CRA-WINFO
N°55 | Winter 2017-2018
Wallonie recherche CRA-W

IMPROVING THE NUTRITIONAL QUALITY OF MILK WHILE REDUCING ITS ENVIRONMENTAL FOOTPRINT

CRA-W AND UCL HAVE DEVELOPED A DIETARY CONCEPT THAT HELPS TO IMPROVE THE QUALITY OF MILK (FATTY ACIDS, VITAMINS AND POLYPHENOLS) WHILE LIMITING METHANE EMISSIONS AND NITROGEN DISCHARGES FROM COWS.

All too often, consumers are fed a negative image of dairy farming. Despite its wealth of nutrients, the consumption of cow's milk is regularly called into question from a health point of view, especially with regard to the saturated fatty acid content in milk, which has a negative impact on cholesterol levels in humans, among other things. Furthermore, farming - and cows indirectly - is often accused of being responsible for global warming, mainly through emissions of methane into the atmosphere and nitrogen discharges.

A trial was conducted during the winter of 2017 in order to compare a conventional ration with an optimised ration. The latter was formulated in order to satisfy the animals' protein needs in a very precise manner, considering their level of production. It was optimised in terms of its energy-yielding nutrients (cereals and oilseeds), its fat component (linseeds) and its sustainability (locally-produced raw materials, legume-rich silage).

For a similar level of production, the milk produced with the optimised ration had a much higher nutritional composition. It contained more polyunsaturated fatty acids (+62 %) with a ω6:ω3 ratio close to 1.0 (low cardiovascular risk). Moreover, it contained more vitamin B12 (+47 %). A lack of this vitamin can cause neurological problems in elderly persons. Finally, it was rich in equol, a specific polyphenol with a high antioxidant potential that may prevent hormone-dependent cancers. At the same time, this optimised ration helped to reduce methane emissions from animals by 12 %, and nitrogen discharges by 29 % compared with the conventional ration. In total, the carbon footprint per litre of milk is reduced by 25 % with the optimised ration. Therefore, as far as the dairy industry is concerned, environmental progress isn't hostile to advances associated with good quality products!

For more information: http://www.cra.wallonie.be/fr/les-projets/grassmilk

Contact: Adeline Lefevre, a.lefevre@cra.wallonie.be

Sign up for this quarterly free on our website www.cra.wallonie.be
Walloon Agricultural Research Center | Building Léon Lacroix | rue de Liroux, 9 | B-5030 Gembloux
Tél: +32 (0)81 62 65 55 | Fax +32 (0)81 62 65 59 | www.cra.wallonie.be

DEVELOPING A DECISION SUPPORT TOOL TO PREVENT WATER BEING POLLUTED BY PLANT PROTECTION PRODUCTS

IT WILL SOON BE POSSIBLE TO DEFINE AREAS AT RISK OF TRANSFER OF PLANT PROTECTION PRODUCTS (PPP) VIA RUNOFF WATERS AND PERCOLATION USING SIMPLIFIED INDICATORS, THUS AVOIDING THE POLLUTION OF RIVERS AND STREAMS AND WATER TABLES.

It is necessary to take the environmental context into account during plant protection treatments in agricultural areas to maintain the quality of the water.

These indicators will help to develop a decision support tool (DST) which, depending on the environmental context of an agricultural parcel, will help users to choose which product to apply, the application date and even take weather conditions into account. This will help to prevent the pollution of surface water or groundwater, which can cause major disruptions in aquatic ecosystems as well as making water unusable in terms of consumption.

To be able to develop such a DST, the first stage consists of simplifying complex PPP transfer models. A great deal of expertise is required to use this type of model and there is also a large amount of input data, which is often unavailable on a regional level. Furthermore, models such as these are dependent on a large amount of computer resources. As for the indicators, they are easier to implement and faster to execute. It is possible to generate qualitative information that can be used as a DST by farming advisers or the farmers themselves.

A connectivity index was therefore developed for surface water and compared with a more complex model (SWAT). The results show that thanks to the connectivity index, it is possible to reliably assess areas at risk of PPP transfer at the level of agricultural watersheds. At the same time, the modified DRASTIC indicator used to discriminate between parcels the most at risk in terms of the underground transfer of PPP in catchment areas, shows similar results to more complex specialised models (GeoPEARL, MetaPEARL).

These indicators were integrated into a DST prototype that allows you to compare different PPP usage scenarios and to guide the user towards the strategy that is most favourable to maintaining the quality of the water resources. Before it is implemented in Wallonia in three years time, future developments of the DST will consist of maximising the validation of the indicators, integrating a greater number of PPP usage scenarios and facilitating the use of the DST to make it more accessible to the largest number of people.

Contact: Alexandre Maugnard, a.maugnard@cra.wallonie.be

JEAN-LOUIS ROLOT RECEIVES THE CHINESE GOVERNMENT'S FRIENDSHIP AWARD

SINCE 1991, THIS FRIENDSHIP AWARD HAS BEEN AWARDED TO A SELECTION OF INTERNATIONAL EXPERTS EVERY YEAR, TO THANK THEM FOR SERVICES RENDERED TO CHINA FOR ITS MODERNISATION AND THE PROMOTION OF ITS ECONOMIC AND SCIENTIFIC ACTIVITY.

Jean-Louis Rolot's application was submitted to the governmental authorities by his colleagues at the Heilongjiang Academy of Agricultural Sciences who are working for the potato crop development in the Province of Heilongjiang situated in the North East of China.

Fifty international experts from 21 different countries active in areas as diverse as medicine, aeronautics, international trade, agriculture, metallurgy, the automotive industry, process automation, environmental protection, solar panels, water resources, history of art, etc., were invited by the Chinese government to Beijing on 29 and 30 September 2017 for the award ceremony.

Jean-Louis Rolot also went to Harbin (Heilongjiang province) to receive the title of Honorary Professor of the Academy from the President of the Academy of Agricultural Sciences.

These rewards are the fruit of 12 years of collaboration and visits to various provinces in China (Chonqing, Anhui, Ninxia, Heilongjiang), all focused on the development of potato cultivation.

Contact: Jean-Louis Rolot, j.rolot@cra.wallonie.be

CONTROLLING THE QUALITY OF CEREAL SEED TREATMENT

THE TREATMENT OF SEEDS WITH PLANT PROTECTION PRODUCTS IS STRONGLY ADVISED TO FIGHT DIFFERENT PLANT DISEASES AND PESTS IN EARLY STAGES OF PLANT GROWTH. BUT WHICH ANALYTICAL METHODS ARE USED TO CONTROL THE DOSE AND HOMOGENEITY OF THE TREATMENT ON A SEED LOT?

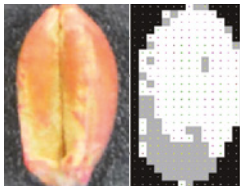
New seed treatment products are effective at very low doses. Good treatment requires application of the active ingredient at the correct dose according to the species, the variety and the health status of the lots. Too low a dose may lead to insufficient protection of the plant while too high a dose could increase the risk of phytotoxicity. Furthermore, the active ingredient must be evenly distributed between the seeds in a lot but also on the surface of the seeds, including the groove.

The reference methods used to control the quality of seed treatment are chromatographic methods, such as high performance liquid chromatography (HPLC, UHPLC) and gas chromatography (GC). However, these methods are long, costly, destructive and difficult to apply in routine controls. Near-infrared spectroscopy (NIRS) is an alternative analytical technique that doesn't present any inconveniences and can be used to identify the active ingredients and their average dosage on a seed lot or individual seeds with adapted sample presentation devices. Near-infrared hyperspectral imaging is a technique that has the advantage of combining spectral information with spatial information. This technique allows you to analyse several seeds simultaneously while assessing the dose and homogeneity of the treatment on each seed. However, it must be validated by reference methods. A study carried out by Pauline Flémal (UCL) within the framework of her thesis, revealed the potential of this technology combined with chemiometrics to control the quality of seed treatment.

The results of the analysis of treated seeds on an average dosage by UHPLC and NIRS showed a high level of variability between lots treated with the same formulation, from different seed producers. Regarding barley, the active ingredient content in 85 % of samples was less than 70 % of the target dose.

Thanks to near-infrared hyperspectral imaging, it was also possible to detect the potential presence of seeds from another species/variety in a seed lot, untreated seeds or seeds treated with a different formulation. It was also possible to assess the homogeneity of the treatment on each seed individually and to classify them according to the target dose. For some lots, the active ingredient content in more than 75 % of the seeds was higher than the acceptable 30 % around the target dose.

This technology opens up new opportunities in terms of seed quality control. This study was the subject of an article in the Journal of Spectral Imaging (doi: 10.1255/jsi.2017.a1).



Visible image and predictive hyperspectral image of a wheat seed showing the treated area in white and the non-treated area in grey.

Contacts: Philippe Vermeulen, p.vermeulen@cra.wallonie.be and Patricia De Vos, p.devos@cra.wallonie.be

BELCAM: COLLABORATIVE WEB PLATFORM COMBINING 'FARMSOURCING' AND REMOTE SENSING

CURRENT INNOVATIONS IN SPACE-BASED REMOTE SENSING ARE AT THE BASIS OF A FLURRY OF NEW PLATFORMS AIMED AT MONITORING AGRICULTURAL PARCELS IN ORDER TO ADVISE FARMERS ON CULTIVATION PRACTICES. CRA-W IS CONTRIBUTING TO THIS THROUGH THE BELCAM PROJECT.

As part of the advent of a new generation of satellites benefiting from increased spatial and temporal resolutions, the European 'Sentinel' satellites enable regular observations of agricultural parcels across a whole area. Surfing on the wave of these technological innovations, the BELCAM (BELgian Collaborative Agriculture Monitoring system for sustainable cropping systems) project started end 2014 and focuses on three major crops in Belgium: winter wheat, potatoes and corn.

One of the original aspects of the project is its collaborative approach based on the grouping of several scientific partners (UCL, CRA-W, ULg, VITO and INRA) and the collection of data from Walloon pilot centres, Flemish technical centres and, above all, Belgian farmers (**'farmsourcing'**).

At the very heart of the system, the BELCAM web platform helps to facilitate the collection of this data from agricultural parcels, and to supply users with a set of constantly evolving products and services in a simple and explicit way, and in real time.

A pioneering group of farmers has had access to it since 2016. They can already visualise the satellite images (Sentinel 2), see the evolution of the biomass in their parcels and compare it to the average situation of parcels in the region, obtain local weather data or even access the early stages of a nitrogen fertilization recommendation module integrating existing tools and satellite information. Much more information will be integrated in the platform later on, such as yield estimations and intra-parcel heterogeneity.

BELCAM is a project financed by the Belgian Federal Science Policy (BELSPO) within the framework of the STEREO III programme.

More info: www.cra.wallonie.be/fr/les-projets/belcam

Contact: Dimitri Goffart, d.goffart@cra.wallonie.be

THREE ORCHARD/ARABLE PILOT PROJECTS MONITORED BY CRA-W

FOR MORE THAN FIVE YEARS, CRA-W HAS BEEN PARTICIPATING IN THE DESIGN AND SCIENTIFIC MONITORING OF SEVERAL ORGANIC ORCHARD/ARABLE AGROFORESTRY SYSTEMS IN WALLONIA.

These projects are based on recent scientific studies showing that it will only be possible to significantly reduce inputs if new farming systems are designed. It is necessary to look for new agroecosystems in order to increase resilience, favour natural regulation processes and obtain products of a healthier quality that meet economic requirements.

The three examples of pilot projects presented below will enable the orchard/arable concept to be tested in different environments:

'Ferme du Maustitchi' project in Leernes (Fontaine-l'Evêque): fruit trees were planted in spring 2017 in an arable parcel of several hectares. The project was designed and set up according to a participatory research approach involving the producer, CRA-W and the 'Verger plus Durable' group led by INRA in Avignon (Ecodevelopment Unit). This project concerns some 15 varieties of apple, pear, plum and cherry grafted onto semi-vigorous rootstocks in double rows 5 m apart ('MM 111', 'Pyrodwarf' and 'Saint-Julien A').

The 'Jardins de Dounia' project in Corroy-le-Grand: this orchard/arable project was set up in 2014 and extends over approximately 5000 m². It mainly contains old apple varieties that are disease tolerant and don't require any fungicides (0 plant protection). Depending on their particular robustness, they are either grafted onto a semi-vigorous rootstock ('MM 106') or onto a more dwarfing rootstock ('M9'). The system was designed in partnership with the producer. It consists of single row fruit trees 20 m apart that are closely associated with vegetable cultivation (asparagus and leeks in 2017). The producer set up a CSA (community-supported agriculture) model and wanted to complete their vegetable production with a range of original fruits while creating a more diversified production space.

CRA-W project in Gembloux: the experimental parcel was established in 2014 in an area of approximately 1 ha. The project's initial goal was to create an extensive and more resilient 'orchard' agroecosystem that didn't require any plant protection treatment. The aim is to create an orchard whose soil is constantly cultivated. The orchard is organised into three double row fruit trees 5.5 m apart with 3 m between the trees in the row. The spaces between these double row fruit trees is 16 m to allow vegetables to be mechanically

cultivated. Planting density is therefore 250 trees/ha. This agroforestry orchard is organically farmed and serves as a basis for experimentation and demonstration. Besides the fundamental objective of associating arable farming with fruit trees, it also aims to compare three types of semi-vigorous rootstocks ('MM 106', 'M 7' and 'M 25') and to experiment with a dozen or so varieties of disease-tolerant apple trees. Every year, the cultivation of vegetables are the subject of variety trials in partnership with the Centre Technique Horticole de Gembloux. This year, 10 varieties of green cabbage and Brussels sprout have been tested in the parcel in combination with different types of mulching.

Contact: Laurent Jamar, l.jamar@cra.wallonie.be

CRA-W IS EQUIPPING WALLONIA WITH 16,000 VIRTUAL WEATHER STATIONS

WITHIN THE FRAMEWORK OF AGROMET, CRA-W IS CURRENTLY SETTING UP A NETWORK OF 16,000 VIRTUAL WEATHER STATIONS TO PROVIDE PARCELS WITH AGRICULTURAL WARNINGS. THE PRODUCTION LAUNCH IS PLANNED FOR 2020.

The Pameseb network has been providing meteorological data for many years to issue agricultural warnings (potato late blightand septoria disease in wheat). Thanks to this data, it is possible to elaborate regional warnings but recommendations per parcel can't be established, since it isn't possible to take into consideration local weather conditions. However, a warning per parcel would allow farmers to better target treatments, thereby optimising crop protection while reducing the quantity of plant protection products used.
Within the framework of the development of integrated pest management in Wallonia, CRA-W decided to support the AGROMET project. The goal of this three-year project (April 2017 - March 2020), conducted in collaboration with RMI, is to set up a network of virtual weather stations aimed at supplying real-time agricultural monitoring epidemiological models anywhere in Wallonia.

This network is based on the spatial interpolation of observations from real weather stations. The hourly data will be spatialised by geostatic analysis on a one square kilometre mesh grid that will cover the whole of Wallonia, representing a network of 16,000 virtual weather stations.

In the beginning, the spatialised parameters will be the air temperature, air humidity and leaf wetness. Because rain makes interpolation difficult, as it can sometimes be heavy and very localised, the platform will be supplied with spatialised hourly data for this parameter, provided by RMI on the basis of radar images and ground observations. Hourly weather forecasts, which are also essential to establishing agricultural warnings, will also be available.

So, see you in 2020, with a platform ready to supply future warning systems per parcel and many other tools as well, aimed at sustainable farming that benefits the farmer, the consumer and the environment!

For more info: http://www.cra.wallonie.be/fr/les-projets/agromet

Contact: Damien Rosillon, d.rosillon@cra.wallonie.be