Resource Efficiency: Making the most of farm resources to reduce greenhouse gas emissions and improve financial performance

Gillian Reid

Summary

- In response to declining Common Agricultural Policy (CAP) direct support payments, many farmers will need to review the efficiency of their businesses. Making more efficient use of farm resources not only has positive cost benefits but also helps to reduce greenhouse gas (GHG) emissions.

- AgRE Calc ©, SRUC’s Agricultural Resource Efficiency Calculator, can be used to measure greenhouse gas (GHG) emissions produced from a farm which, when benchmarked against similar farm businesses, highlights areas where actions should be taken to reduce emissions leading to improved efficiency. This process is commonly known as carbon footprinting or a resource efficiency assessment.

- A range of technologies and management practices can be implemented on farm that have the potential to reduce emissions, improve efficiency and lead to direct financial benefits. Such benefits have been demonstrated by the Climate Change Focus Farms, funded under the Scottish Government’s Farming for a Better Climate (FFBC) Initiative.

- Various processors, retailers and organisations promote the uptake of carbon footprinting or resource efficiency assessments but further support and incentives are required to ensure greater uptake, thereby helping the Scottish Government to meet its emission reduction targets and improve the efficiency of Scottish farms.

- Factors, such as the weather, can counteract any positive impacts from implementing technologies or management practices that would otherwise reduce emissions and improve efficiency. To fully quantify the benefits of such actions, assessments should be prepared year-on-year after any changes have been implemented to account for/diminish the effects of adverse weather impacts.

- The benefits of improved resource efficiency in the agricultural sector also extend beyond the farm-gate. Improved efficiency will also help stimulate technological innovation, open up new export markets and benefit consumers through more sustainable products.

---

1 Rural Business Consultant, SAC Consulting. E: Gillian.Reid@sac.co.uk. This briefing was funded through the Rural Policy Centre’s core funding from the Scottish Funding Council for knowledge transfer and exchange.

2 AgRE Calc ©, SRUC’s web based Agricultural and Resource Efficiency Calculator. For more information, see: www.agrecalc.com

3 Farming for a Better Climate. For more information, see: www.farmingforabetterclimate.org

4 Scottish Government. For more information, see: http://www.gov.scot/Topics/Environment/climatechange/scotlands-action/climatechangeact/targets
Introduction

The new CAP will result in a decline in the amount of support payments many farmers receive, impacting negatively on profitability. At the same time farmers are under increasing pressure to reduce farm GHG emissions. Although this may appear challenging, making more efficient use of farm resources can reduce emissions and benefit the business in financial terms, delivering win:win opportunities.

At the farm level, GHG emissions, and hence efficiency, can be measured by a process called carbon footprinting. The three main GHGs produced from a farm and their sources include:

- Carbon dioxide (CO₂), produced by burning fossil fuels and embedded in purchased inputs (i.e. feed, bedding, fertilisers, lime and pesticides);
- Methane (CH₄), produced as a natural by-product of ruminant digestion and from management of organic manure;
- Nitrous oxide (N₂O), released during the management and application of organic manure, the application of manufactured nitrogen fertiliser, from crop residues and following soil disturbance.

The above emissions are expressed as carbon dioxide equivalents (CO₂e) based on their relative global warming potential (GWP) over a 100 year period. Expressing emissions in this way allows bundles of GHGs to be quantified as a single number allowing year-on-year results or, different farms to be easily compared.

This Policy Briefing will outline how farmers can measure emissions produced by their farm and will show how this can highlight areas where efficiency could be improved and financial savings made using AgRE Calc © as an example tool. Some of the challenging issues surrounding the uptake of carbon footprinting will be discussed. The Briefing concludes by suggesting some key messages for policy.

Measuring GHG emissions and efficiency using AgRE Calc ©

From readily available farm records about the land and crops grown, livestock and energy use, AgRE Calc © calculates the quantity and source of emissions produced. Total emissions and emissions intensity (per unit of output) for the whole farm, an enterprise and a product are calculated. Presenting emissions as an intensity also allows changes in production to be taken into account as well as changes in total emissions.

Emissions intensity is benchmarked against similar farm businesses, highlighting areas where emissions are higher or lower, providing an indication of efficiency. Higher emissions intensity indicates reduced efficiency, prompting the farmer to review technologies and practices. Globally, it is estimated that a 30% reduction of GHG emissions would be possible if farmers in a given system region and climate adopted the technologies and practices currently used by the 10% of farmers who have the lowest emission intensity. This highlights the importance of benchmarking to help reduce emissions and increase efficiency.

---


Examples of efficiency practices and benefits

Technologies and practices that have the potential to reduce emissions and lead to direct financial benefits can be grouped into five key action areas:

1. Management of energy and fuel;
2. Development of on farm renewables;
3. Locking carbon into soils and vegetation;
4. Optimising fertiliser, slurry and manure use;
5. Managing livestock and storage of livestock wastes.

By using the AgRE Calc ©, resource use efficiency assessments and carbon footprints have been prepared for 12 Climate Change Focus Farms, as part of the FFBC initiative. Examples of actions implemented by two of the farms and the resultant benefits are as follows, results are from the full three year period of the initiative:

**Dairy Climate Change Focus Farm**

- **Improved energy use in the dairy.** Installed a variable speed pump, increased hot water tank insulation, and monitored time clocks on the boilers. Reduced electricity use by 20,718 kWh, saving £1,900.
- **Reduced age of calving.** Calved a batch of 15 heifers at 24 months rather than 34 months. Increased milk production by around 50,450 litres, generating approximately £17,500 of additional income.
- **Improved soil structure.** Used a subsoiler i.e. tillage tool, on 50 hectares of grassland to alleviate soil compaction. Increased quantity of grass silage made by 38 tonnes, saving around £950 in feed costs.

**Beef and Sheep Climate Change Focus Farm**

- **Silage analysis.** Silage was analysed and sheep ration prepared. The silage was of high quality and therefore resulted in a reduction of purchased feed use by 13 tonnes, saving approximately £3,000.
- **Reduced age of calving.** Reduced calving age from 36 months to 24 months resulted in the farm requiring 20 fewer beef replacements, Reduced feed use by 19 tonnes, saving £7,000.
- **Reduced use of straw.** Bedded a trial batch of cattle on recycled wood fines i.e. waste wood which is of lower cost than straw. Reduced straw use, saving around £700.

Through these and other measures, over a three year period, the efficiency of both farm businesses improved, delivering financial benefits and a 10-11% reduction in emissions intensity.

**Challenges surrounding the measurement of emissions and efficiency**

- Assessing emissions produced from a farm via the process of carbon footprinting is not a new concept. Some processors and retailers have been requesting this to be prepared as part of their contract with farmers for many years. Organisations such as Soil Association Scotland® and Cool Farm Alliance® have also been promoting the concept, and work undertaken through the FFBC initiative has, and will continue to, also raise awareness of the benefits. Despite these initiatives there are still many farmers who have never had a carbon footprint or resource efficiency assessment prepared.

---

8 Soil Association Scotland. For more information see: [http://www.soilassociation.org/scotland](http://www.soilassociation.org/scotland)
9 Cool Farm Alliance. For more information see: [http://www.coolfarmtool.org/](http://www.coolfarmtool.org/)
10 FFBC. For more information see: [www.sruc.ac.uk/info/120200/climate_change_focus_farms](http://www.sruc.ac.uk/info/120200/climate_change_focus_farms)
• Funds have been earmarked under the new Scotland Rural Development Programme (SRDP 2014-2020) to provide all farmers in Scotland with the opportunity to have a resource efficiency assessment prepared for their farm. This would be funded through the new Advisory Service, which is due to open in 2016 and is expected to be voluntary. However, to ensure farmers take up this option, support should be targeted and incentives provided.

• It is widely recognised that changes in the weather can impact on on-farm management practices. For example, during a wet year, livestock may have to be housed for longer or drought and flooding can reduce crop yields. These and many other scenarios can result in reductions in emissions and emission intensities being less than expected or can even result in emissions and emission intensities increasing in a given year.

• Not all technologies or management practices deliver immediate results. For example, the benefits of increased yields from improving soil nutrient status can take at least a couple of years to be evident. Therefore in order to see the benefits of such management practices, resource efficiency assessments should be undertaken over at least a three year period.

Key messages for policy
This briefing has described SRUC’s Agricultural Resource Efficiency Calculator (AgRE Calc ©), which can be used to measure GHG emissions from a farm and highlight where these can be reduced, in order to improve efficiency. Drawing on two examples it has shown the kinds of actions that have been implemented on farms which have used the tool, and the resultant benefits. Based on the evidence presented, this final section provides four key messages for policy in this area.

• On-farm consultancy should be supported through the new Advisory Service to help farmers complete their baseline resource efficiency assessment and to prepare an action plan containing appropriate technologies and management practices for the farm. All farms have natural limitations which need to be recognised within the plan.

• Supported follow up assessments should be prepared year-on-year to allow all the benefits from adopted management practices to be assessed and for any negative effects of the weather to be diminished.

• Incentives should be provided to encourage technologies and management practices to be implemented. These might include diagnostics (i.e. soil tests, forage analysis, blood tests, etc.) and SMART farming technology (i.e. Global Positioning Systems (GPS), Electronic Identification (EID), etc.), which have low-medium costs per unit actions but deliver high resource efficiency and carbon reduction score\(^1\). Under the SRDP 2014-2020 there is no funding for these types of activities, which potentially places Scottish agriculture at a disadvantage compared to its counterpart south of the Border, where on-farm analysis of livestock foodstuffs and monitoring and detection equipment are included in the English RDP’s Countryside Productivity Scheme\(^2\).

• Weather is a factor that is beyond the control of the farmer and any negative impacts this may have on emissions or emissions intensity - and hence efficiency - must be recognised. Farmers will also have to adapt their management practices to suit changing climatic conditions, which may in the short term not deliver the expected benefits. Due to these factors, the setting of any farm level emission reduction targets linked to receipt of CAP payments is not advocated as this would likely to be perceived as a disincentive by farmers.

For more information on the work of SRUC’s Rural Policy Centre, please contact: Dr Jane Atterton, Manager and Policy Researcher, Rural Policy Centre, SRUC, T: 0131 535 4256; E: jane.atterton@sruc.ac.uk; W: www.sruc.ac.uk/ruralpolicycentre

---


12 Rural Payments Agency, England. For more information, see: https://www.gov.uk/government/collections/countryside-productivity-scheme