Cream of the crop

Dr Bernadette O'Brien is a senior research officer of a project aiming to revolutionise the milking industry in Ireland and across the EU. Here, she discusses the research findings, the challenges the team has faced and the positive elements of combining automatic milking and cow grazing

Could you explain what is meant by an automatic milking (AM) system and how it might transform the milk production process on dairy farms?

The AM system can perform the tasks of cow identification, supplementary feeding, teat washing, teat location, milking cup attachment, milking and cup removal – all without human intervention. AM is reliant on voluntary cow traffic, where the cows present themselves for milking by walking to the milking unit and entering a stall, on an individual basis. Ideally, the cows will come in a steady stream throughout the day and night, resulting in the almost continuous use of the AM system. Instead of being a conventional 'batch' process involving high levels of farmer input – perhaps once, twice or even three times a day – milking can become a continuous 'background' activity.

For what reasons must farmers increase the amount of grass in the diet of a milking cow?

The main markets for AM systems have traditionally been in countries with high-yielding cows, high milk prices, high labour costs and indoor feeding systems. However, grazed grass feeding systems are increasingly appreciated, especially from environmental, animal welfare, product quality, sustainability and economic perspectives. Grassland is also associated with lower inputs of pesticides and fossil fuels, particularly where it is harvested as grazed pasture. In many areas, grassland is seen to have a positive impact on landscapes and is more species-rich with greater above- and belowground biodiversity of fauna and flora.

Your team is interested in the integration of AM technology in grass-based milk production systems. How are you exploring this area?

In a grass-based system where cows graze almost all of the time, we believe that the

Greenery and machinery

AUTOGRASSMILK is a collaborative research project intent on developing and implementing a sustainable approach to farming that integrates automatic milking practices with cow-grazing systems. The team is planning to disseminate new technology to end-users in a way that is both easily accessible and adapted to local circumstances

ROBOTS HAVE BEEN used to benefit civilisation for decades. Since the 1960s, machines have boosted the productivity of numerous manufacturing processes and, today, they account for more than 50 per cent of the total labour in some parts of the automotive industry. It has been suggested that, in the future, robots will routinely perform surgeries, conduct the majority of household tasks and perhaps even rival human intelligence – at least in terms of the amount of instructions per second they can execute.

Agriculture is one field that makes use of robots for a number of purposes, including fruit picking, sheep shearing and operations involving driverless tractors. Moreover, since automatic milking (AM) systems were introduced for commercial use in 1992, approximately 25,000 AM units have been implemented worldwide, with some 10,000 located across Northern Europe. In some EU countries today, approximately 50 per cent of new milking parlours installed are AM systems – and it is expected that by 2020, 20 per cent of cows in the EU will be milked automatically.

There are a number of reasons for the widespread adoption of AM systems. For example, not only do cows volunteer themselves for milking, but the whole process can be spread out across a 24-hour period

milking frequency per day will be less than that of indoor systems. Also, the milk yields of these cows will normally be lower than those on an indoor diet, so the daily milking time of an individual cow will be shorter, meaning that a larger herd of cows can be milked. Thus, the total volume of milk from the larger number of cows with a lower yield may in fact be greater than from the smaller number of high-yielding cows. Focusing on milk output also allows farmers to make more informed decisions regarding whether or not to change or upgrade their existing milking machine. This research will provide farmers with objective information for such decision making. Farmers with AM systems already on their farms can be provided with information on best practice guidelines for the integration of AM systems and grazing.

What challenges have you come up against during the project?

Managing the grassland is always challenging, as the grass allocations must be exactly right to create the incentive for the cow to move around the system and get milked. The initial two-to-three month period following the conversion from conventional milking to an automatic system is especially challenging, though perhaps more for the system manager than the cow! There was quite a significant amount of data to be analysed and interpreted, which created challenges for the farmers engaging with AM. The user-friendliness of the robot is important if we want to maximise the advantages of gathering so much information.

Finally, could you outline the benefits of using your robotic milking unit?

There are significant potential positive impacts to be gained. One of the main impacts is increasing the competitiveness of the farms that adopt the system. There are several reasons for the boost in competitiveness, including increased pasture in the cow diet, more efficient management of the pasture, greater possibility of herd expansion where land is limited, reduced labour costs and reduction in the cost of milk production as less supplementary concentrate feeds are needed. Finally, there will be improved individual cow management through having more specific knowledge of cow requirements through increased data capture.

Other important impacts include conforming to EU legislation on the amount of time cows spend outdoors, improvements to farmer-family lifestyle, reduced labour demand, increased nutritive quality of milk and better cow wellbeing. With specific reference to the Irish context, the main advantages include reduced labour, counteracting the issue of fragmented land bases and the ability to work off-farm to build some capital. Ultimately, we expect that the outcomes of our project will make a highly positive contribution to dairy farming within the EU.

and conducted without the presence of humans. These factors have helped transform milk production processes, significantly promoting the comfort and welfare of the cow. AM systems also lead to a sizeable reduction in the amount of physical work involved, accordingly optimising work-life balance for the farmer.

INTEGRAL INTEGRATION

The increased use of AM systems across the EU has highlighted their effectiveness when employed on farms that utilise indoor feeding systems. While this is not a problem for European countries where such systems are widely deployed, it is an issue for countries such as Ireland that use cow-grazing systems almost exclusively. Thus, it is important to develop a means of integrating AM practices on grass-based farms if countries like Ireland are to find an alternative to conventional, manual milking.

The researchers are planning to identify optimum feeding strategies for dairy cows and new technologies that facilitate the integration of AM with cow grazing

AM systems in many EU countries are associated with a significant reduction in grazing-based production systems – but it is well established that grasslands are essential for the continuation or introduction of sustainable farming systems. It is therefore not enough to find a means of introducing AM systems to Irish farms; researchers must also come up with ways of ensuring that the milking robots can operate satisfactorily within milk production systems across Europe, where grass forms different proportions of the cows' diet.

NEARING COMPLETION

It is with these issues in mind that a European consortium has established the AUTOGRASSMILK research project. Funded by the EU's Seventh Framework Programme, the project aims to develop integrative practices appropriate for a range of diverse approaches to dairy farming across the continent. As a joint research endeavour, it is comprised of 14 members that each bring their own unique expertise to bear: six Research Performers, six SME Associations and two SMEs representing

AUTOGRASSMILK

OBJECTIVE

To create innovative and sustainable systems that combine automatic milking and precision grazing techniques for dairy cows.

KEY RESEARCH PARTNERS

Dr Agnes van den Pol-van Dasselaar, Wageningen UR, Netherlands • **Dr Willem Oudshoorn**, SEGES (previously Aarhus University), Denmark • **Dr Valérie Brocard**, Institut de l'Elevage, France • **Dr Eva Spörndly**, Swedish University of Agricultural Sciences • **Dr Isabelle Dufrasne**, Universite de Liege, Belgium

SME ASSOCIATION PARTNERS

Irish Grassland Association, Ireland • **Land- en Tuinbouw Organisatie Noord**, Netherlands • **Knowledge Centre for Agriculture**, Denmark • **Centre national interprofessionnel de l'economie laitiere**, France • **VAXA**, Sweden • **Comité du lait**. Belgium • **Aidan and Anne Power**, End user FARM, Ireland • **SME FARM DK – Thure Worm**, End user FARM, Denmark

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CONTACT

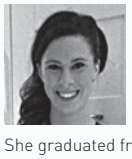
Dr Bernadette O'Brien
Senior Research Officer

Animal and Grassland Research and Innovation Centre
Teagasc
Moorepark, Fermoy
Cork
Ireland

T +353 254 2274
E bernadette.obrien@teagasc.ie

www.autograssmilk.eu

DR BERNADETTE O'BRIEN is a senior research officer at Teagasc Animal and Grassland Research and Innovation Centre. Her fields of research include automatic milking, labour efficiency on-farm and milk quality. O'Brien has secured EU funding for two projects, which she is currently coordinating, and National Government funding for a number of other dairy projects. She has published more than 60 peer-reviewed papers and numerous technical and popular articles.



DR CATHRIONA FOLEY is a research officer at Teagasc Animal and Grassland Research and Innovation Centre working on the EU funded AUTOGRASSMILK project. She graduated from University College Cork in 2009 with a BSc in Biochemistry and obtained a PhD in Immunology from Trinity College, Dublin, in 2014.

AUTOGRASSMILK

AN AMBITIOUS PROJECT

The AUTOGRASSMILK project is divided into four different work packages:

- Design – optimum feeding strategies for dairy cows that incorporate grazing with automatic milking in the contexts of different European production systems
- Implementation – optimise the integration of automatic milking systems with cow grazing through the use of new technologies
- Sustainability – increase the sustainability of an integrated automatic milking and cow-grazing milk production system
- Economics – economic assessment of integrated grazing and automatic milking technologies

two end-user farms. One of these farms is based in Ireland while the other is based in Denmark – and it is on these farms that the technological solutions generated from the research findings are tested.

Importantly, the project researchers are drawing on the strengths of the farming systems in each of the different European countries. In Denmark, for instance, AM is widely used but indoor feeding systems are also common. Meanwhile, in Ireland, cow-grazing systems are well-developed but AM is not a common practice.

The researchers are therefore planning to identify optimum feeding strategies for dairy cows, as well as new technologies that facilitate the integration of AM with cow grazing. They are also hoping to increase the sustainability of optimised integration and provide farmers with the tools to improve the economic efficiency of their farms.

Currently three-quarters of the way through, the project has thrown up some interesting findings. As Senior Research Officer coordinating the project, Dr Bernadette O'Brien, explains: "Results to date have revealed that AMS provides a 36 per cent reduction in labour compared to conventional systems. A French study showed that grazing can be combined with AM and, although milk yield was reduced, feed cost was substantially lowered – specifically, by 66 per cent per 1,000 litres of milk".

A DAIRY REVOLUTION

The research has also led to the development, testing and modification of several tools to assist farmers in their integration strategies. These include tools that enable automated grass measurement, the collection of sensor data to record and assess cow behaviour, and sustainability assessments of the different environmental, economic and social factors on between five and six 'monitor farms' in each participating country. In the future, the team is also planning to conduct economic analyses that examine the financial interaction between capital investment, labour requirements, running costs and the optimisation of AM integrated with grazing.

It is anticipated that the project will drive progression within the dairy farming industry, particularly on farms in Ireland. Indeed, with the abolition of EU milk quotas, many new opportunities are opening up for Irish dairy farmers – not least the fact that businesses are able to expand for the first time in 25 years: "The labour element on farms will be crucial to the success of the operation, as well as to the sustainability of the farming industry in the medium and long term," points out O'Brien. "Because milking is a critical component of the total labour on the farm, the successful integration of AM into Ireland's grass-based dairy system could in time herald a revolution in dairy farming."