Development of tools for optimising the joint management of livestock manure and the improvement of agricultural fertilisation, crop quality and environmental protection

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01. Rationale

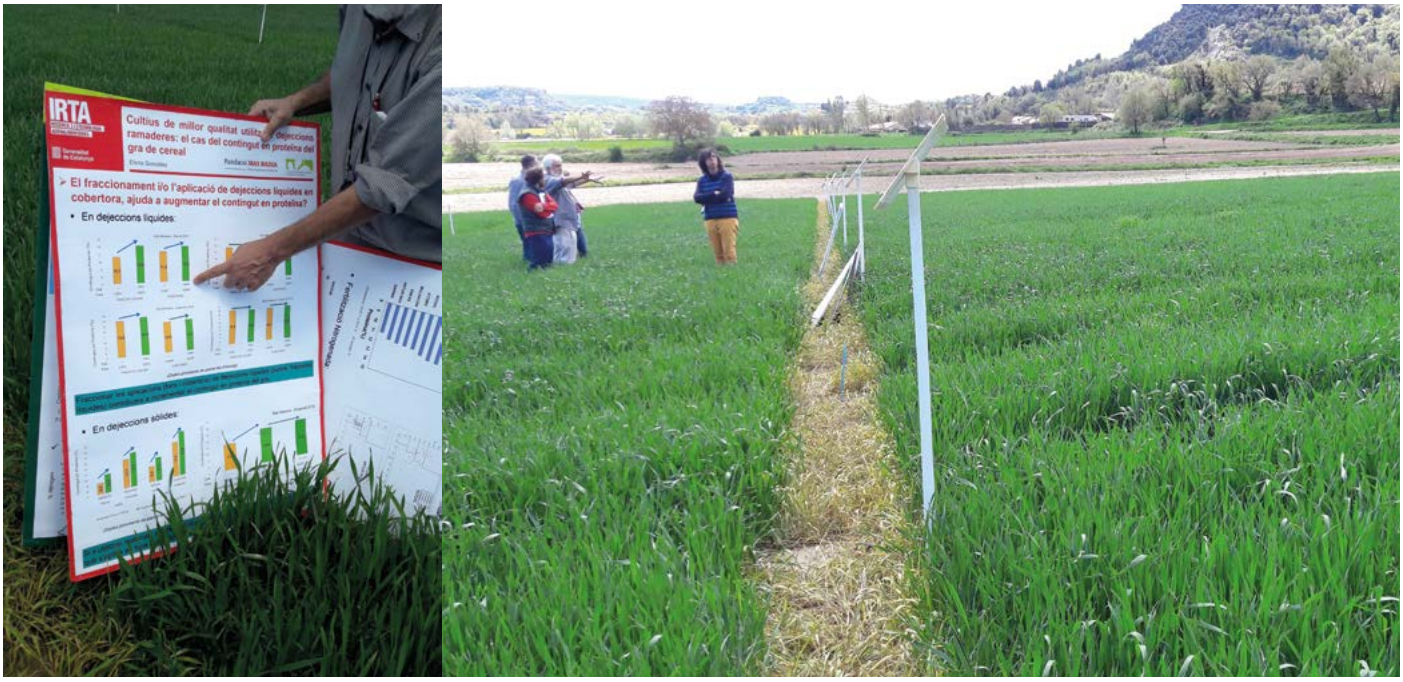
Innovative tools and strategies for the optimisation of livestock manure management and agricultural fertilisation have been validated, focusing on both economic and environmental aspects, in a joint project with coordination between the participating cooperatives, and with the following specific objectives:

- To achieve joint management of manure and fertilisation in a careful and sustainable manner.
- To recover livestock manure for its fertiliser content and reduce its environmental impact.
- To improve the technological management tools available and adapt them to the needs of the participating cooperatives.

Various cross-cutting measures and pilot experiences have been carried out, in a joint management framework based on four fundamental areas of improvement:

1. Improving slurry application through fertilisation planning. Soil analyses, use of conductivity meters, precision machinery, GPS, etc.
2. Improving management logistics: optimisation of transport routes, registering applications, etc., by means of computer tools to facilitate tasks and to obtain traceability of the applications on the plot.
3. Improving cereal quality: increasing protein through fertilisation.
4. Reduced environmental impact.

Photo: Operational Group - IRTA.



Photos: Operational Group - IRTA.

02. Results and conclusions

For the purpose of finding out the nutrient content *in situ* and in real time by using a conductivity meter, we have obtained as many regression lines as situations represented by the selected farms, providing more accurate information on the nutrient content being applied. Depending on the type of slurry (breeding sows or fattening pigs), breed of pig or the geographical area where it was generated, the applicator will be able to select the most appropriate line. The use of conductivity meters during application for the *in situ* determination of the NPK content allows the fertilisation to be optimised.

By means of devices installed in transport tanks, tests have been carried out on real-time data access and trasmission to the evaluated software. It has been possible to verify the differences and advantages in management optimisation, with real-time monitoring, control of the vehicle's location, routes, timetables, number of operations per loading and unloading point, total kilometres travelled, etc. All this information recorded in the computer application has made it possible to generate the livestock manure management book (LGDR, for its Catalan initials), as well as the fertilisation plans more quickly and accurately.

It has been shown that the application of emission reduction strategies during slurry storage, such as acidification and the addition of plant material (straw), are relatively economical tools that allow the reduction of ammonia and greenhouse gas emissions. The use of flexible bags also allows emission control, but promotes the generation of biogas. In order to minimise its impact, it will have to be used or burned with a torch.

Composting technology has also been shown to be a good alternative for the stabilisation of poultry manure. However, as it is a material with a high nitrogen content and little structure, a good choice of structuring material is necessary to obtain a quality compost and to minimise emissions.

Through the demonstration plots, improvements to be implemented in the individual and joint agricultural management of livestock manure, mainly slurry, have been identified: the use of hose equipment to apply liquid manure; the use of conductivity meters to estimate the nutrient content of slurry; the application of liquid manure in crop cover; the adequacy of the dose of nutrients to be applied to crops. The tools and management model will need to be slightly adapted to fit the specific needs for each of these situations.

The contribution of livestock manure to improving crop quality has been demonstrated. Improvements to be implemented in both individual and joint farm management of manure in relation to crop quality improvement have been identified: the adequacy of the nutrient dose to be applied to crops at each moment and the importance of livestock manure in increasing crop protein.

The application of liquid manure to crop cover brings nutrient inputs closer to the time of maximum nutrient extractions by crops and improves the efficiency of the elements applied. The use of agronomic tools and criteria to plan fertiliser applications to crops should prevail over the use of criteria of maximum doses allowed by legislation. Fertilisation is a key aspect for the improvement of crop quality and requires careful management to achieve a quality product.

The general conclusion derived from the activities carried out and from the above recommendations is that the livestock farming sector must evolve and innovate in order to carry out the correct individual or joint management (and treatment) of manure and to adapt to the new regulations, especially those farms located in vulnerable areas. Other recently published regulations, such as the regulation on fertilisers, put an end to the waste status of manure and open the door to greater agronomic recovery of manure. There are, therefore, useful tools that the sector can apply to increase its economic and environmental sustainability, complying with the established limits and those that could be established in relation to aspects such as the minimisation of emissions during storage.

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