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NEW FEEDING STRATEGIES FOR SUPER-EFFICIENT DAIRY COWS...

High nutritional quality milk can be compatible with a sustainable production method that gives the farmer a decent income and also manages environmental constraints.

Ruminants have the advantage of converting cellulose and food processing industry by-products into valuable products and are thus not serious competitors for human food.

However, they also have the well-known drawback of being inefficient processors. For every 100 g of protein consumed by a dairy cow, no more than 25 to 28 g make their way into the milk. This is a much lower yield compared with other types of livestock, or in relation to the efficiency of nitrogen fertilizer applied to pasture in good conditions. Ruminants are therefore a weak link in the production system. And, unfortunately, that's not all, as ruminant farming is also criticised for the greenhouse gas emissions it produces, methane in particular. So how can the environmental impact of dairy farming be lessened while at the same time producing higher quality milk?

This is the issue addressed by CRA-W and UCL (Professor Y. Larondelle, Professor M. Focant) in the context of a cooperative project with three private-sector companies, subsidised by the Regional Government of Wallonia. The first avenue explored is that of specifically formulated feed that provides exactly what the animal really needs. The use of minor natural ingredients thought to optimise the digestive process or to interact favourably with the digestive microflora is a second line of research. Three rations were therefore tested in a trial aimed at optimising the feed efficiency of dairy cows in full production (30 l/day). Limiting the ration protein content to 13% (as against 16 to 18% in practice) has already increased the cows' nitrogen efficiency by more than 25% in relation to on-farm observations, and the 35% threshold has been reached. The addition to the ration of two specific plant ingredients duly selected following a battery of in vitro tests has raised the nitrogen efficiency to over 37%. That makes the dairy cow just as efficient as a pig in terms of protein. And those are not the only improvements. It was found that replacing the beet pulp in the control ration with cereals and extruded linseed (with the aim of increasing the health value of the milk via fatty acids) cut the methane emissions by 16% per litre of milk produced, for the same nutritional contribution. These results suggest that there is significant scope for improving ruminants' nitrogen efficiency and energy efficiency and that there are still good prospects for research in this area, with both economic and environmental benefits to be expected.

Contact: Eric Froidmont, e.froidmont@cra.wallonie.be

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Walloon Agricultural Research Center | Building Léon Lacroix, rue de Liroux, 9 - B – 5030 Gembloux
Tel: +32(0) 81/62.65.55 - Fax:+32(0) 81/62.65.59 | cra@cra.wallonie.be | **www.cra.wallonie.be**

REDEVELOPMENT OF WALLONIA'S INDUSTRIAL HEMP INDUSTRY

After several decades of neglect, industrial hemp growing is making a come-back in Wallonia, with a few hectares under cultivation since 2006. CRA-W is playing a part in this resurgence, in close cooperation with the Walloon hemp association (Chanvre wallon).

220 hectares were cultivated in Wallonia in 2013, mainly to supply defibration lines in Flanders and elsewhere. The renewed interest in hemp is due to farmers' desire to diversify and to invest in processing their products, the attractiveness of the crop and its derivatives with regard to sustainable development, and the range of potential outlets for the crop.

Industrial hemp is easy to produce and can be grown anywhere in Belgium on land that is not subject to flooding and has a good soil structure and a pH between 6 and 8. Once the April sowing has emerged, farmers wait until either mid-August before harvesting the unthreshed hemp (straw only) or mid-September to harvest the threshed crop (mature grain and straw).

Hemp growing offers a number of advantages, and CRA-W is providing its expertise in particular through field trials covering all the stages from sowing to harvesting. Advantages include no plant protection product application, a deep root system, rapid growth that can compete with weeds, smooth integration into crop rotation and increased biodiversity. From an environmental point of view this crop is particularly low impact in terms of greenhouse gas production, as it stores a large amount of CO_2 in its biomass and releases very little while growing.

So far, four Walloon companies have definitely invested in hemp production and processing (construction, horticulture, food): Chanvreco SA, PurChanvre SPRL, Belchanvre SC and Isohemp SPRL.

The hemp industry is currently buoyed up, on the one hand, by players won over by a relatively straightforward crop that offers both environmental and agronomic advantages and, on the other, by emerging markets with potential for big sales capacity.

Contact: Donatienne Arlotti, d.arlotti@cra.wallonie.be

DETECTING HEAT IN COWS

To ensure profitability, a cow has to calve once a year. Each missed cycle impacts directly on the farmer's income. Detecting heat in order to carry out insemination is therefore vital.

Mounting is a characteristic sign of animals in heat. Mounting generally happens at night. That makes it difficult for the farmer to pinpoint heat in a cow and thus carry out insemination at the right time.

Various equipments are available for automated surveillance on herd. An innovative prototype has been designed by a Walloon farmer to detect mounting installed cattle within a delimited surveillance area. The method involves scanning the area with a distance sensor (infrared laser beam) and recording several distances as a function of a scanning angle. If mounting takes place within the area, the laser beam is broken and the action is detected.

The prototype is undergoing technology coaching by the Innovatech association in Charleroi, which asked CRA-W to validate the functioning and reliability of the device. One particular requirement was to determine whether the equipment detects all instances of mounting and, conversely, whether each movement detected is in fact an instance of mounting.

Before running the experiment, some preliminary measurements were made to establish a number of parameters necessary toadjustthe equipment. Afterward, a herd of nine Holstein heifers divided between two stalls was used to validate the device. Heat was artificially induced in order to trigger intense mounting within a specific, predictable two-day period. A surveillance camera was set up above the stalls for continuous video recording of the animals and subsequent determination of mounting. The equipment was validated by combining both methods.

The preliminary measurements showed that the prototype was very sensitive to weather conditions, specifically sun and mist, both of them causing many inopportune beam breaks. On the other hand, over the two-day validation the prototype detector picked up 99.4% of the 616 mountings displayed, and 97.6% of the recorded beam breaks were found to correspond to actual instances of mounting. The prototype was therefore established to be reliable over the experimental period. Accordingly technology coaching is ongoing, as a contribution to the development of precision agriculture.

Contact: Vincent Servais, v.servais@cra.wallonie.be

MERINOVA: EXTREME WEATHER EVENTS AS INNOVATION FACTORS

Climate change has become a tangible reality affecting all of the world's population and ecosystems at different levels. These changes are also accompanied by increased occurrence of extreme weather events, such as drought, hail or torrential rain.

The MERINOVA project focuses on such extreme weather events and starts from the principle that these may act as factors for innovation in Belgian agroecosystems. As more than half of Belgium's land area is dedicated to agriculture, extreme weather events can significantly affect the supply of agroecosystem services and sustainable management of agricultural land . The prospect of increased exposure to such risks is heightened by the limiting of aid for agricultural disasters and the overall reduction in direct aid to farmers in the context of agricultural policy reform. Current gaps in our knowledge about the occurrence of extreme weather events and how agroecosystems respond must be addressed, along with their vulnerability, resilience and ability to adapt.

To achieve this aim the project is following four interdependent lines of research. The first of these involves determining the occurrence of extreme weather events (of a given level of intensity) by calculating their return period.

The present and future impact of such extreme weather events on agroecosystems will then be assessed by a modelling approach. That impact will vary from one agroecosystem to another, according to their vulnerability to a particular extreme weather event. In the context of the MERINOVA project, vulnerability will be considered from both an economic and an environmental and social point of view.
The third line of CRA-W research aims to make vulnerability maps for all the agroecosystems studied and, by combining them with the return period maps previously created, to produce risk maps. These maps will enable the most vulnerable areas/risk areas to be identified for each extreme weather event.

Within the risk areas, surveys will be conducted to ascertain farmers' perception of climate change and extreme weather events and to identify which adaptation strategies they have implemented or could implement to cope with such extreme weather events. Experiments will be set up involving farmers in the risk areas who operate in different sectors, and innovative adaptation strategies are expected to emerge.

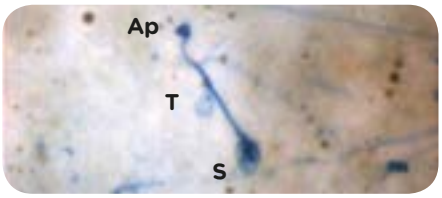
MERINOVA is a four-year project (June 2012-May 2016) within the framework of the seventh call for proposals entitled 'Natural risks to ecosystems and the socio-cultural heritage of Belgium and/or Central Africa' (contract no. SD/RI/03A), funded by the Belgian Science Policy Office (BELSPO) and combining the expertise of four scientific teams (IRM/KMI, VITO, CRA-W and UGent).

Website: www.merinova.vito.be

Contact: Yannick Curnel, y.curnel@cra.wallonie.be

SPOTLIGHT ON POTATO LATE BLIGHT:

Whereas the initial stages of an infection are determined by the quality of the immune response, successful tissue invasion depends on access to the host's nutritional resources..



Key Initial stages of leaf infection by Phytophthora infestans: the sporangium (S) forms a germ tube (T) terminating in an appressorium (Ap), the starting point of tissue invasion.

Understanding how the immune system is activated in plants has made a big contribution to improving pathogen resistance in cultivated species. The various models that have been built are based on the plant's perception of 'non-self'. That perception calls forth a set of defence responses (thickening of the cell wall, production of toxic compounds, cell death, etc.) which are generally sufficient to check the infection.

However, the agricultural value and, in particular, the sustainability of this form of resistance can be vastly undermined by the emergence of new genotypes of the pathogen that are able to by-pass, weaken or even suppress the immune response.

However, resistance / susceptibility to pathogens are more than simply a matter of immune response development. Recent data show that having avoided the pitfalls of immune response, rather than finding itself in a nutritional paradise the pathogen in fact faces a potentially hostile medium which it must adapt to and which it attempts to control.

The proteomic strategy we have adopted in order to characterise potato/late blight interactions has revealed a particular aspect of the interactions between the host and pathogen metabolisms. In a compatible relationship the pathogen induces the chloroplast to use the light energy to break down the reserves in the cells and thus to feed its growth (Bertrand Colignon, doctoral thesis). These results open up promising prospects for controlling late blight development.

Contact: Sergio Mauro, se.mauro@cra.wallonie.be

STRIP-TILL, HALF-WAY BETWEEN PLOUGHING AND NO-TILL

Tilling only where the crop will be sown looks like an attractive compromise for Wallonia's farmers.

Strip-till plot

Tillage is the subject of vast amounts of research, with two permanently opposing 'schools of thought', namely overturning (ploughing) and reduced tillage practices (ranging from decompacting to no-till).

Reduced tillage practices are considered to be more favourable to soil fertility (physical and biological), but can have drawbacks such as frequent lower yields and increased use of total herbicides (glyphosate) to counter weed pressure.

Also, the diversity of the cropping patterns and the high proportion of row crops in the rotations are two characteristics of Walloon agriculture that curb the expansion of reduced tillage practices here.

Against this background, strip-till, a hybrid between reduced tillage and ploughing, appears to offer the best of both worlds and is likely to be acceptable to Wallonia's farmers. With this method the soil is tilled in strips, in other words, the soil is loosened only along the line of the seed drill, leaving the interrow intact and covered by crop residues.

The technique was developed in the United States, where farmers faced serious erosion problems, in maize growing in particular. Having tried no-till and found that the resulting soil compaction was often deleterious to crops, one farmer developed this tillage method.

The first European strip-tillers appeared in 2005, but the technique did not really take off in Europe until 2010. In Wallonia, CRA-W has been conducting research since 2000 into the positioning of beet rows in relation to tine passes through decompacted soil (cf. CRA-W Info No. 5 – Winter 2004). CRA-W's research then naturally extended to strip-till, and exploratory trials with the technique were set up in 2012 and 2013.

The expected benefits of strip-till are reduced tractive effort, fuel savings, lessening of the negative impact of the settling that often occurs with reduced tillage, ease of establishing the crop (good access to the row), water savings, faster soil warming than with reduced tillage, less risk of erosion, wider choice of intercrops (removal of the constraints associated with winter destruction). In addition, there is the possibility of carrying out localised fertilisation and weed control (savings on inputs, and less risk to the environment).

Contacts: Claire Olivier, c.olivier@cra.wallonie.be; Christian Roisin, c.roisin@cra.wallonie.be

AGENDA

17 February · 11 March · 13 June · 6 July

17-21 February 2014
VIBRATIONAL SPECTROSCOPY AND CHEMOMETRICS TRAINING COURSE
CRA-W, Henseval Building, Gembloux
Contact: Juan Antonio Fernandez Pierna, j.fernandez@cra.wallonie.be

19 February 2014
CARREFOUR DES PRODUCTIONS ANIMALES
19th conference, on the topic of beef: from production to consumption
Espace Senghor, Gembloux
Contact: Geneviève Minne, g.minne@cra.wallonie.be

25-27 February 2014
SCIENTIFIC CONFERENCE FOR BIOLOGICAL CONTROL 'PESTICIDE AND BENEFICIAL ORGANISMS'
International Organisation working party
Namur (Arsenal)
Contact: Jean-Pierre Jansen, j.jansen@cra.wallonie.be
For more information: www.iobc-wprs.org/events

11-14 March 2014
TRAINING COURSE ON CONTAMINANTS IN FEED AND FOOD
CRA-W, Henseval Building, Gembloux
Contact: Pascal Veys, p.veys@cra.wallonie.be

13 & 14 June 2013
AGRONOMIQUEMENT VÔTRE: A RESEARCH FOR ALL
Liroux, Gembloux
Contact: communication@cra.wallonie.be

17-26 June 2014
CIPAC/FAO/WHO ANNUAL CONFERENCE
Liège
For more information: www.cipac.org/datepla.htm
Contact: Olivier Pigeon, o.pigeon@cra.wallonie.be

6-11 July 2014
EAPR TRIENNIAL CONFERENCE
19th Triennial Conference of the European Association for Potato Research (EAPR).
Bruxelles
For more information: www.eapr2014.be
Contact: Jean-Pierre Goffart, j.goffart@cra.wallonie.be

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