CRA-W NEWS

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No-till sowing techniques: precision serving the environment

Erosion control is attracting increasing attention in this part of the world. Reduced tillage practices are frequently mentioned in this context as one of the solutions to be adopted.However, most of the experiments carried out in this area by CRA-W have shown that, in the absence of ploughing, the topsoil has to be loosened if certain crops are to be sufficiently productive. This applies to row crops, such as beet and maize, which are indeed generally known to be erosive. For the technique to be effective, the soil should be decompacted with the aid of tools with spike teeth that can reach down at least to ploughing depth. This requires high tractive efforts and is therefore confined to the biggest farms with sufficiently powerful tractors.This observation led to a series of experiments aimed at investigating the feasibility of a planting method based on localised tillage concentrated in the area of the drills. The method involves loosening the soil with a tool that has teeth with very short blades, to reduce the tractive effort, followed by sowing in the teeth tracks in order to site the plants in the places with the most favourable structural conditions. This tillage and precision drilling technique requires the use of an automatic control device, but allows a conventional seed drill to be used rather than a specific machine with opening disks. Overall, the technique is expected to be financially more attractive and therefore accessible to more farmers. Also, as the soil is not disturbed between the rows, the soil has greater erosion resistance, the soil bearing capacity in the interrows is enhanced and there is less rutting at harvest, thus facilitating continuing reduced tillage practices for the next crop.Very encouraging initial results with beet suggest that this technique deserves to be developed for wider use.

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Co-composting: towards a code of good practice ...

Co-composting, now an essential organic by-product processing technique, involves mixing different materials in appropriate proportions to achieve the ideal conditions for aerobic fermentation: around 60% humidity, sufficient structure to guarantee over 5% oxygen in the mixture pores and a C/N ratio of 30-35. The method can be applied to materials such as food processing or sewage sludge, liquid manure, fruit and vegetable waste, stercoraceous matter, etc., mixed with structuring ingredients such as plant residues.While the rules for combining materials for an efficient process and the rules for use of the composts produced are being constantly refined (First-Entreprise project, Farming Systems Section/scrl Agricompost), many questions remain to be answered as regards environmental impact. This is the case in particular with greenhouse gases (CO_2, CH_4 and N_2O) and acidifying gases (NH_3) released during fermentation. There is a dearth of relevant literature.The international agreements (Kyoto) to which Belgium has signed up set targets for cutting emissions of these gases. It is thus vital to have accurate data on the basis of which to assess the part played by the various processes used in organic waste treatment.Against this background CRA-W, together with scrl Agricompost and the Department of Natural Resources and the Environment (DGRNE), has launched a research project aimed at developing a method for measuring greenhouse gas and acidifying gas emissions from co-composting materials. The method uses the static chamber technique for measurement of the accumulated gas. This system is already widely used to measure gas flows in connection with soils. The gas is measured directly by photoacoustic technology.Initial results for a materials balance show a 53% loss of mass from processing of a mixture of plant residues/wool/food processing by-products. As the trial is under cover, all of the losses occur in gaseous form: 76% water vapour, 15% CO_2 and CH_4 and 1% nitrogen. Application of the static chamber method will enable the emission kinetics to be determined according to the by-products processed, as well as providing details of the proportions of the different gaseous emissions. Besides this "greenhouse gas production" aspect, another aim of the project is to investigate the self-purification effect of the co-composting process with respect to organic micropollutants and pathogenic microorganisms. A wide range of materials will be studied, including stock farming effluent. Lastly, the third part of the project will plot the bioavailability of metal trace elements in the course of treatment. Ultimately, the study results should lead to the drafting of a "code of good co-composting practice", in order to optimise product quality while lessening the environmental pressure of the process.

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Caption: A mixture of materials entering the co-composter

COMPARATIVE STUDY OF TOOLS AVAILABLE FOR SPRAY FAN NOZZLE PERFORMANCE ASSESSMENT

The nozzle is a key component of plant protection product (PPP) application by spraying. Its performance determines the success and effectiveness of treatment.

A number of tools are available for assessing spray nozzle performance: spray output, spray pattern and droplet size distribution. These quality parameters will vary according to nozzle wear and ought therefore to be good performance indicators.

The relevance of these parameters, their correlation/interaction and comparison are all hitherto unexplored areas.

The aim of the project is to study and compare the three main quality parameters with respect to spray nozzles. These parameters are regularly measured during forced nozzle use in order to observe changes.

Research is currently confined to fan nozzles, as these are the commonest type (used by over 90% of operators). Within the fan nozzle family, however, different models (conventional, law drift and air injection) and component materials (ceramic, plastic and stainless steel) are studied.

The three main nozzle quality parameters are measured at the laboratory. The following data and ranges are obtained:

Spray output

Nozzle spray output is measured individually under controlled conditions (pressure), using an electronic test bench. The main variable considered is the difference between the measured output and the nominal output (output from a new nozzle at the same pressure). The greater the nozzle wear, the greater the difference.

Spray pattern

Spray pattern is measured under controlled conditions (pressure, boom height, air temperature and humidity) using an electronic spray patternator. The spray pattern is measured either individually or for a set of nozzles spraying at the same time. The main variable considered is the coefficient of variation (CV) of the sprayed volumes.

Droplet size

Droplet size distribution is measured from a deposit under controlled conditions (pressure, boom height, speed of travel, volume/hectare, air temperature and humidity). A measuring chain based on digital image processing allows a series of variables to be determined: representative distribution diameters (NMD, SMD, ND10,…), coverage ratio, number of impacts...

So far, the comparative studies have shown no systematic correlation in quality parameter changes as a function of nozzle wear. The relationship seems more complex. Some parameters or variables are more reliable indicators of the "nozzle wear rate". Lastly, the wear dynamics observed at the laboratory do not correspond to the actual situation (in the field). In time, the project is expected to lead to identification of the most relevant parameters for spray nozzle quality assessment, as well as improving method quality and treatment effectiveness.

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PRECISION NITROGEN FEEDING FOR THE DOUBLE-MUSCLED BELGIAN BLUE BULL

The double-muscled Belgian Blue bull is one of the jewels of Walloon stock breeding, with a reputation extending well beyond our borders. While often chosen for its big growth potential and high proportion of carcass muscle, its particular features also mean it has specific nutritional requirements, notably in terms of proteins and digestible amino acids (AAs), that are not always liable to be satisfied by conventional rations based on forage as the main raw material. The lack of one single essential AA is sufficient to inhibit protein accretion and thus prevent the animal's genetic potential from being fully exploited. Moreover, such a lack prevents greater utilisation of the non-limiting AAs, which are catabolised and thus help to increase urinary nitrogen excretion. Precision nitrogen feeding, providing the correct proportions of the AAs which the animal needs, ought therefore to have two major effects: increased growth performance and a smaller pollution burden from the animal. CRA-W studied the AAs provided by a conventional, maize silage based ration and discovered a significant lack of histidine, methionine and lysine for growing animals (300 kg). We went on to formulate an additive enriched with these AAs, which was fed to the animals throughout the growing and fattening phase. The special feature of our research was that the AAs were provided in free form, that is to say, not protected from ruminal fermentation. It in fact appears that a considerable part of the AAs, as much as 45%, is likely to leave the rumen intact in the Belgian Blue. This casts doubt on the profitability of the AA protective coating, contrary to what is sometimes said in the case of the high-production dairy cow. The additive also contained an appetizer to promote rapid ingestion, thus maximising the quantity of digestible AAs in the small intestine. Results indicate that the additive thus formulated has the effect of increasing the mean daily weight gain by 300 g/d and the utilisation of ingested N by 12% during the growth phase, with no effect at the finishing stage. Unfortunately, the cost price of the histidine-rich additive was too high to be economically profitable. All the same, our research shows the importance, in breeding and ecological terms, of a balanced ration for the Belgian Blue bull based on digestible AAs. In future, protein sources offering a complementary or better AA profile than conventional protein sources ought to play a more prominent role in this sector. Further research is called for here into the quality of potato protein concentrate to replace the main limiting AAs.

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GUIDANCE: AN ESSENTIAL COMPONENT OF FAIR PAYMENT FOR MILK

Milk producers in Belgium are paid according to an official system based on compliance with various criteria applied to milk composition (fat content and total nitrogen fraction) and milk quality (total germ count, somatic cells, milk freezing point, tracing of antibiotics and oxidants and visible cleanliness of the milk). Payment is governed by the terms of a Royal Decree which also covers the supervision of Interprofessional Organisations (IOs) which have overall responsibility for analysis. Provision has also been made in the legislation for scientific support for the IOs, commonly referred to as Guidance. The main aim of this is to ensure that milk analyses are fair and equitable throughout Belgium. In view of its extensive experience in the dairy sector, the CRA-W has been appointed in partnership with CLO to organise Guidance. The activities involved are:

Organizing comparative analyses

For each of the parameters listed above the IOs are sent a monthly set of samples which they analyse, using routine methods. At the same time, the reference laboratories carry out reference analyses, if necessary. The IOs' results are assessed according to the application standards described in a common protocol. In case of excessive differences, the IO concerned has to adjust its measurements.

Calibration of infrared spectrometers for determination of fat content and total nitrogen fraction

Calibration is carried out six times a year using combined samples with increasing fat and total nitrogen content, formed from milk representing the total Belgian milk supply. The samples are prepared according to an international standard by combining cream, skimmed milk, dialysis residue and permeate. The reference values for fat content and total nitrogen fraction are determined by specialist laboratories. Equivalent calibration of all the spectrometers in Belgium is thus ensured.

Weekly Belgian standard

In order to maintain infrared spectrometer calibration, a common standard for the two regions of the country is formed each week. This is made up from milk representing the total Belgian milk supply. Four specialist laboratories determine the reference values for fat content and total nitrogen content.

And that's not all…

Guidance staff also do other work. For instance, they organise comparative analyses for total coliforms, they supply standards for use in antibiotic detection tests, they arrange training sessions for IOs or dairy personnel, they approve new methods, they are asked for expert opinions, and so forth.

To sum up, Guidance is a system that enables a precise level of quality to be maintained as regards analyses for milk payment purposes in Belgium and, consequently, fair payment for everyone concerned.

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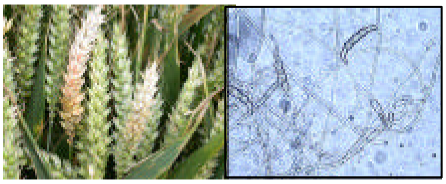
GENETIC CONTROL OF WHEAT FUSARIUM HEAD BLIGHT

Fusarium head blight is currently a food safety problem for agriculture in the Walloon Region, Belgium and Europe. Damage by the various types of Fusarium has been increasing markedly some years. Mycotoxins (trichothecenes: deoxynivalenol (DON), nivalenol (NIV), etc.) can cause serious illness in humans. Various methods are available for controlling Fusarium head blight; genetic resistance is one of the most effective and economical. However, the sources of resistance known to date occurred in germplasms unsuited to our latitudes. The creation and recent marketing of resistant Walloon varieties (Centenaire and Fourmi) have opened the way to their widespread use in plant breeding, thanks to selection assisted by molecular markers. The aim of our project is to locate loci (chromosome sites) involved in adult resistance to Fusarium head blight in wheat. Firstly, we want to demonstrate the existence of links between molecular markers (microsatellites, EST, AFLP) and quantitative loci (QTL) involved in Fusarium head blight resistance. Secondly, we will study and also position candidate genes (ABC carriers …) involved in the various plant defence mechanisms in order to understand the genetic determinism of the quantitative aspects concerned. Identification of the molecular markers associated with these genes will make it possible to follow their introgression when breeding new varieties, thus shortening breeding schemes for preventive control of wheat Fusarium head blight. This work is being carried out jointly with M. Ducourouble (V. Jorion and Son), Dekeyser A. and the Mycotoxin Unit at CRA-W.



Fusarium graminearum

Financing: DGA

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QUALITY AT CRA-W: EVERYONE INVOLVED, EVERYONE BENEFITS…

The QA Office is now five years old and a lot of ground has been covered.

The Agricultural Engineering Department D5 has just been ISO 17025 accredited (Beltest 325-T certificate for solid biofuel analyses, sprayer testing and physical analysis of fertilizers, October 2004). This follows on from the accreditation of the Pesticide Research Department D4 (250-T certificate for pesticide residues, April 2002), which had previously been GLP accredited (research into plant care product formulations and residues) since 1994 (C04 certificate).

The Quality of Agricultural Products Department D7 and the Farming Systems Section D9 are about to apply for accreditation (scheduled for early 2005) and are due shortly to be followed by the Biological Control and Plant Genetic Resources Department D3 (already GLP accredited for ecotoxicological studies since 1998). The Crop Production Department D2 , the Biotechnology Department D1 and the Animal Production and Nutrition Department D6 are also making progress along similar lines in their respective areas.

These procedures are carried out with the involvement of the QA Office according to a schedule of priorities, having regard to the legal (or contractual) accreditation obligations in the different areas. In some cases (e.g. microbiological analyses and milk composition, breadmaking value of cereals, detection of antibiotics or carcass meal in cattle feed, GMOs (D7), mycotoxins, quarantine organisms (D3), pesticide residues (D4), sprayer testing (D5), virological testing of potatoes (D9), mineral nitrogen (D2,) etc.), accreditation is already or will come to be mandatory if CRA-W is to maintain approval or official recognition by the food chain safety agency, AFSCA (statutory analyses), the Ministry of the Walloon Region (e.g. application of the nitrates directive) or certifying bodies (labels, organic farming, etc.) and international organisations (EU, WHO, FAO, FDA, EPA, CIRAD, etc.).

In other areas, such as the food value of forage and cattle feed (D9), NPK determination in soil (D2), biofuel and fertilizer analysis (D5), potato and cereal variety identification (D1), detecting harmful microorganisms in orchards (D3, D1) and analysis of impregnated substrates for the World Health Organisation (D4), accreditation is still voluntary, though likewise perceived as a sign of credibility of the laboratory's technical and organisational efficiency.

It is wrong to think that a quality initiative only applies to routine analysis. Guaranteed reliability of results and management of resources in connection with experimentation and research projects can also usefully be based on a standard such as ISO 17025, as the CRA-W is well aware (setting up of a Working Party on good experimental practice).

Gaining a certificate is not the only benefit of accreditation, nor should it by any means be the sole aim. Even though resistance to change is commonplace, if a quality system is well designed, using common sense, and based on the actual needs of both the external beneficiaries and CRA-W personnel, and enjoys the backing of Management, it should continuously improve working methods and reduce the costs associated with quality deficiencies (errors, wasted time, ...).

A quality system means constantly questioning everything that should be changed. The QA Office is partly responsible for centralising information about needs for change and, despite the limited personnel resources available, teamworking, transparency and shared experiences enable a steady pace to be kept up in developing quality systems.

Attainment of quality objectives, application of procedures put in place and the technical expertise of laboratories are monitored by internal audits (currently 14 qualified internal auditors in accordance with ISO 17025 or GLP standards). These internal audits are regarded by the BELAC (the Belgian accreditation organisation) auditors as one of the strong points of the quality systems in place at CRA-W.

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