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MEASURING PESTICIDE RESIDUES IN FOOD

THE PRODUCTS THAT WE USE TO PROTECT FOOD CROPS AGAINST DISEASE, PESTS AND WEEDS LEAVE RESIDUES IN BOTH AGRICULTURAL PRODUCE AND THE ENVIRONMENT. THIS IS A KEY CONCERN FOR CONSUMERS, THE AUTHORITIES AND THE PLANT PROTECTION PRODUCT INDUSTRY. THE CRA-W HAS BEEN WORKING FOR MORE THAN 25 YEARS TO QUANTIFY PESTICIDE AND METABOLITE RESIDUES IN A RANGE OF DIFFERENT CROPS.

These studies provide the scientific data that manufacturers need to secure European approval for their plant protection products, and are used to set maximum residue limits (MRLs) for pesticides (which are vital for product application checking, consumer protection and international food trading purposes).

Residue tests are performed on various insecticides, fungicides, herbicides and growth regulators used across a variety of crops, especially market gardening, fruit and cereal crops.

What does residue testing involve?

Residue testing is a two-stage process. The first, so called "agronomic" stage involves performing tests (either in the open air or under shelter), carrying out various processes in line with good agricultural practice, gathering samples according to EU requirements, and sending the samples to the laboratory for testing. These tests are performed throughout Belgium, in both Wallonia and Flanders, to cover a diverse array of soil types, climates and cropping methods, and to quantify residues across a broad, representative sample.

The second, so-called "analytical" phase involves receiving, preparing and storing the samples before they are analysed, as well as developing, optimising and approving the analysis protocol and determining the pesticide residue content in the samples.

The studies are conducted by the CRA-W, either alone or in conjunction with other European partners, in accordance with European (EU) and international (FAO, WHO, Codex Alimentarius) regulations on pesticide residues, and in line with the OECD Principles of Good Laboratory Practice (GLP) (GLP certificate C04).

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TRESOGEST USED FOR ORGANIC PIG FARMING RESEARCH

FOR MOST ORGANIC FARMS IN WALLONIA, PIG FARMING IS ONLY A SMALL PART OF THEIR BUSINESS MODEL, WITH PIGS RAISED ALONGSIDE OTHER ACTIVITIES. AT SOME DIVERSIFIED FARMS, FARMERS EVEN ADJUST THE SIZE OF THEIR PIG HERDS ACCORDING TO THE PRODUCTS OR BY-PRODUCTS THEY WISH TO SELL.

The fact that pig farming is incorporated into other activities makes it difficult to measure performance. While herd management software programs give farmers detailed insights into pig farming productivity and profitability, organic farmers tend not to use them because they are geared towards specialist farms, are relatively expensive to buy, and take time to configure. These practical challenges mean that, as things stand, data on organic pig farming is hard to come by.

Yet producing data is vital – both for farmers, so they can get objective information and adjust their system accordingly, and for the sector as a whole, so that reliable statistics about the state of the industry in Wallonia can be produced. The CRA-W and the Belgian Union of Agrobiologists (UNAB) have therefore joined forces to provide TresoGest – a simplified financial management tool developed as part of CRA-W organic farming research – to members of the organic pig farmers' group. The tool was used to gather economic data from around a dozen organic pig farmers using a variety of different, diversified systems (breeding, fattening, and outdoor- and indoor-rearing). The results were then presented at a group feedback workshop, where farmers had a chance to talk about their practices and the circumstances under which they operate.

The TresoGest tool, and the associated group dynamic, have proven extremely useful for some members of the organic pig farmers' group. At the Action Research in Organic Farming Day event, organised on 29 November by the CRA-W (presentations available online*), participants talked about the tool's benefits and the challenges around large-scale deployment.

Farmers require adequate support and monitoring to use the TresoGest tool, and efforts to promote wider uptake involve making it available online and working in tandem with support organisations. The AgriCoGest development project, designed with precisely these aims in mind, was recently accepted under the SPW/DGO3 call for proposals. The project will combine Tresogest with Ecobox, a pooled online access tool developed by Groupe One for very small businesses.

**http://www.cra.wallonie.be/fr/conferences/2e-journee-de-la-recherche-a-laction-en-agriculture-biologique-1*

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SAGRIWASENT: USING SPATIAL REMOTE SENSING TO MONITOR AGRICULTURE

CURRENT INNOVATIONS IN SPATIAL REMOTE SENSING TECHNOLOGIES ARE SHOWING HOW FARMLAND IS EVOLVING AND PROVIDING INSIGHTS INTO THE MANY CROP TYPES GROWN HERE ON EARTH. THE CRA-W IS MAKING ITS OWN CONTRIBUTION TO THIS MOVEMENT WITH THE SAGRIWASENT PROJECT.

Spatial remote sensing is moving forward in leaps and bounds. A prime example is the European Copernicus programme, with the Sentinel-1 and Sentinel-2 satellites – the first producing radar images that can capture the surface through cloud, and the second equipped with multi-spectral instruments with 13 spectral bands – providing high-resolution images and passing over the same spot every 5-6 days.

The SAGRIWASENT project uses the data contained in these high-resolution images to monitor agriculture:

- by developing an automated method to detect changes at plot level (see image 1) using Sentinel-2 images; s.
- by producing crop type maps covering the whole of Wallonia, using optical and radar images (the temporal resolution of these images means that different crop types can be monitored across variable annual cropping calendars).

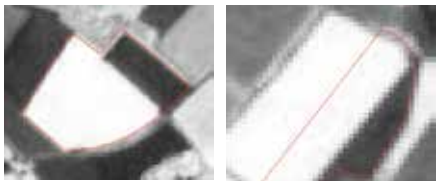

Image 1: Agricultural plots reported in 2017 (outlined in red) that have undergone changes visible on a Sentinel-2 image captured on 22 November 2017. The change, marked by two different shades of grey, occurred after the end of the main crop growing season, and reveals that there are now two new crops in each plot.

The SAGRIWASENT project's primary objective is to use remote sensing to continuously monitor agriculture in Wallonia, using the data to help local farmers complete their surface area declarations and to assist the region's government in apportioning CAP subsidies.

The research is being carried out in tandem with the Earth and Life Institute (Environmental Sciences, UCL).

The SAGRIWASENT project is a joint venture with the Walloon government's Agriculture Directorate, and is funded by the SPW/DGO3 (agreement no. D31-1368).

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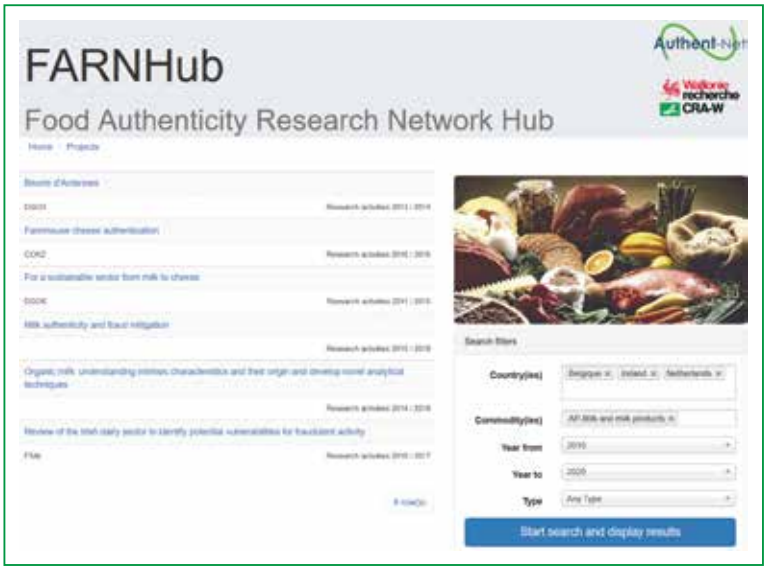
EVERYTHING YOU WANTED TO KNOW ABOUT FOOD AUTHENTICITY

THE FARNHUB PLATFORM PROVIDES COMPREHENSIVE FOOD AUTHENTICITY INFORMATION AND A RANGE OF TOOLS TO HELP COMBAT FOOD FRAUD, MAKING IT A VITAL RESOURCE FOR EVERYONE INVOLVED IN FOOD AUTHENTICATION – RESEARCHERS, ANALYSTS, INSPECTORS, LEGAL EXPERTS, PROJECT MANAGERS AND NEWS PUBLISHERS ALIKE.



The Food Authenticity Research Network Hub (FARNHub) is an online portal that provides an overview of the latest country- and sector-specific food authenticity resources.

Food authentication involves checking that food is authentic – in other words, that its actual characteristics match its description. The portal features scientific articles, reports, projects, online databases, news items, details of research and development funding organisations, and food authentication laws and regulations. The application was developed by the CRA-W in conjunction with the Norwegian Institute of Food, Fisheries and Aquaculture Research (NOFIMA) and a network of partners under the European Authent-Net project. FARNHub is available at the following address: http://farnhub.authent.cra.wallonie.be/. Because the hub is open-access by design, its content is available to all potential users, from manufacturers and inspection bodies, to research institutes, funding organisations and decision-making centres. Users can get information about funded research projects, ongoing initiatives, existing structures, applicable laws and regulations, and food authentication and fraud detection priorities per country or per product category.

There is also a map (http://www.authent-net.eu/AN_FARNH_click_map.html) that provides statistics about the number of publications, projects and news items, with links to national or sector-specific expert panel reports stored in the FARNHub database.

Users can suggest updates or additions by writing to farnhub@cra.wallonie.be. A network of national Authent-Net project representatives has been set up to approve new entries and update the database.

Coordination and Support Actions (CSA) project no. 696371, funded by the EU H2020 Programme and coordinated by the Food and Environment Research Agency (FERA, UK). For more information, go to http://www.authentnet.eu

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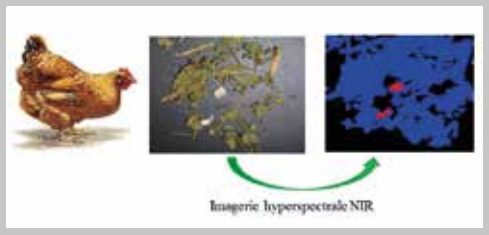
HYPERSPECTRAL IMAGING IN POULTRY FARMING

POULTRY TRIALS INVOLVE MANUALLY SIFTING THROUGH COUNTLESS SAMPLES. BUT WHAT IF THIS CUMBERSOME OPERATION COULD BE AUTOMATED USING HYPERSPECTRAL IMAGING?



Measuring how much feed livestock ingest is a vital part of animal husbandry. The measurements are used to calculate the feed conversion ratio. However, because poultry have unique feeding habits – scratching and digging in the ground in search of feed – they are particularly difficult to study. Even when kept in cages with adequate feeding troughs, they generate feed waste, which mixes together with sawdust, droppings and other debris. As such, it is only possible to measure their feed intake accurately by identifying feed waste and separating it from other particles.

One way to do this is to sift through the samples by hand. Yet this is a laborious and time-consuming operation. Fortunately, near-infrared (NIR) hyperspectral imaging technologies mean that this process can now be automated. The samples are carefully laid out on a tray then analysed using an NIR hyperspectral imaging camera. The resulting images contain pixels, each of which corresponds to a full infrared spectrum. The spectra are then processed using chemometrics tools (via linear regression) to determine which pixels are feed waste and which are not, so that the total amount of feed waste in the sample can be measured. As well as being a real time-saver, this method also produces more reliable results than manual sorting. It could also be applied to other sample types, where one or more fractions need to be quantified.

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WHAT IS THE BEST NITROGEN FERTILISATION MANAGEMENT TOOL?

IN SUSTAINABLE AND PRECISION AGRICULTURE, CURRENT NITROGEN FERTILISATION STRATEGIES COMBINE SPLITTING THE RECOMMENDED NITROGEN RATE AND THE ASSESSMENT DURING GROWTH OF THE POTATO CROP NITROGEN STATUS BY THE USE OF OPTICAL TOOLS. IN THIS CONTEXT, WHAT ABOUT THE USE OF CHLOROPHYLL FLUORESCENCE BASED TOOLS FOR THE MANAGEMENT OF CROP NITROGEN FERTILISATION?

The main objective of the POTFLUO project (2012-2018) was to explore the potential of using chlorophyll fluorescence tools to assess the nitrogen content of potato crops. Its secondary objective was to determine fluorescence indicator thresholds to help farmers in the decisionwhether in season additional nitrogen supply is required.

The potential of chlorophyll fluorescence was assessed over a three-year period for two potato varieties, Bintje and Charlotte, using increasing nitrogen rates. Optical measurements were recorded at different sampling dates using the Dualex and Multiplex fluorimeters, the Cropscan radiometer, and the Hydro-N Tester chlorophyll meter.

The comparison of the in-season plant readings shows that the indicators based on the estimation of leaf flavonoids content, measured by fluorescence, and whether or not combined with leaf chlorophyll contentare more promising for evaluating the crop nitrogen status than indicators measured by transmittance and reflectance. In particular, measuring the leaf flavonoids content enables sensitive nitrogen response, an early detection of nitrogen deficiency and good accuracy of the readings.

Due to the influence of external factors on optical readings, the use of relative values (using a nitrogen-deficient reference plot, or an over-fertilised reference plot) instead of working with absolute values improved the specificity of optical readings to nitrogen status.

A comparison of the irrigation methods (irrigated and non-irrigated) and nitrogen fertilisation methods tested over a two-year period shows that flavonoid content (measured using chlorophyll fluorescence) is not sensitive to water availability, unlike chlorophyll measurements.

By determining the nitrogen nutrition index (based on the nitrogen dilution curve under our conditions) considered as the analytical reference index for the assessment of crop nitrogen status (), we were able to derive the threshold values for chlorophyll fluorescence measurements.

These threshold values are currently under agronomic and environmental validation. One potential application of the project would be to incorporate these values into an easy-to-use decision support system that farmers could use to manage potato crop nitrogen fertilisation.

Research project funded by an SPW/DGO3 grant

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Caption: Hand-held chlorophyll fluorescence sensors (Dualex and Multiplex)

THE CRA-W IS PUBLISHING ITS FIRST "KNOWLEDGE BASE" BOOKLET

Covering research outcomes from studies conducted in Belgium and elsewhere. This excerpt, from the largest chapter of the knowledge base, provides a snapshot of progress to date on research into organic pig feed, which accounts for 60-70% of total product costs for organic pig farmers. Managing feed properly is therefore vital for a farm's long-term survival, since it affects profitability, animal health, well-being and reproductive capacity, and the environment.

To request a hard-copy version of the booklet, please write to **celluleagribio@cra.wallonie.be**.
An electronic copy can be downloaded from **www.cra.wallonie.be**