An Tionól Saoránach | The Citizens' Assembly

Paper of

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Smart Farming

An *adaptive leadership approach*[1] to addressing climate change, which empowers farmers by addressing the dual challenges of improving farm returns while reducing climate impact.

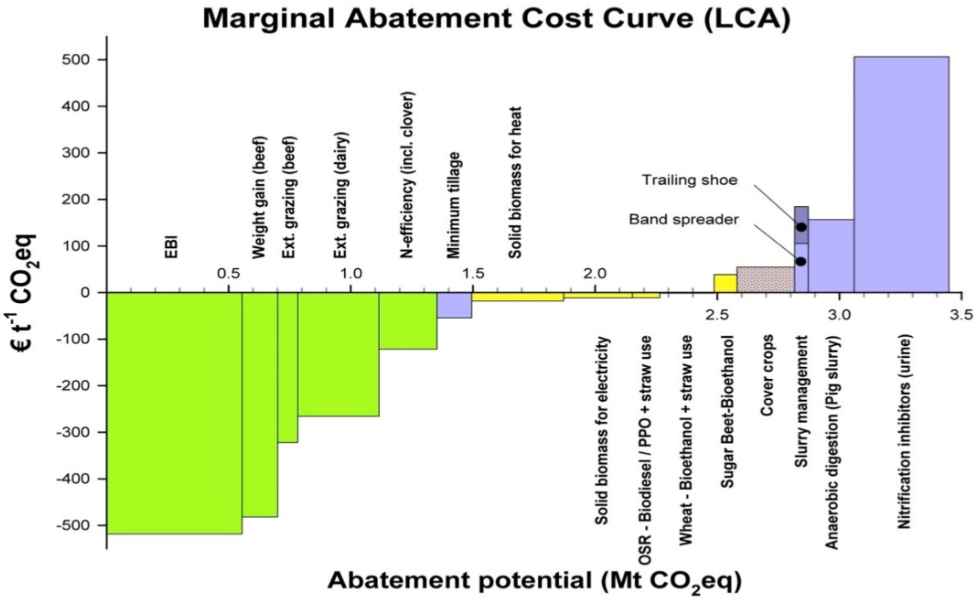
1. What is Smart Farming?

Smart Farming is a voluntary resource efficiency programme led by the Irish Farmers' Association (IFA), in conjunction with the Environmental Protection Agency (EPA).

The programme collates existing knowledge and expertise from Ireland's leading academic and advisory bodies, state agencies and technical institutions. It communicates this knowledge in a targeted way, to deliver on the *double dividend* of improving farm returns and enhancing the rural environment through better resource management.

The programme's scientific foundation is derived from Teagasc's *Marginal Abatement Cost Curve (MACC)* for Irish agriculture (Figure 1.1). This cost curve quantifies the opportunities to reduce for agricultural greenhouse gases, as well as the associated costs or benefits.

Figure 1.1 Marginal Abatement Cost Curve, based on Life Cycle Assessment Analysis



Over 80% (c.2.8 Mt CO_2eq.) of the measures identified are considered to be cost-efficient, i.e the adoption of these measures is good for the environment and also saves farmers money.

The development of the Smart Farming resource efficiency programme and identification of the eight focus areas (Figure 1.2) of the programme were strongly influenced by this research.

[1] Heifetz, R., Grashow, A. and Linsky, M. (2009). *The practice of adaptive leadership*. Boston, Mass.: Harvard Business Press.

Figure 1.2 Smart Farming focus areas

The Teagasc *MACC* research and *Four Well-Beings of Community Sustainability* (Figure 1.3) continue to be at the centre of all Smart Farming's activities. This community sustainability model advocates that society can have a long-term positive impact on the wider environment and their own well-being when environmental needs are better aligned with the economic, social and cultural needs of individuals, in this case – farmers. Thus, Smart Farming is focused on improving farm returns and enhancing the environment by operating through accepted cultural communication norms such as discussion groups, IFA branches and purchasing groups.

Figure 1.3 Four Well-Beings of Community Sustainability

2. Smart Farming – improving farm returns

Each farmer who participates in the Smart Farming programme receives a resource efficiency assessment (REA) of their farm, which is also called a cost saving study. These REAs are completed by a qualified agronomist who has a minimum level 8 qualification and is an agricultural science graduate.

In preparation for the REAs, the participating farmers submit the following information to the Smart Farming agronomist:

- House & farm electricity & fuel bills (heating & diesel) for the previous 12 months.
- Results of any soil samples that may have been taken in recent years and the farm map showing where soil samples were taken.
- Any Nutrient Management Plan completed in the last 2 – 3 years.
- Copy of the most recent Basic Payment Scheme application form (without details of the value of the Basic Payment, as this is not required).
- Copy of BPS Maps sent from the Department of Agriculture, Food and the Marine.
- Land Parcel Identification Numbers.
- Water:
  - Water bills for previous 12 months (if using water supply other than own well).
  - Results of any water quality tests.
- Feed - dockets for the previous 12 months.
- Results of the most recent silage tests.

Using this information, the Smart Farming agronomist prepares a draft desktop REA which focuses on identifying average cost savings on each participating farm of €5,000. This is delivered by focusing on the eight themes of soil fertility, inputs and waste, grassland, feed, energy, machinery, time management and water - as identified in figure 1.2.

The net cost savings identified often require an initial investment. For example, an expenditure on lime may be required to address underlying soil pH issues, in order to maximise grass growth and reduce more expensive concentrate requirements. Therefore, the cost savings identified in the draft REA will also include the likely payback period, so that the farmer can determine whether it is reasonable when considered against the investment required.

The agronomist then completes a farm walk with each participating farmer. This is used to examine the information provided and to get a more complete understanding of particular areas of farm management including the grassland reseeding plan, approach to feed purchasing, energy management and nutrient management.

The REA is then finalised and discussed with the participating farmers in advance of the REA being disseminated to the host farmer's discussion group, IFA branch or purchasing group.

At the discussion group meeting, the completed REA is presented by the Smart Farming agronomist and the host farmer. Robust and challenging exchanges usually take place during which the recommendations in the REA are questioned and debated.

3. Smart Farming – Enhancing the Environment

As part of the REAs, participating farmers receive a suite of environmental indicators for their farms.

A carbon reduction strategy for each farm is developed by using the Carbon Navigator (Figure 3.1) decision support tool developed by Teagasc and Bord Bia. The Carbon Navigator provides an estimate of greenhouse gas emission reductions that can be delivered on each participating farm, by achieving the targets which are set.

Figure 3.1 Teagasc and Bord Bia Carbon Navigator

Soil tests are also taken and a nutrient management plan for each participating farm is completed, using the Teagasc Online Nutrient Management Planning tool. Maps are generated which indicate the existing soil fertility levels as well as the liming and fertiliser requirements.

The quality of the water from the domestic water well and quality of the silage is also analysed. Recommendations are provided regarding feed management strategies based on the results of the silage tests.

4. Smart Farming – stakeholders collaborating to make a difference

A unique aspect of Smart Farming is the enthusiastic willingness of farmers, representative organisations, academia, advisory bodies, technical institutions and state agencies (Figure 4.1) to collaborate and share their knowledge and expertise in a targeted way to deliver change. The focus of all this collaboration is a desire to improve farm incomes and enhance the rural environment, through better resource management.

Figure 4.1 The stakeholders that collaborate to make the Smart Farming difference

Smart Farming experts from these organisations continue to significantly enhance the efficacy and standard of resource efficiency messages communicated to farmers. These individuals devised and developed the scientific, agronomic and economic content of each of the eight themes on the Smart Farming website, www.smarttfarming.ie. They also contributed to a comprehensive Smart Farming guide, which provides top-tips on how to save money on feed, fertiliser, energy and water bills; as well as ideas on reducing waste and the environmental impact.

5. Smart Farming – farmers making the real difference

The most important part of the Smart Farming programme is that farmers themselves continue to lead the programme's evolution.

The National Environment Committee (Figure 5.1) of the Irish Farmers' Association, which comprises of farmer representatives from every county in Ireland, has taken an *adaptive leadership approach* when developing this programme and dealing with the agri-environmental challenges facing the sector.

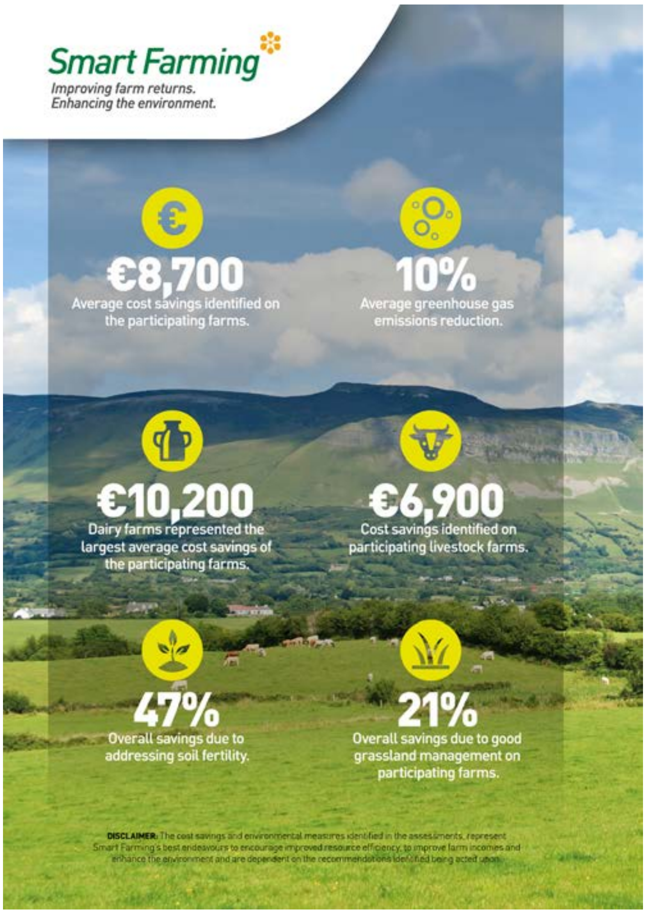
They recognise the issues in terms of air, water, soils, climate and other areas within farming and have moved beyond a standard enforcement and compliance approach. The Committee established the eight focus areas (Figure 1.2) of the Smart Farming programme; expanded the initial cost saving focus of the programme to incorporate environmental indicators; proofed the guide and all national communications; as well as participated in the studies. They also supported the Smart Farming Programme Leader and Manager in continuing the collaboration with others to deliver on better resource management, which will improve farm returns while enhancing the rural environment.

Figure 5.1 IFA National Environment Committee on water mini-catchments study trip and planning meeting in Teagasc Johnstown Castle.

6. Smart Farming results for 2017

In October 2017, Smart Farming's *Progress Report 2017* was published. Figure 6.1 provides a summary of the results, with the average cost savings target of €5,000 being exceeded by 74% and the target to identify greenhouse gas emissions reductions of 5-7% also being exceeded.

Figure 6.1 Summary of the results from the 2017 Smart Farming programme



7. Case Study – Andrew McHugh

Andrew and his family are dairy farmers and live near Newtownforbes in County Longford. Andrew took part in the Smart Farming programme which helped him to identify cost savings on his farm of over €9,000 (Figure 7.2).

Andrew is also on a pathway to reducing his climate impact by 20% (Figure 7.1), using the results of the Teagasc and Bord Bia Carbon Navigator decision support tool outlined in section 3. The following five areas were examined on Andrew's farm, to identify ways to reduce greenhouse gas emissions: grazing season length, herd breeding strategy, improved nitrogen efficiency, improved slurry management and better energy use.

7.1 Grazing season length

Using the Carbon Navigator decision support tool, Andrew can reduce his emissions by 0.8% by increasing the grazing season length by one week in March and November, as grazed grass in the early and late grazing season is a higher quality more digestible feed than grass silage, leading to reductions in the proportion of dietary energy lost as methane (CH_4). Also the shorter housing season leads to reduced slurry methane and nitrous oxide (N_2O) emissions from storage and energy use from spreading.

7.2 Herd breeding strategy

The largest (-15%) reduction in greenhouse gas emissions identified on Andrew's farm when using the Carbon Navigator decision support tool was by increasing the genetic merit of his herd. Increasing genetic merit by using the Economic Breeding Index (EBI) has the capacity to reduce emission through four mechanisms:

- Improving fertility reduces calving intervals and replacement rates, thus reduces enteric CH4 emissions per unit of product.
- Increasing milk yield per unit of grazed grass and improving milk composition increases the efficiency of production, which decreases emissions per unit of product
- Earlier and more compact calving increases the proportion of grazed grass in the diet and reduces culling and replacement rates.
- Improved survival and health reduces deaths and disease incidences, reduces replacement rates and emissions.

Andrew's current EBI figures have scope for improvement and thereby reducing greenhouse gas emission. This is because dairy cows that are milking for three seasons or longer in Andrew's herd are currently trailing the national EBI average. Andrew's focus over the coming years will be to target his breeding strategy on improving the genetic metric of his herd by using the EBI index to breed for improved performance (yield and fertility).

7.3 Improved nitrogen efficiency

Andrew can reduce his greenhouse gas emissions by almost 3% by increasing nitrogen efficiency. Andrew will be focusing on the following areas:

- The increased use of clover in swards thereby reducing N usage.
- Better soil fertility management.
- Effective grazing management leading to high levels of grass production and utilisation.
- Improvements in the timing and application of fertiliser nitrogen and
- The application of the most appropriate N fertiliser type for the prevailing conditions. (Urea v CAN).

7.4 Improved slurry management

The Carbon Navigator has identified that by improving manure management Andrew can reduce greenhouse gas emissions associated with manure by almost 2%, through a transition from summer application to spring application of manure and the use of low-emission application methods.

Spring application reduces ammonia emissions (NH_3) following land spreading due to the more favourable weather conditions at that time of year. Also storage losses are reduced due to the shorter storage period.

The reduced ammonia losses increases the fertiliser replacement value of slurry, and therefore reduces the total fertiliser nitrogen inputs and reduces associated emissions from manufacturing and spreading.

7.5 Better energy management

While energy usage accounts for a relatively small amount of total system emissions on dairy farms, the Carbon Navigator has identified that Andrew can reduce his greenhouse gas emissions by almost 1%. Three key areas are identified as having significant potential to reduce energy related emissions.

- Effective pre-cooling in a Plate Heat Exchanger
- The use of Variable Speed Drive (VSD) Vacuum Pumps and the
- Presence of energy efficient water heating systems.

Each of these three areas were relevant for Andrew, however the Smart Farming study drew Andrew's attention to the need to resize his plate heat exchanger.

Figure 7.1 Greenhouse gas emissions reductions identified on Andrew McHugh's farm

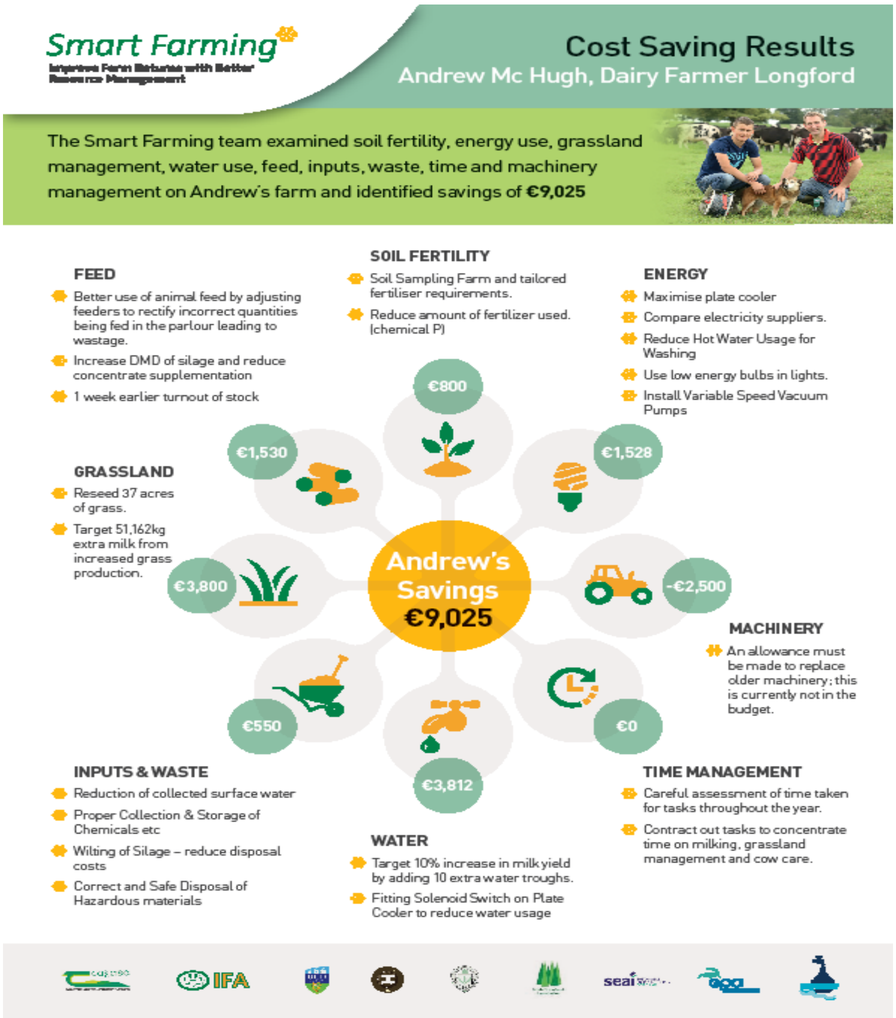
Measure	Action	GHG Change
Grazing season length	Increased grazing season length in shoulders of the year	-0.8%
EBI	Scope to improve EBI by 55 points – breed for milk production and fertility	-15.0%
Nitrogen Efficiency	Reseeding and grassland management to allow greater kg solids output per hectare for similar inputs.	-2.9%
Slurry spreading timing	Spread slurry 70% in spring v's current 60%	-1.9%
Energy efficiency	Reduce energy consumption through increased plate cooler capacity	-0.8%
Total		**-21.3%**

7.5 Energy production, forestry and biodiversity

In addition to using the Carbon Navigator decision support tool Andrew would like move to an energy neutrality position on his farm, whereby he is using the shed roofs and manures for renewable energy production. The lack of necessary stimulus measures from the Department of Communications, Climate Action and Environment is holding back the potential for farm scale renewable energy production.

Andrew would also like to complement his existing dairy farming enterprise by developing an agro-forestry and biodiversity strategy for his farm, which would allow him plant certain parts of his farm. However the compulsory re-planting obligation, restrictions on planting and administrative burdens around the forestry roads scheme all act as barriers to supporting the developing of an agro-forestry strategy on Andrew's farm.

Figure 7.2 Smart Farming cost savings identified on Andrew McHugh's farm



8. Concluding comments

Smart Farming is one means by which the agriculture sector in Ireland and in particular farmers themselves are endeavouring to provide leadership in addressing climate change. The programme draws on the expertise of the sector and complements other knowledge transfer programmes such as Better Farms, PastureBase Ireland and Dairy Sustainability Ireland.