen.be



Which key performance indicators are most useful to determine the most appropriate improvement strategies for management on an organic farm?

Title: Organic in the picture  
Funding: ADLO, Flemish Government  
Duration: 2012 - 2015  
Collaboration: Inagro, Wim Govaerts & co cvba, Proefbedrijf Pluimveehouderij  
jo.bijttebier@ilvo.vlaanderen.be

A selection of current projects in the Social Sciences Unit

**What are the best agricultural practices and what is the applicability of these practices on various types of agricultural businesses in the EU?**

Title: CATCH – C (Applicability of agricultural practices in various agricultural firms in the EU, with a focus on increasing soil quality and combatting climate change)  
Funding: EU  
Duration: 2012 - 2014  
Collaboration: ILVO Plant Sciences and ILVO Social Sciences, various European partners  
jo.bijttebier@ilvo.vlaanderen.be



**How can scientifically-based animal-friendly production be included in marketing strategies?**

Title: MELKWEL (Animal welfare monitoring in Flemish dairy cattle, consumers and cattle husbandry research including stakeholder participation)  
Funding: ILVO, Ghent University  
Duration: 2012 - 2015  
Collaboration: Ghent University, ILVO Animal Sciences  
sophie.degraaf@ilvo.vlaanderen.be

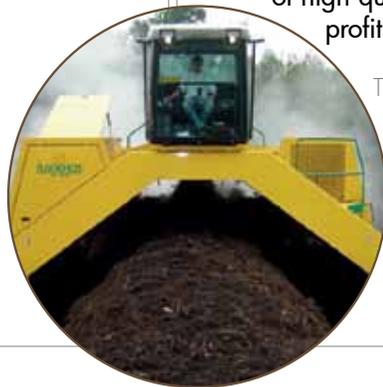
**Together with the local people involved, how can we develop sustainable and climate-friendly agricultural systems?**

Title: ERA-Malawi (Improving rural livelihoods in sub-Saharan Africa: sustainable and climate-smart intensification of agricultural production)  
Funding: ERA  
Duration: 2012 - 2015  
Collaboration: various foreign partners  
erwin.wauters@ilvo.vlaanderen.be

**What are the possibilities for city-oriented agriculture in highly urbanized rural areas?**

Title: Opportunity study for city-oriented rural development in the European metropolis of Lille-Coutrai-Tournai  
Funding: Provincie West-Vlaanderen  
Duration: 2012  
Collaboration: Studiegroep Omgeving  
elke.rogge@ilvo.vlaanderen.be

**How can the compost industry optimally use biomass for green energy sources and high-quality soil improvers? Which innovations are possible in terms of the composting process which also allow the demand of high-quality end products and optimize profit?**



Title: New dynamics in the compost from synergy between green energy and quality compost  
Funding: IWT - VIS  
Duration: 2012 - 2014  
Collaboration: ILVO Plant Sciences, K.U.Leuven, VLACO vzw  
jef.vanmeensel@ilvo.vlaanderen.be

**Is the role of economics, education and policy-making changing in terms of animal health?**

Title: Networking to enhance the use of economics in animal health education, research and policy making in Europe and beyond)  
Funding: EU, Lifelong Learning Programme, ERASMUS sub-programme, Erasmus Networks Action  
Duration: 2012 - 2015  
Collaboration: international consortium (coordinator Royal Veterinary College)  
erwin.wauters@ilvo.vlaanderen.be

A selection of current projects in the Social Sciences Unit



**How can we better valorize by-products from agriculture and fisheries and better close cycles?**

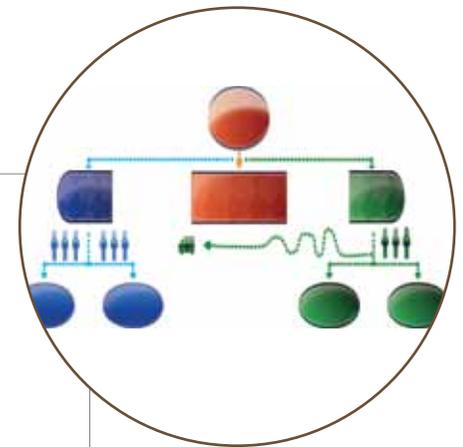
Title: GENESYS  
 Funding: ILVO - Coordinated Actions  
 Duration: 2012 - 2016  
 Collaboration: ILVO Animal Sciences, ILVO Plant Sciences, ILVO Technology & Food Science  
 koen.mondelaers@ilvo.vlaanderen.be

**How can science help to valorize sustainably and freshly-caught fish?**

Title: VALDUVIS (Valorization of sustainable and fresh caught fish)  
 Funding: EVF As 4, Flemish Government, Provincie West-Vlaanderen  
 Duration: 2012 - 2014  
 Collaboration: ILVO Animal Sciences, Visveiling  
 koen.mondelaers@ilvo.vlaanderen.be

**Which instruments and processes are needed to facilitate the agrofood systems innovation toward a bio-economy?**

Title: GENESYS PhD1 (Use of by-products as system innovation)  
 Funding: ILVO - Coordinated Actions  
 Duration: 2012 - 2016  
 jonas.vanlancker@ilvo.vlaanderen.be



**Which strategies are economically and technically achievable to manage crop residues from field and greenhouse vegetable production?**

Title: Research on crop residue management in field vegetable cultivation and the use of catch crops and crop rotation  
 Funding: VLM  
 Duration: 2012 - 2014  
 Collaboration: ILVO Plant Sciences, ILVO Technology & Food Science, Bodemkundige Dienst België, Inagro, Provinciaal Proefcentrum voor de Groenteteelt Oost-Vlaanderen, Proefcentrum voor de Groenteteelt Sint-Katelijne-Waver, Ghent University  
 jef.vanmeensel@ilvo.vlaanderen.be

**Is scale enlargement a good management strategy in dairy production?**

Title: Participative business modelling in dairy firms  
 Funding: ILVO  
 Duration: 2012 - 2013  
 Collaboration: IIBA  
 jolien.hamelinck@ilvo.vlaanderen.be



<sup>60</sup>services & products

## SERVICES & PRODUCTS

The fundamental and practical scientific research performed at ILVO forms the foundation of the services we provide. All of the agricultural and fisheries-related industries can choose from an ever-expanding list of highly specialised services. These service activities deliver a win-win situation for all involved: the clients know that they are receiving only the most up-to-date scientific knowledge and advice, and by performing these services, ILVO stays in touch with the daily complexities of the agribusiness and fisheries sectors.

For the first time, this annual report gives a well-structured overview of the services and products available from ILVO. For more information, contact the person(s) noted below. Businesses, individuals and organizations requesting a service from ILVO always receive a fair and unchanging price quote, and that confidentiality can be guaranteed whenever possible within the applicable legislation.

- ✓ LABORATORY ANALYSES
- ✓ REFERENCE LABORATORIES
- ✓ INSPECTION AND CERTIFICATION
- ✓ TECHNOLOGICAL SERVICES
- ✓ ADVICE
- ✓ PRODUCTS



## LABORATORY ANALYSES

*ILVO has dozens of specialized and mostly accredited labs for scientific research. These labs can also be visited by the public. All tests are performed by experienced and well-trained staff under supervision by a scientist. As needed, the researchers examine whether such tests would be appropriate for use under practical and industrial conditions.*

### Food Science

Chemical food safety	els.daeseleire@ilvo.vlaanderen.be wim.reybroeck@ilvo.vlaanderen.be sigrid.ooghe@ilvo.vlaanderen.be
Microbiological food safety	koen.dereu@ilvo.vlaanderen.be
Ingredients, authenticity and quality	jan.deblock@ilvo.vlaanderen.be els.daeseleire@ilvo.vlaanderen.be hadewig.werbrouck@ilvo.vlaanderen.be hendrik.deruyck@ilvo.vlaanderen.be wim.reybroeck@ilvo.vlaanderen.be sigrid.ooghe@ilvo.vlaanderen.be isabel.taverniers@ilvo.vlaanderen.be
Organoleptic research	jan.deblock@ilvo.vlaanderen.be hendrik.deruyck@ilvo.vlaanderen.be
GMO detection	isabel.taverniers@ilvo.vlaanderen.be bart.vandroogenbroeck@ilvo.vlaanderen.be marc.deloose@ilvo.vlaanderen.be
Allergies	isabel.taverniers@ilvo.vlaanderen.be bart.vandroogenbroeck@ilvo.vlaanderen.be marc.deloose@ilvo.vlaanderen.be

In vitro screening and gastro-intestinal simulations

marc.heyndrickx@ilvo.vlaanderen.be  
geertrui.rasschaert@ilvo.vlaanderen.be

### Agricultural Engineering

Under-water weighing of vegetables and fruit

bart.eloot@ilvo.vlaanderen.be

Spray application technology

david.nuyttens@ilvo.vlaanderen.be

### Plants and Soil

Plants, soil and substrates

chris.vanwaes@ilvo.vlaanderen.be

Diagnostic Centre for Plant Diseases (DCP)

lutgart.dewael@ilvo.vlaanderen.be

Ploidy analysis

leen.leus@ilvo.vlaanderen.be

Molecular markers

jan.deriek@ilvo.vlaanderen.be



“ Each year on the fields in Flanders, about 1200 hectares of seed potatoes are cultivated and certified. Every Flemish seed potato grower strives to deliver certified quality. Bacterial disease is a lasting problem for high-quality seed potatoes: only a small amount can ruin a whole crop. The resulting loss of quality damages the image of the seed potato growers and hinders the potatoes' marketability. The Diagnostic Centre for Plants (DCP) at ILVO supports the certification of seed potatoes by performing diagnostic research, tracking bacterial disease in the batches of seed potatoes and researching the virulence and damage caused by the various bacterial variants. This help is essential to ensure the quality of seed potatoes in Flanders in a sustainable way.

Dirk Ryckaert, seed potato grower in Assenede and Chair of the Flemish Association of Seed Potato Growers (WVP)

## Animal/Marine Sciences

Animal feed	johan.deboever@ilvo.vlaanderen.be
Blood analysis - animal	johan.aerts@ilvo.vlaanderen.be
Intermediate products (rumen fluid and intestinal content)	johan.deboever@ilvo.vlaanderen.be
Excretion products (excreta, faeces and urine)	johan.deboever@ilvo.vlaanderen.be
Animal end products (milk, meat, eggs)	johan.deboever@ilvo.vlaanderen.be
Marine environment (fishing boat, sea water)	bart.verschueren@ilvo.vlaanderen.be
Marine sediment	bavo.dewitte@ilvo.vlaanderen.be
Epibenthos	sofie.vandendriessche@ilvo.vlaanderen.be
Macrobenthos	jan.wittoeck@ilvo.vlaanderen.be
Plankton	karl.vanginderdeuren@ilvo.vlaanderen.be
Fish	karen.bekaert@ilvo.vlaanderen.be

## REFERENCE LABORATORIES

*Who analyses the lab analyses for their reliability? Who is the independent referee? The answer, in a growing number of cases, is "ILVO". This year, the federal government of Belgium added GMO detection in food matrices and detection of allergens in food, to the list of reference analyses performed at ILVO's Technology and Food Science Unit. We are also officially mandated to perform independent and reliable tests and monitoring of labs and instruments to ensure that industrial, private or public labs exactly measure what they say they measure. Customers with questions or doubts about the exactness of a lab analysis performed elsewhere can also go to ILVO for help.*

*Of course, being chosen as a reference lab illustrates the excellence of ILVO's labs. But even more importantly, this reference work contributes to correct analyses throughout the nation, which guarantee that the correct assessments will be made and lead to better public health.*

## Certified national reference labs (NRL)

NRL Plant diseases	martine.maes@ilvo.vlaanderen.be annemie.hoedekie@ilvo.vlaanderen.be
NRL Milk and dairy products	koen.dereu@ilvo.vlaanderen.be
NRL Water content in poultry	hadewig.werbrouck@ilvo.vlaanderen.be
NRL GMO's	isabel.taverniers@ilvo.vlaanderen.be
NRL Allergies	isabel.taverniers@ilvo.vlaanderen.be

“ Colruyt has had its assortment of wild-caught fish examined by two independent organizations, the Institute for Agricultural and Fisheries Research (ILVO) and Sea First Foundation. They examined sustainability in all aspects on the basis of four criteria: the fish stocks, the ecological impact, the fisheries management and animal welfare. This last criterium was included for the first time in an evaluation. Colruyt will clearly display the results of the analysis and four sustainability criteria in its stores with handy color codes. In this way the customer will be able to consciously choose a fish based on the criteria he or she found most important.

Colruyt press release, September 2012

## Mandated reference work

Coordination of the Milk Control Centre of Flanders hadewig.werbrouck@ilvo.vlaanderen.be

VCU and DUS research – variety lists joke.pannecoucque@ilvo.vlaanderen.be  
johan.vanwaes@ilvo.vlaanderen.be

Air emissions and sustainable production techniques (LNE) peter.demeyer@ilvo.vlaanderen.be  
eva.brusselman@ilvo.vlaanderen.be

Coordination of fisheries management els.torrele@ilvo.vlaanderen.be

## Other reference work

Ring tests for the dairy industry wim.reybroeck@ilvo.vlaanderen.be  
sigrid.ooghe@ilvo.vlaanderen.be  
hadewig.werbrouck@ilvo.vlaanderen.be

Animal marine laboratory (ANIMALAB) johan.aerts@ilvo.vlaanderen.be

## INSPECTION AND CERTIFICATION

*The safe production of primary agricultural products requires machines in perfect working order. Milk machines, spray installations or any other agricultural equipment must both work well and be well-maintained. The government has selected ILVO to inspect certain installations. To do so, one must have technical and chemical-biological knowledge. In addition to periodic inspections and certifications, ILVO is also actively involved in the training of maintenance technicians.*

### Milk technique

Inspection/certification of milking machines (Control) stephanie.vanweyenberg@ilvo.vlaanderen.be  
sarah.delaeter@ilvo.vlaanderen.be

Quality inspection of maintenance of milking machines (Control) stephanie.vanweyenberg@ilvo.vlaanderen.be  
sarah.delaeter@ilvo.vlaanderen.be

### Spray application technology

Certified inspection of sprayers in Flanders johan.declercq@ilvo.vlaanderen.be  
david.nuyttens@ilvo.vlaanderen.be

Testing of agricultural equipment jurgen.vangeyte@ilvo.vlaanderen.be

Kits for antibiotic determination wim.reybroeck@ilvo.vlaanderen.be

“ In 2012 ILVO strengthened its reputation as a service provider. As we continue to expand our offering of feed-related analyses, the analysis of higher fatty acids (from C6:0 to C24:1) was certified in our Chromatography lab. In the Bioanalysis research group, the analysis of cortisol in blood was accredited in our Immunophysiology lab. This is related to the ILVO research on the applicability of glucocorticoids as bio-marker for chronic stress in innovative matrices such as hair, fin samples, otoliths, scales, etc.

Johan Aerts, ILVO Animal Sciences Unit

“ Since the end of 2012, all technical inspectors of milk machines and milking robots can make use of a digital reporting package developed at ILVO (called MILCONTROL). This marks the end of the large paper “measuring and advice reports” – about 11,000 per year in Belgium. Soon the inspection reports of cooling tanks will also be digitized. ILVO is responsible for the coordination, the certification and the advanced training of the entire self-monitoring system for milk machines and cooling tank technicians. After only one month after launching MILCONTROL, the first 650 digital inspection reports for milk machines in MILCONTROL had already been submitted.

Stephanie Van Weyenberg, ILVO Technology and Food Science Unit

## TECHNICAL / TECHNOLOGICAL SERVICES (TO SMEs, BUSINESS AND GOVERNMENT)

*Businesses and organisations wishing to progress through innovation can call on ILVO's scientific expertise. The key to our service provision and advice is flexibility. Experience has taught us that the process of sharing scientific expertise with diverse industrial sectors requires custom-made services that address the customers' specific needs and requests. Some examples of this can be found in the knowledge network for ornamental plants (Sierteelt Sietinet), the Welfare Quality Protocol, which ILVO developed to measure animal welfare in agribusiness, and the possibility to pilot-test new food products in the renewed and expanded Food Pilot.*

### Plant Sciences and Crop Husbandry

Experimental field tests	kristiaan.vanlaecke@ilvo.vlaanderen.be
Disease resistance screening	kurt.heungens@ilvo.vlaanderen.be
Image-based analysis of shape and color	peter.lootens@ilvo.vlaanderen.be
Monitoring growth	peter.lootens@ilvo.vlaanderen.be
Genetic analyses	kristiaan.vanlaecke@ilvo.vlaanderen.be
Development of crossing schemes	johan.vanhuylenbroeck@ilvo.vlaanderen.be
Pre- en post-control of seeds and propagation material	johan.vanwaes@ilvo.vlaanderen.be

### Animal husbandry

Feed evaluation and feed preservation	johan.deboever@ilvo.vlaanderen.be
Zootechnical tests with dairy cows	sam.decampeneere@ilvo.vlaanderen.be stephanie.vanweyenberg@ilvo.vlaanderen.be
Zootechnical tests with meat cattle	leo.fiems@ilvo.vlaanderen.be stephanie.vanweyenberg@ilvo.vlaanderen.be
Zootechnical tests with pigs	sam.millet@ilvo.vlaanderen.be annelies.vanuffel@ilvo.vlaanderen.be
Zootechnical tests with small farm animals	luc.maertens@ilvo.vlaanderen.be evelyne.delezie@ilvo.vlaanderen.be
Behaviour and welfare of farm animals	frank.tuytens@ilvo.vlaanderen.be annelies.vannuffel@ilvo.vlaanderen.be
Emissions from cattle	sam.decampeneere@ilvo.vlaanderen.be nico.peiren@ilvo.vlaanderen.be peter.demeyer@ilvo.vlaanderen.be
Excretion experiments - poultry	evelyne.delezie@ilvo.vlaanderen.be els.daeseleire@ilvo.vlaanderen.be
PreventAgri: safety on the farm	robin.desutter@ilvo.vlaanderen.be

“ Within ILVO's PreventAgri project, in 2012 the ADIO research project "Arbeid adelt" took place. The sustainability compass developed in this research helps a dairy farmer to assess which (sometimes very small and inexpensive) procedures can lead to a dramatic improvement of the sustainability of work on the farm. This compass can also be used to determine whether it is possible to expand the amount of work done by the employees already present in the business.

Robin De Sutter, PreventAgri, ILVO Animal Sciences Unit

## Fisheries, aquaculture and aquatic environment

Design and testing of fishing boats	bart.verschueren@ilvo.vlaanderen.be
Evaluation of sustainability	kim.sys@ilvo.vlaanderen.be kelle.moreau@ilvo.vlaanderen.be arne.kinds@ilvo.vlaanderen.be
CIVIS (fishing gear and guidance)	kris.vancraeynest@ilvo.vlaanderen.be
Test setups for marine experiments (including aquaculture)	daan.delbare@ilvo.vlaanderen.be johan.robbens@ilvo.vlaanderen.be kris.hostens@ilvo.vlaanderen.be hans.polet@ilvo.vlaanderen.be
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Marine biology	hans.polet@ilvo.vlaanderen.be els.torreele@ilvo.vlaanderen.be

## Food and feed technology

Food Pilot	geert.vanroyen@ilvo.vlaanderen.be katleen.coudijzer@ilvo.vlaanderen.be karen.verstraete@ilvo.vlaanderen.be nathalie.bernaert@ilvo.vlaanderen.be
Advice for dairy (TAD Zuivel)	katleen.coudijzer@ilvo.vlaanderen.be
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## Agricultural Engineering

ICT/automation	koen.mertens@ilvo.vlaanderen.be jürgen.vangeyte@ilvo.vlaanderen.be
Machine design	jürgen.vangeyte@ilvo.vlaanderen.be
Low-emission stalls (indoor climate and emissions)	peter.demeyer@ilvo.vlaanderen.be eva.brusselman@ilvo.vlaanderen.be
Cattle emissions	sam.decampeneere@ilvo.vlaanderen.be nico.peiren@ilvo.vlaanderen.be peter.demeyer@ilvo.vlaanderen.be
Spray tech lab	david.nuyttens@ilvo.vlaanderen.be
Sustainability of stall materials	veerle.vanlinden@ilvo.vlaanderen.be
Analysis of mechanical impact during potato harvest	bart.eloot@ilvo.vlaanderen.be
Zootechical tests with dairy cows	sam.decampeneere@ilvo.vlaanderen.be stephanie.vanweyenberg@ilvo.vlaanderen.be
Zootechical tests with pigs	sam.millet@ilvo.vlaanderen.be annelies.vanuffel@ilvo.vlaanderen.be

## Social Sciences

(Participatory) process facilitation	fleur.marchand@ilvo.vlaanderen.be lies.debruyne@ilvo.vlaanderen.be elke.rogge@ilvo.vlaanderen.be joost.dessein@ilvo.vlaanderen.be
Quantitative and model-driven support of decision-making processes	jef.vanmeensel@ilvo.vlaanderen.be dakerlia.claeys@ilvo.vlaanderen.be



## ADVICE

*ILVO offers advice on the following subjects to the government. This list also contains the expertise offered via participation in numerous national and international networks.*

### Advice to government

Advice about the legal decision regarding damage from wild animals [bert.vangils@ilvo.vlaanderen.be](mailto:bert.vangils@ilvo.vlaanderen.be)

Certification of the PDPO (Flemish Program Document for Rural Development) [jef.vanmeensel@ilvo.vlaanderen.be](mailto:jef.vanmeensel@ilvo.vlaanderen.be)

Low-emission animal housing systems (VLM) [peter.demeyer@ilvo.vlaanderen.be](mailto:peter.demeyer@ilvo.vlaanderen.be)

### Advice to organizations and networks

Soil Fertility in Croatia (CROCAN) [alex.devlieghe@ilvo.vlaanderen.be](mailto:alex.devlieghe@ilvo.vlaanderen.be)

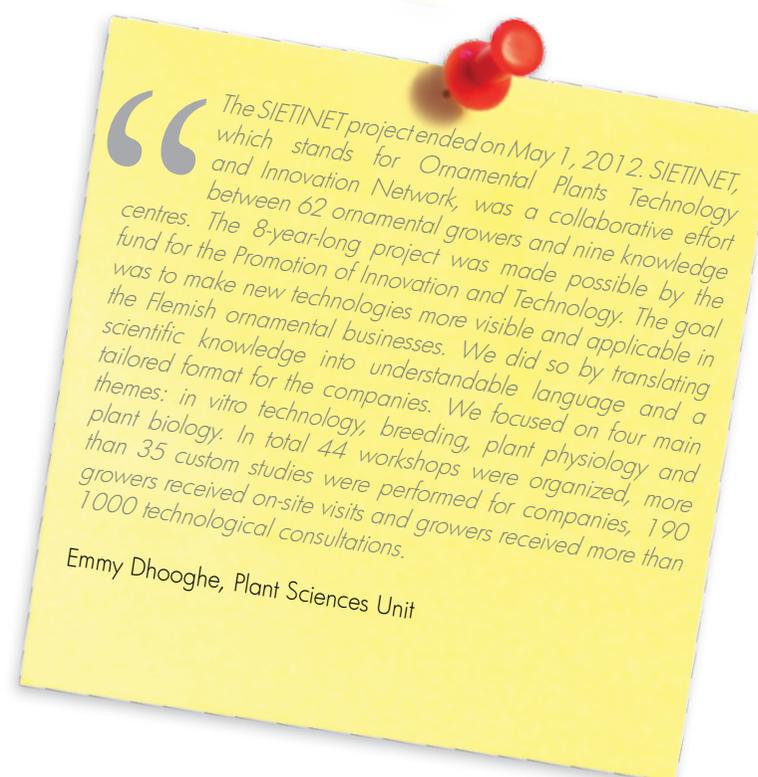
Organic Agriculture in Macedonia (LEGUMAC) [alex.devlieghe@ilvo.vlaanderen.be](mailto:alex.devlieghe@ilvo.vlaanderen.be)

Pilot farm in Kosovo [alex.devlieghe@ilvo.vlaanderen.be](mailto:alex.devlieghe@ilvo.vlaanderen.be)

Network for Research on Organic Farming and Food (NOBL) [lieve.decock@ilvo.vlaanderen.be](mailto:lieve.decock@ilvo.vlaanderen.be)

ERA net (ICT-Agri, SUSfood, marina) [jurgen.vangeyte@ilvo.vlaanderen.be](mailto:jurgen.vangeyte@ilvo.vlaanderen.be)  
[hendrik.deruyck@ilvo.vlaanderen.be](mailto:hendrik.deruyck@ilvo.vlaanderen.be)

Consortium for Knowledge-Building about Air Emissions in Animal Husbandry (VEMIS) [peter.demeyer@ilvo.vlaanderen.be](mailto:peter.demeyer@ilvo.vlaanderen.be)



## Advice to SMEs and businesses

Sustainability Monitoring [fleur.marchand@ilvo.vlaanderen.be](mailto:fleur.marchand@ilvo.vlaanderen.be)

Consortium for Knowledge-Building about Air Emissions in Animal Husbandry (VEMIS) [peter.demeyer@ilvo.vlaanderen.be](mailto:peter.demeyer@ilvo.vlaanderen.be)

Cost/benefit analysis and technological advice for aquaculture activities [daan.delbare@ilvo.vlaanderen.be](mailto:daan.delbare@ilvo.vlaanderen.be)

Technology Pool for Ornamentals (knowledge centre for ornamental growers) [johan.vanhuylenbroeck@ilvo.vlaanderen.be](mailto:johan.vanhuylenbroeck@ilvo.vlaanderen.be)

The Pig Window ("Varkensloket") [sarah.desmet@ilvo.vlaanderen.be](mailto:sarah.desmet@ilvo.vlaanderen.be)

## PRODUCTS

*Breeding of ornamentals and agricultural varieties (mainly grasses) at ILVO is always done to increase both sustainability and profitability of the plants. New ornamental cultivars bred at ILVO are commercialized via two cooperatives. New agricultural varieties are sold to multiplication companies worldwide.*

*ILVO Fisheries has witnessed a growing demand for sea water. ILVO owns a direct pipeline that brings water from deep in the North Sea onto land and can thus sell sea water on demand.*

### Ornamental Plants

Azalea - AZANOVA [johan.vanhuylenbroeck@ilvo.vlaanderen.be](mailto:johan.vanhuylenbroeck@ilvo.vlaanderen.be)

Woody Ornamentals - BEST SELECT [johan.vanhuylenbroeck@ilvo.vlaanderen.be](mailto:johan.vanhuylenbroeck@ilvo.vlaanderen.be)

### Field and Greenhouse Plants

RVP varieties [marianne.malengier@ilvo.vlaanderen.be](mailto:marianne.malengier@ilvo.vlaanderen.be)

Seawater [daan.delbare@ilvo.vlaanderen.be](mailto:daan.delbare@ilvo.vlaanderen.be)

Marine Organisms [hans.polet@ilvo.vlaanderen.be](mailto:hans.polet@ilvo.vlaanderen.be)

“ One of the action points from the Flemish Action Plan for Pig Husbandry is the “Pig Window” (Varkensloket). This centralised information access point, housed at ILVO, became a reality in spring 2012. The main target audience are Flemish pig farmers but other members of the pork industry can ask specific questions at the Pig Window. This service is offered free of charge and questions are answered in an objective and understandable manner. The answers are based on the knowledge from the Pig Research Station. The Pig Window is also the place where relevant research results are collected, inventoried and communicated to the pork sector. This information is presented on the website [www.varkensloket.be](http://www.varkensloket.be), as well as in publications in trade journals and study and demonstration days. The Pig Window is part of the Pig Research Station and therefore will play a coordinating role in creation of the research and communication plans.

Sarah De Smet, Pig Window, ILVO

“ Judging by the 2012 results, the future of ILVO's grass varieties is looking bright. The grass breeding programme was operating (and still is) at full capacity. At the end of 2012, a record 13 grass cultivars participated in official variety tests in Belgium, the Netherlands, France, Germany, the UK and Switzerland. The application for the first *Festulolium* (a cross between rye-grass and *Festuca*) in Belgium has occurred in the name of ILVO. We are keeping our fingers crossed for a successful registration.

Marianne Malengier, RVP-varieties, ILVO Plant Sciences Unit

## Knowledge, cut to order

### The great leap forward: ILVO on the internet

Knowledge only becomes effective once it is shared. Therefore ILVO strives to provide up-to-date information about our projects, future plans and results to policy-makers, the agriculture and fisheries industries, and society in general. As a government-funded institute, it is our duty to communicate openly and clearly about our efforts.

This information must not be only understandable; it must also go out into the world. But leaving our doors is not enough: it also needs to be easily found. That is why we launched a brand new ILVO website last fall. The site is not only more attractive and modern than the former - most importantly, it is more user-friendly and the layout is more accessible. The new website is the ideal way to bring our research, services and products to our audience. To respond to the needs of both layperson and specialist, we have created a special two-layer structure. The upper layer ([ilvo.vlaanderen.be](http://ilvo.vlaanderen.be)) is a general website with a summary of all relevant information, and the lower layer (our research portal) contains all the project-related information that our fellow researchers and other experts might wish to know. This research portal (in reality, a second website) presents our current and past research, along with a great deal of information about our researchers, research units, projects and publications.

The website represents a great leap forward for external as well as internal communication. Together with the University College Ghent, ILVO is one of the first research institutions to invest in PURE - software developed specifically for scientific institutions. PURE was developed by the Danish company Atira (now Elsevier). With the financial help of EWI (the Flemish Department of Economy, Science and Innovation) we were able to purchase this software package. PURE links all four of ILVO's internal databases: the personnel database, the list of stakeholders, the database of research clusters, and the system we use to follow up all of our research projects (including the bookkeeping).

In addition to maximizing the transparency of our scientific information, every potential client can find the way to our "Services and Products" section to find all of the ways that ILVO can be of service. All of our expertise and advice is supported by groundbreaking research. Based on our 80 years of experience with agricultural and fisheries research, we offer a broad range of services and products. The building blocks of ILVO's service provision are our experience, data, infrastructure

and employees with a passion for agriculture and fisheries. After all, service provision is also good communication: building practical, useful expertise based on scientific knowledge and making that expertise available to the sector.

Our website, [www.ilvo.vlaanderen.be](http://www.ilvo.vlaanderen.be), is also the perfect mirror of our daily active press activities. Via the calendar on the home page, you can find all the news of upcoming study-days, demonstrations, workshops, conferences, symposia, etc. But there is also a new section under "Press and Media". By clicking on the "Press and Media" button, you will find all kinds of news items, press releases, films, photos, newsletters (our redesigned "Newswave") and popularizing publications. In this way, not only the press but also the general public can easily access ready-to-use news items in text and images. That is also a good way to get an overview of the activities and important events at ILVO in 2012. A sampling of those events: we participated in the Open Enterprise Day, where more than 6000 visitors got a taste of our research; study days and press conferences about biochar and other subjects; the Pig Window (*Varkensloket*) and our new odour lab; Minister-President Kris Peeters' visit to our field experiment with GMO potatoes and soy and sorghum; and the baptism of our AIKO® azalea by European President Herman Van Rompuy at the Floriade in Venlo, NL.

Not only did we get a new website this fall, ILVO also got a new logo. The logo was developed together with students from the University of Arkansas who were participating in an internship at ILVO. They came to Belgium to help with the preparation and practical aspects of our programme for the Open Enterprise Day. With their help, we designed a tour that led our visitors past machines, animal housing, glasshouses, posters, video screens, and demonstrations and explanations by the researchers themselves. The new logo has fresh colours that echo the website and a playful touch on the upper left of the logo that tickles the viewer to think about the diversity of our research. Is it a pig's ear, a leaf, or a fish? It is all of that and much more. Now we have an appropriate symbol to illustrate the diversity of the research done at ILVO.



## Optimization, modernization and consolidation

### Finances and internal control

#### Finances

ILVO's finances rest on a double support. As an Internally Autonomous Agency (IAA) of the Flemish Government, ILVO receives a basic subsidy for the operations, investment and personnel paid by the Flemish Government. In addition to this subsidy, ILVO has traditionally gained approximately 50 % of its income from the separate corporate personality called ILVO Own Capital (OC). ILVO, being a scientific institute, can also receive various grants to carry out project research.

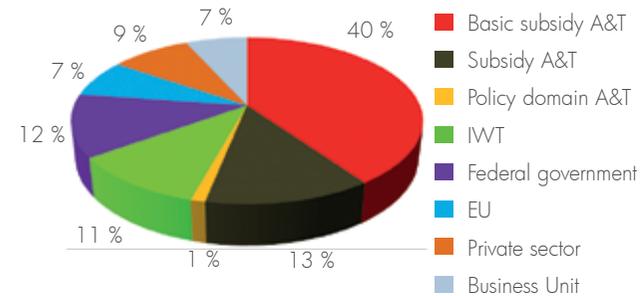
Both annual accounts are controlled through appropriate channels. The financial statement of the Own Capital is presented to the Management Commission of ILVO, attended by the Inspector of Finance. The accounts are audited by the IVA Central Accounting and the Court of Auditors. Each year, ILVO management combines the income from the Flemish Government and OC to form a complete picture of the total operational cost of the institute.

#### Internal Control

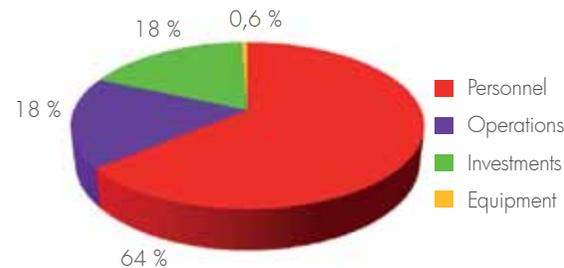
In 2011, ILVO received a good score from the Internal Flemish Audit Administration (IAVA) for its method of approaching the organizational process. This score is based on a general progress audit within the framework of 'Beter Bestuurlijk Beleid'. In addition, ILVO received new recommendations which we applied in the course of 2012. In the future, ILVO plans to continue to optimize and maximize control of its internal processes, to pursue the goal of meeting its strategic and operational goals. The ILVO Quality Handbook, which describes ILVO's operations in detail, along with the work processes and their risk analysis is continually being updated.

The Committee of Scientific Directors (COWEDI) set ILVO's future operational objectives for 2013. These short-term objectives guarantee the realization of the long-term strategic objectives.

Each year, the COWEDI also evaluates the degree of internal control by allocating an internal maturity score to each of the thematic management measures. This system in turn influences a specific performance indicator. To follow up the operational



Income sources 2012



Expenses 2012

objectives for 2011, new critical success factors (KSFs) and their related critical performance indicators (KPIs) were set. The research units and ILVO's management are required to adhere to these performance indicators. The consolidated Balanced Score Card (BSC) system gives a general overview for ILVO. The KPIs were evaluated by the COWEDI during their annual strategic seminar.

## Investing in people

### Personnel and Human Resources management

In June 2012 the HR management plan for 2012 - 2105 was approved.

At ILVO, we have a human resources management policy that meet the specific requirements of a scientific research institute with an Own Capital fund.

The essential role of HR within ILVO includes:

- Delivering enough motivated and qualified employees while keeping costs within socially and economically appropriate limits.
- Searching for optimal employee satisfaction by seeking common interests and combinations, and bridging conflicts where needed.

ILVO has a clear mission, vision and strategic goals. During the past several years, we have started several HR projects which became lasting processes accompanied by a sometimes heavy workload. The HR management plan will harmonize these existing processes as well as new ones by including them all in specific HR goals which are in turn based on ILVO's organizational goals.

Three areas of focus were chosen for the coming years, each coupled with the required HR goals.

#### Operational capability

To stimulate our personnel's engagement and commitment and to encourage flexible hiring, personnel are offered all possible opportunities to develop their talents along lines of the competencies that ILVO now needs and may need in the future.

The first concrete step towards this goal is to develop a competency management system which is linked to the personnel database, employee's training history, and their PLOEG (evaluation) documents. This system will enable us to integrate and manage which competencies are currently present in our organization, and which are still needed.

#### Knowledge-sharing and collaboration

Within ILVO, a larger percentage of the currently-available knowledge is being made structurally available for all employees so that it is available for the entire organization. One of the advantages of this is to prevent loss of knowledge when an employee leaves ILVO.

To accomplish this goal, we first made an inventory of existing and potential initiatives to bring employees in contact with each other with the goal of sharing knowledge among the various research units and between people with comparable responsibilities.

#### Leadership and coaching

At ILVO, supervisory staff are supported in their development so they can take responsibility in all areas and find a balance between the three roles of a supervisor (leader, manager and coach). In this way they can both achieve ILVO's goals and increase employee satisfaction.

In various steps, we have clearly described and communicated the role, the mandate and the responsibility of ILVO supervisory staff and we have provided the necessary support to the supervisory staff members.

*Total staff composition as of 31/12/12, number of staff expressed in full-time equivalents (FTE)*

	male/VTE	female/VTE	total/VTE	percent OC (%)
A-level	127/124,7	137/123,4	264/248,1	58,7/59,7
B-level	55/53,2	67/55,4	122/108,6	50,8/51,2
C/D-level	115/108,5	86/63,8	201/172,3	38,8/40,5
Total	297/286,4	290/242,6	587/529,0	50,3/51,7

## Environment, Employee Health and Facilities Management

### ILVO infrastructure updated

In 2012 it became clear that we could take on the responsibility of investing in and maintaining our own buildings. Transparent reporting allows for a flexible investment policy. Because of this, we can respond quickly to a changing situation coupled with long-term planning. We have thus outfitted the new glasshouse complex with the technical installations required for safe GMO and pathogen research. In our Ostend site, we added 15 special cabinets. This investment ensured that our colleagues can perform their work in a safe and healthy manner. We also started construction of an experimental animal housing for dairy cattle (144 cows) with the appropriate technical requirements and outfitting. The Food Pilot construction and finishing work are now complete. Safety as well as ergonomic and environmental considerations (such as re-use of cooling water) were taken into consideration.

Together with the Department of Facilities Management from the Government of Flanders, we researched whether we could place solar panels. We would still like to place wind turbines in partnership with a private organization but the objections of a third party hinder progress in this area. The wastewater separation on the Melle-Merelbeke campus is nearly complete.

## 2012: sowing, harvesting, and sowing again

### New pathways for research at ILVO

In 2011 our policy-supportive and fundamental research were bundled into 9 interdepartmental research programmes: the organization-wide brainstorming for ILVO2020 ensures increased interaction between the four units of ILVO (Plant Sciences, Animal Sciences, Technology and Food Science, and Social Sciences). ILVO2020 not only delivers mutual knowledge-building and appreciation of each others' work, but also leads to new research questions and challenges based on one of ILVO's trump cards: multidisciplinary.

In 2011, ILVO put a significant amount of resources on the table for the first time in its long history to give concrete support to the research areas wishing to work together. This took the form of a research project symbolizing a "big challenge" as defined by ILVO2020. After the first call for the so-called "Coordinated Actions", we received no less than 10 innovative, multidisciplinary project proposals. A big success. After a thorough selection procedure, the Management Commission made a decision on May 15, 2012. They chose the project called GeNeSys, "Market-oriented development and introduction of innovation: system innovation about valorization of by-products from agriculture and fisheries". This Coordinated Action is the first step in building a strategic research platform that should put ILVO squarely on the map.

After GeNeSys was launched, an intensive search for a team of four complementary and driven doctoral students and a coordinator began. This also was met with success: in December 2012 the team was complete. We are curious to know which (r)evolutions this will bring in 2013.

In 2012 the seeds of new ideas for the second Coordinated Action started to grow. The selection of the second CA award will be announced in mid-May 2013.

2012 was a year of growth and evolution in another aspect as well. ILVO is growing and blossoming in terms of research, and the organizational side of our research coordination needs to evolve along with this growth. To better manage our internal data and to increase the visibility of our researchers and their expertise, we have made some dramatic changes to our existing databases, coupled them together and updated them with new initiatives. The introduction of PURE, ODIS and the new website together form the first big step towards preparing ILVO's internal motor for the future.

What does the future hold in 2013? After the selection of the second CA, we have several organizational challenges in store: OC training cycles, the selection of the research programme for 2014-2017, Horizon2020, an update to ILVO2020, and more. We are ready for another well-filled, dynamic year.



<http://pure.ilvo.vlaanderen.be>

publications

## PUBLICATIONS

### Animal Sciences

#### Scientific publications (A1)

Aluwé, M., Tuytens, F.A.M., Bekaert, K.M., De Smet, S., De Brabander, D.L. & Millet, S. (2012) Evaluation of various boar taint detection methods. *Animal* 6 (11): 1868-1877

Bekaert, K.M., Aluwé, M., Millet, S., Goethals, K., Nijs, G., Isebaert, S., De Brabander, D.L., Verheyden, K., De Brabander, H.F., Vanhaecke, L. & Tuytens, F.A.M. (2012) Predicting the likelihood of developing boar taint: Early physical indicators in entire male pigs. *Meat Science* 92 (4): 382-385

Bekaert, K. M., Vanden Bussche, J., Francois, S., Tuytens, F., De Brabander, H.F., Vandendriessche, F. & Vanhaecke, L. (2012) A validated ultra-high performance liquid chromatography coupled to high resolution mass spectrometry analysis for the simultaneous quantification of the three known boar taint compounds. *Journal of Chromatography A* 1239: 49-55

Broekaert, N., Daeseleire, E., Delezie, E., Vandecasteele, B., De Beer, T. & Van Poucke, C. (2012) Can the use of coccidiostats in poultry breeding lead to residues in vegetables? An experimental study. *Journal of Agricultural and Food Chemistry* 60 (50): 12411-12418

Buijs, S., Van Poucke, E., Van Dongen, S., Lens, L., Baert, J. & Tuytens, F. (2012) The influence of stocking density on broiler chicken bone quality and fluctuating asymmetry. *Poultry Science* 91: 1759-1767

Buijs, S., Van Poucke, E., Van Dongen, S., Lens, L. & Tuytens, F. (2012) Cage size and enrichment effects on the bone quality and fluctuating asymmetry of fattening rabbits. *Journal of Animal Science* 90: 3568-3573

Castro Montoya, J., De Campeneere, S., Van Ranst, G. & Fievez, V. (2012) Interactions between methane mitigation additives and basal substrates on in vitro methane and VFA production. *Animal Feed Science and Technology* 176 (1-4): 47-60

Cranford, P., Kamermans, P., Krause, G., Mazurié, J., Buck, B., Dolmer, P., Fraser, D., O'Beirn, F., Sanchez-Mata, A., Thorarinsdottir, G., Strand, O. & Van Nieuwenhove, K. (2012) An ecosystem-based approach and management framework for the integrated evaluation of bivalve aquaculture impacts. *Aquaculture Environment Interaction* (2): 193-213

De Bruyne, E., Flahou, B., Chiers, K., Meyns, T., Kumar, S., Vermoote, M., Pasmans, F., Millet, S., Dewulf, J., Haesebrouck, F. & Ducatelle, R. (2012) An experimental *Helicobacter suis* infection causes gastritis and reduced daily weight gain in pigs. *Veterinary Microbiology* 160: 449-454

De Gussem, B., Soetaert, M., Hennebel, T., Vanhaecke, L., Boon, N. & Verstraete, W. (2012) Catalytic dechlorination of diclofenac by biogenic palladium in a microbial electrolysis cell. *Microbial Biotechnology* 5 (3): 396-402

Delezie, E., Maertens, L. & Huyghebaert, G. (2012) Consequences of phosphorus interactions with calcium, phytase, and cholecalciferol on zootechnical performance and mineral retention in broiler chickens. *Poultry Science* 91 (10): 2523-2531

Deprez, K., Robbens, J., Nobels, I., Vanparys, C., Vanermen, G., Tirez, K., Michiels, L. & Weltens, R. (2012) DISCRISSET: A battery of tests for fast waste classification - Application of tests on waste extracts. *Waste Management* 32 (12): 2218-2228

Dermauw, V., Froidmont, E., Dijkstra, J., De Boever, J., Vyverman, W., Debeer, A-E. & Janssens, G.P.J. (2012) Sulphur levels in saliva as an estimation of sulphur status in cattle: a validation study. *Archives of Animal Nutrition* 66 (6): 507-513

Di Mavungu, J., Malysheva S.V., Sanders, M., Larionova, D., Robbens, J., Dubruel, P., Van Peteghem, C. & De Saeger, S. (2012) Development and validation of a new LC-MS/MS method for the simultaneous determination of six major ergot alkaloids and their corresponding epimers. Application to some food and feed commodities. *Food Chemistry* 135: 292-303

Fiems, L., De Boever, J., Vanacker, J. & De Brabander, D. (2012) Effect of cull potatoes in the diet for finishing Belgian Blue double muscled cows. *Animal* 7 (1): 93-100

Fiems, L., De Boever, J., Vanacker, J., De Campeneere, S. & De Brabander, D. (2012) Spelt as an ingredient in concentrates for rearing calves. *Livestock Science* 150: 349-356

Filliers, M., Goossens, K., Van Soom, A., Merlo, B., Pope, C.E., de Rooster, H., Smits, K., Vandaele, L. & Peelman, L.J. (2012) Gene expression profiling of pluripotency and differentiation-related markers in cat oocytes and preimplantation embryos. *Reproduction, Fertility and Development* 24 (5): 691-703

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**“Wij testen stallucht”**  
 22 collega's van het Instituut voor Landbouw- en Visserijonderzoek (ILVO) helpen hun collega's Nathalie Hove en Peter Demeyer bij een ingewoven onderzoek: ze testen vrijwillig stallucht.  
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**VRIJWILLIGERS HELPEN UNIEK LABORATORIUM OM GEURHINDER LANDBOUWBEDRIJVEN IN TE PERKEN**

Vanaf wanneer bestempel je de geur van een varkensstal als stank? Geen wetenschapper die het je kan zeggen, maar daar komt verandering in. Twintig proefkonijnen gaan voor het Instituut voor Landbouw en Visserijonderzoek (ILVO) aan stalen stallucht snuffelen. Minister Schauvliege hoopt zo een norm te bepalen van wat nu wel en niet stinkt. Die moet helpen om de geurhinder van landbouwbedrijven tegen 2020 met 4 procent te drukken.



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 VANAF 1 JANUARI 2013  
 CONTROLE VAN MELKMACHINES EN -ROBOTS  
 Gedigitaliseerd  
 Maandag 24 December 2012

**Vele kleintjes maken een groot**  
 makend een groot  
 Ondanks de wijdverbreide verstedelijking is slechts 13 procent van de bodem bebouwd en dus nog altijd 87 procent van Vlaanderen 'open'. Dat biedt mogelijkheden voor het beleid...  
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 van Verhove, Elka Vananpen, Valeria Dewaachyns, Kirsten Bomsen  
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**80 jaar landbouw- en visserijonderzoek**  
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**“Tuinen zijn het groene facet van verstedelijking”**  
 Open ruimte e twee begrippen  
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**ZuivelZicht**  
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**80 jaar landbouw- en visserijonderzoek**  
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