Sustainable Organic and Low Input Dairying: main outcomes of a pan-European dairy research project

The five-year Sustainable Organic and Low Input Dairy (SOLID) project has taken a holistic perspective of dairy farming and addressed an important set of questions related to dairy cow nutrition, breed choice, environmental impact, biodiversity, farm management and strategies to increase sustainability for the supply chain and consumers. ***Konstantinos Zaralis, Mark Measures, Susanne Padel*** *and* ***Pip Nicholas*** *present some of the outputs.*

In work led by ORC on participatory research we started by asking farmers and stakeholders to identify problems and key issues of the organic and low-input sector from their point of view. Further discussions narrowed this down and farmers, SME partners and researchers jointly engaged with 18 participatory projects, including six in te UK) evaluating some potentially innovative solutions. Not all topics and themes initially suggested could be investigated, because only a limited number of studies could be carried out. Three major participatory research approaches were used:

- Farm case studies or comparative farm case studies that were based on monitoring certain aspects on one or several farms, using a variety of data collection methods both quantitative and qualitative;
- On-farm trials in which a specific treatment (e.g. use of new feed resources) was compared with a control group or with the performance before the treatment was introduced; and
- Group discussion or 'field labs' where farmers' experience and other knowledge sources were shared with the aim to improve practice.

Such participatory research is normally effective in generating a better understanding about and adapting new technologies for a range of farming conditions. However, it is not always easy. One problem can be lack of treatment replication, and differences in management practices between farms participating in on-farm trials or in comparative case studies can limit the statistical power of the research. Sometimes, if farmers feel that the system/treatment does not work for their farm, the business might take priority over the experimental procedures. Nonetheless, the majority of the farm trials in the SOLID project produced valuable information and some will result in scientific publications. A selection of the results is presented in the Farmer Handbook (see next page).

SOLID also carried out research using more traditional scientific methods. The diversity of low-input and organic

Introduction to SOLID

SOLID was a European project on Sustainable Organic and Low Input Dairying (cows and small ruminants - sheep and goats), financed by the European Union.

For five years (2011 to 2016) agricultural scientists and farming experts from 25 institutions in ten European countries worked together in order to develop new knowledge and methods to improve the sustainability of the organic and low-input dairying systems in Europe. Nine of the project partners were SMEs working with low-input and organic dairy farmers (co-operatives, including OMSCo in the UK, advisory services and one organic certification body). The project was co-ordinated by the Institute of Biological, Environmental and Rural Sciences at Aberystwyth University, UK.

SOLID partners in the UK, Denmark, Austria, Italy, Belgium, Finland, Greece, Spain, Romania, Germany.

The results and full details of the project are available on-line on the SOLID website http://farmadvice.solidairy.eu

dairy cow systems throughout Europe implies that the livestock should also be adapted to the specific conditions. Results from a trial with adapted breeds suggests that cow breeds perceived as being better adapted to low-input and organic systems did not necessarily show clear advantages over conventional breeds. In contrast, a large dairy goat study in Greece involving indigenous and imported breeds indicated breed-specific advantages, especially in terms of milk quality, which are important to future dairy goat breeding programmes.

Nutritional studies demonstrated the potential for a range of novel and local feed sources to be important sources of energy and/or protein in the future, for example vegetable by-products like tomato silage were fed to milking goats in Spain and other by-products (e.g. Camelina meal) were used as protein supplements for dairy cows in Romania. A decision support tool was developed to assist farmers to evaluate the balance of feed supply and herd requirements on dairy farms. The potential use of the tool includes simulations, for prototyping, education or scientific modelling, but it has not been widely tested under UK conditions.

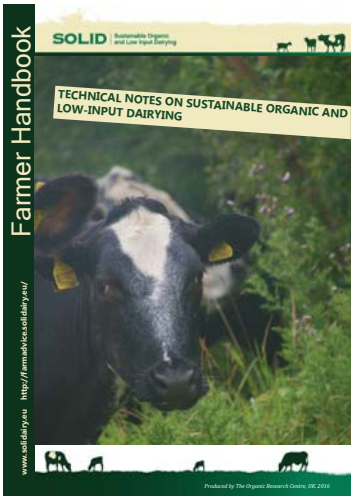
An environmental toolbox to support organic and low-input dairy production was also developed. The work demonstrated that it is important, and also possible, to include carbon sequestration and biodiversity in Life Cycle Analysis (LCA) studies to help further underpin the environmental strengths of low input and organic dairy production systems.

Supply chain and consumer surveys helped to further understand which types of innovative production strategies are acceptable to dairy supply chain participants, from the farmer to consumer. Of three novel strategies tested, alternative protein sources to soya were a priority for farmers but not with consumers. In contrast, consumers liked the idea of rearing calves on cows whereas this was not popular with the farmers. The organic dairy farmers responded cautiously to using agroforestry on dairy farms, with main concerns centred round a lack of information about the wider implications. The studies suggested that to avoid bottlenecks in innovation uptake within the organic and low-input dairy supply chains, increased collaboration and information-sharing activities along the whole supply chain are important.

Data from the European Farm Accountancy Data Network (FADN) were used to establish a definition of 'low-input' (LI) dairy production based on the costs of external inputs, relative to grazing livestock units on a farm. The diversity is substantial, so tailor-made farm planning is required to maximise competitiveness of an individual farm. This builds on the unique combination of farmer and entrepreneur to make smart decisions, whether this is related to farm management practices and/or most appropriate routes to adding value along the supply chain.

The project showed that organic and/or low-input dairy cow and goat production systems are competitive but for future sustainability attention must focus on continuous improvement in farm management with close attention to animal welfare and the production of high quality milk. More effective and shorter supply chains will also help to improve the collaboration, competitiveness and sustainability of these dairy systems.

An overview of the SOLID Farmer Handbook



ORC produced a series of technical leaflets in which we present key results and recommendations of the work undertaking in SOLID, aimed at farmers. The handbook covers three major themes:

1. Feeding forage-based diets;
2. Animal production and health and welfare; and
3. Wider environment and economic impact.

It includes results derived from the participatory research but also from more traditional scientific experiments carried out as part of the SOLID project.

The SOLID work on cow nutrition reported in Technical Note 1 *Energy requirements and ration planning for low-input cows* confirms that energy requirements of breeds adapted to low input dairying e.g. Norwegian Red are similar to Holstein cows, so existing feed rationing systems are appropriate. However, it was also found that the energy requirements for maintenance of cows on high forage diets typical for organic and low input herds are greater than those of cows on low forage diets. This will require some adaptation of feed rationing programmes, particularly in France and Germany.

A notably successful example of addressing the need for home grown protein was demonstrated by Finnish organic farmers in the SOLID project, who grow and process their own oilseed rape, consequently being entirely self-sufficient, no soya and no imported proteins (see Technical Note 2).

Table 1: List of SOLID Technical Notes

Technical Note	Topic
	Feeding of ruminants with forage-based diets
1	Energy requirements and ration planning for low-input dairy cows
2	Feeding home-grown protein and novel feeds to dairy cows
3	Use of diverse swards and 'mob grazing' for forage production
4	Minerals and trace element management for dairy cows
5	Vegetable by-products for feeding dairy goats
	Animal management for health and welfare
6	Breeding cows suitable for low- input and organic dairy systems
7	Low-input antibiotic strategies: improving animal health & welfare
8	Rearing calves on milking cows: key points to consider
	Wider issues of the environment and economics
9	Carbon footprint and biodiversity assessment in dairy production
10	Profit on low-input and organic dairy farms
11	Strategies to increase sustainability for the supply chain & consumers
12	Agroforestry for livestock systems

comment@organicresearchcentre.com

Technical Note 3 covers results of two UK studies on the *Use of diverse swards and 'mob grazing' for forage production*, showing a clear potential for diverse, multi-species swards also on dairy farms. The grazing system that involves long grazing intervals and high residuals advocated as 'mob grazing' seems to result in an increase of the soil organic matter as evidenced in a case study, but the study was not able to confirm all of the claimed benefits attributed to this grazing system. Nevertheless, this is an area that attracts the interest of many organic and conventional farmers and more research is needed in this respect.

The Technical Note 4 on *Minerals and trace element management for dairy cows* provides a summary of the role and supply of all trace elements and emphasises the importance of taking a whole-farm approach and the need for regular monitoring of mineral levels in cows. The work that SOLID did on Iodine (UK participatory study led by ORC) is of immediate importance in view of recently published papers on low levels of iodine in organic milk. The SOLID milk data analysis from 2014 and 2015 has shown that although iodine levels in organic milk vary between farms more than is desirable, the overall average is in fact well within the optimum range for cow and human health. However, milk iodine concentrations in some of the study farms were systemically low and this requires attention. The most significant factor affecting iodine levels was found to be the use of iodised teat dips. In practice this means that where post-dip teat disinfectant is used the iodine concentrations in milk do not serve as a robust indicator in identifying shortfalls in iodine intake. To avoid the health status of the animals being negatively affected by low iodine intake, urine samples can be used to monitor the cow's iodine status (See ORC Bulletin 119).

The section on *Animal management and health and welfare i*s covered by Technical Notes 6, 7 and 8. Technical Note 6 on *Breeding cows suitable for low-input and organic dairy systems* addresses some important points on breeding selection criteria and the use of genetic indexes. Surprisingly, the experimental work of the project found that breeds perceived as being better adapted to low-input conditions did not always perform better than conventional breeds, but nonetheless there are advantages under some conditions. The potential for crossbreeding was confirmed by the project but the variability in cow size was highlighted as a potential management problem. Breeding strategies should be farm specific; there are no 'one size fits all' solutions. Technical Note 7 provides an overview of on-farm practices used to improve health and welfare without relying on antibiotics, including the use of herbs in grass and the field lab on using liniment mint oil cream against mastitis. TN 8 discusses the challenges of rearing calves on cows based on case studies carried out on farms in the UK and Denmark, and a study tour to The Netherlands visiting six different farmers who have been rearing calves this way for several years. It is concluded that calves allowed to suckle drink more milk, but according to the Finnish farmer who attended the final SOLID conference in January, "Every litre of milk invested in the calf is returned in the form of higher milk production by the cow she grows into".

The Farmer Handbook section on *Wider issues of the environment and economics* is covered by Technical Notes 9 to 12. Technical Note 9 deals with *Carbon footprint and biodiversity assessment in dairy production* and shows evidence that organic farms generally have higher soil carbon sequestration, due to a higher proportion of grassland and greater use of manures, instead of synthetic fertilisers. Likewise, organically managed fields generally have higher biodiversity compared to conventional. These two factors – soil carbon and biodiversity – are not normally included in the environmental LCA of milk, resulting in a biased comparison of organic and conventional milk, but the project has developed an approach showing how both could be more widely included in LCA studies.

Technical Note 10 *Profit on low-input and organic dairy farms* shows that across the EU member states, the low-input dairy farms (LI) compared to high-input (HI) are smaller, less specialised, have a larger share of forage and grassland in their utilised agricultural area, and grow less maize, but differences between countries exist. They also have more family labour, a lower productivity and less intensive production. Organic dairy farms need to be seen as a separate group.

Technical Note 11 on supply chain strategies highlighted consumers' liking for 'prolonged maternal feeding'. Claims relating to animal welfare always score high with consumers, but the willingness to pay on top of an organic premium is not necessarily there. Technical Note 12 describes the agroforestry trials carried out at Elm Farm (ORC) and Wakelyn's Agroforestry, which have shown that multifunctional land use approach balances the production of commodities with non-commodity outputs such as environmental protection and cultural and landscape amenities. Tree fodder may offer nutritional benefits to livestock that complement other feed sources, but the feed value will vary depending on tree and animal species.

E-Learning tutorials

The project produced four e-learning tutorials that present selected project results in a different and more interactive format. This allows the users to advance and also to test their knowledge and understanding of the subject. The e-learning tutorials are available on-line on the SOLID website http://farmadvice.solidairy.eu and are covering the following topics:

- Genotypes for low-input and organic dairy systems
- Life Cycle Assessment of dairy products
- Novel and underutilised feeds for European organic and low-input dairy farms
- Participatory research in organic farming systems

Other resources

The project has also produced reports, held workshops as well as developing E-learning materials and the activity of publishing selected results in scientific publications continues. All of this can also be accessed via the project website www.solidairy.eu and via http://farmadvice.solidairy.eu.

For proceedings of the *Future sustainability of organic and low-input milk production: Challenges and solutions* conference, held in Bristol 26-27 January go to: http://tinyurl.com/SOLID-UK-event