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ARABLE (CEREALS)
Towards net zero

Approximately 2,695,000 hectares (ha) of cereal crops were grown in the UK in 2019 comprising almost 70% of all arable land[1]. The key greenhouse gas emissions arising from the cropping sector are (in order of impact) nitrous oxide, carbon dioxide and then methane.

Emission challenges

Nitrogen use efficiency

The main challenge for the arable sector is emissions of nitrous oxide. Emissions from the cultivation of soils, along with the production and application of mineral nitrogen fertiliser, is the largest source of nitrous oxide emissions from the sector. Emissions are dependent primarily on the nitrogen quantity applied and the timing and application method used. Losses of nitrogen in run-off also negatively impacts water quality.

Fossil fuel use

The major source of carbon dioxide emissions from the sector is from the use of fossil fuels (primarily diesel) on farm. Diesel used in agricultural machinery, transportation and in fans and heaters used for grain drying all contribute to an arable farm's emissions.

Decreasing soil health and organic matter

Arable soils are particularly at risk of degradation. It is estimated that the UK has lost 84% of its fertile topsoil since 1850[2]. The loss of soil structure, texture and organic matter has occurred as a result of highly mechanised systems, compaction, erosion and the inappropriate or sub optimum timing of cultivations. Degraded soils are a source of carbon dioxide emissions as soil carbon is lost in the decomposition of organic matter[3].

56%

of farmers were taking action to reduce emissions in 2017[4].

> It is the practices of the farmer that play the most important role[5].

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Short term solutions to reduce emissions

Productivity gains and optimising nitrogen use efficiency

More efficient use of nitrogen fertilisers and organic manures have the potential to increase productivity and reduce emissions. Improved nitrogen use efficiency can be achieved by:

- Balancing soil nutrients (N:P:K) through planned and precise application. This will provide for crop requirements and reduce nutrient losses to the environment.
- Minimising nutrient requirements by selecting the right crop, cultivation method and nutrient regime for conditions on farm.
- Investing in low emission spreading equipment for organic manures. Emissions during spreading can be reduced:
  - 30% by trailing hose,
  - 60% by trailing shoe,
  - 70% by shallow injection and
  - 90% by deep injection compared with splash plate application.

Mitigation of emissions from nutrient management provide the greatest potential for reduction. If the use of mineral nitrogen fertilisers could be reduced in relation to the yield, emissions can be reduced by up to 30%[6].

Improve soil drainage and soil health

Upgrading drainage infrastructure on arable farms will facilitate improved soil structure and soil health. The requirement for large scale drainage alongside water storage capacity will also be required as future climate modelling predicts wetter winters and increased summer storm events[7].

Use reduce tillage, residue retention and crops that fix nitrogen

Shifting cultivation practices to direct drilling and minimum tillage will further improve soil health and help increase soil organic matter. Reducing the intensity of soil cultivation lowers energy consumption and emissions of carbon dioxide. Overwintering of stubbles plus the use of cover crops are also valuable options to help raise organic matter in soils. Consider the use of leguminous cover crops such as forage rye, vetch, white clover and black oats to provide nitrogen inputs to soil thus reducing the use of nitrogen fertilisers.

Consider alternative land use for non-productive areas

Areas of lower productivity or high-risk fields should be considered for alternative land-uses such as:

- Arable reversion to permanent herb rich grassland.
- Increasing habitat area of pollinators to assist in crop fertilisation.
- Renewable energy generation such as solar panels, wind turbines or bioenergy crops.
- Increasing areas of woodland and silvo-arable systems.

Long term investments

Invest in precision agriculture technology and agri-tech
Minimising field traffic can reduce fuel use by up to 25% and lower carbon dioxide emissions[4]. Investing in tractor guidance technology improves pass to pass efficiency, reduces overlaps and application gaps. Autonomous vehicles and field robots are an emerging technology that may soon be available to implement at scale.

Variable application rate spreaders and sprayers help to avoid overuse and reduce environmental impacts and can have a payback period of between 2 – 8 years[8]. Investment in field mapping and yield software, as well as machines that are capable of variable rate GPS applications, will be required to optimise these systems. Using variable rate fertiliser application can reduce emissions of nitrous oxide by 5% without yield impacts[9].

Agri-tech advances such as the use of drones and autonomous vehicles allow applications of fertiliser and sprays onto growing crops without damaging impacts to the soil. Pivot and lateral move gantry irrigation and nutrient supply systems would also decrease compaction and vehicle travel.

Improve on farm storage of grain

Improvements in on-farm storage of harvested grain will have the benefit of reducing crop losses between harvest and point of sale. Reducing losses will increase the saleable tonnage and therefore reduce the emissions, as well as production cost, per tonne of product.

In recent years, due to the variations in the harvest seasons, grain storage and cleaning has been used to dry wet grain and cool hot grain, this requires energy efficient climatic control systems. These new buildings could be powered by renewables and provide additional opportunities for the capture and storage of rainwater for cooling and irrigation.

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