

Low carbon mixed farming **Summerhill Farm, Devon**

Introduction

Ben Moseley farms Summerhill Farm in Hittisleigh, Devon. Ben manages the 92 acre mixed farm along with an additional 50 acres which is rented on a long-term agreement. The predominantly improved culm grassland farm supports a range of livestock enterprises as well as 7 acres of rotational arable land producing cereals.

Livestock

The livestock at Summerhill Farm are the main source of emissions – producing approximately 53 tonnes of CO₂ equivalent per year. The farm has 600-700 laying hens, 450 geese for meat production, a 20 head North Devon suckler herd, and 20 Black Welsh mountain ewes. Beef cattle and lambs are kept on the farm through to finishing and are sold through a local co-operative. Because methane emissions from the cattle and sheep are part of a natural process and cannot be eliminated, effort needs to be focused on reducing the emission intensity on the farm – amount of gas emitted per kg of meat produced. This can be done to a certain extent through improved production efficiency.

Beef and sheep are reared on a grass based system with some home produced cereals used for feed. The 'home produced' nature of the diet reduces emissions associated with importing feed to the farm and the production of that feed elsewhere. The inclusion of legumes in the sward enhances animal performance –

compared to grass, legumes have less structural fibre and a higher protein content and are therefore more digestible and more efficiently utilised by the animals.

The cattle manure is also used to enhance soil fertility within the farm and aiding carbon sequestration. The manure is stored under cover in the summer months and moved outside in the winter, as part of the farms management practices – the release of nitrogen is highest during the early stages of decomposition, storing the manure inside during this period reduces the risk of nitrogen loss through leaching as the manure is on a hard standing and covered.



Geese are important part of the farm operation

Direct emissions from the poultry enterprises are minimal and predominantly come about from their manure. Poultry manure on the farm is managed to minimise emissions - it is composted and used with the farm yard manure. Another

aspect of the poultry enterprises which hold potentials in terms of indirect greenhouse gas emissions is the sourcing and import of feed. Summerhill Farm imports 40 tonnes of poultry feed annually, which is sourced from a local supplier - a cereal-based feed with a protein supplement.

Emissions from the livestock are somewhat counter-balanced by the potential the farm holds for carbon sequestration. Grazing management and therefore livestock play an important part in increasing carbon levels in the soil.

Grassland

Livestock grazing at Summerhill is a key aspect of grassland management which enhances carbon sequestration in the soil. Grazing grassland increases root turnover and grass productivity which increases above and below ground biomass and therefore the amount of organic matter in the soil, providing an increased source of carbon. The dense nature of grassland roots also contributes to increasing soil carbon levels – root contribute in building soil carbon both through the addition of biomass and also continually through root exudates, cell shedding and root hair turnover. Grass roots have the ability to distribute this organic matter throughout the soil profile and to greater depths than annual cereal crops. Fine root hairs can deposit carbon within soil aggregates where it is protected from microbial degradation and remains locked up within the soil structure.

Sheep generally follow the cattle as part of the grazing rotation – they graze more tightly, helping to improve productivity. Care is taken to ensure that land is not over grazed or poached as this can result in bare ground and damage to the soil structure which is detrimental to carbon

storage. Compacted soil can also lead to anaerobic conditions which promote the release of nitrous oxide as a result of denitrification.

Organic management at Summerhill Farm means that legumes are included in the sward to fix nitrogen. The potential emissions associated with the production and application of artificial fertilisers are therefore eliminated from the farm's potential footprint. Legumes provide a continuous supply of nitrogen throughout growing season to support grassland productivity. This continuous supply reduces the risk of excess nitrogen being lost from the system and emitted contributing to the farm's footprint. The presence of legumes boost grassland productivity and increases the amount of above and below ground biomass, this in turn raises organic matter levels in the system and increases the potential for carbon sequestration.



Varied on-farm activities contribute to its success

Pasture management techniques chiefly involve the application of lime to maintain optimum pH for grass and clover production. The breakdown of calcium carbonate (limestone) will contribute to emissions; however this is potentially balanced out by the subsequent carbon

sequestration which occurs as a result of maintaining grass and clover productivity. The sloping topography of the farm has to be taken into account when considering management techniques at Summerhill Farm. Minimal mechanical and tillage activities are carried out which impacts positively on the farm's carbon footprint - minimising soil disturbance and therefore breakdown and release of soil carbon.

Cropping

A small proportion of the farm (7 acres) is used to grow cereals. Feed wheat and oats are grown in rotation with a 4-5 year grass/clover ley fertility building phase - all grain produced is used to feed the cattle and geese on the farm, reducing the need for bought in feeds and the emissions associated with transportation and potentially less sustainable production elsewhere. Straw produced from the cereal crops meet some of the winter bedding requirements for the cattle. Indirect emissions from straw bought in are therefore reduced - straw is produced organically, on-farm, so nitrous oxide emissions resulting from fertiliser production and use are zero, as are emissions that would be associated with transport if straw was imported.

Direct emissions resulting from cereal production are limited to nitrous oxide emissions from the decomposition of applied FYM and as a result of soil disturbance, and from cultivation, which is minimised by using one pass with a harrow drill. Nitrous oxide emissions from the application of FYM are minimised by ensuring timely application of manure so that nitrogen is taken up by a growing crop promptly. The amount of FYM applied is also tailored to meet the requirements of the crop so that potential surpluses of nitrogen in the soil are kept to a minimum. The use of FYM as opposed to slurry is also better for reducing potential emissions as

FYM is a more stable form of organic matter.

The farm uses minimum tillage cultivation practices to minimise soil disturbance with 4-5 years grass before ploughing. This reduces the amount of both carbon dioxide and nitrous oxide lost from the soil. Microbial activity and therefore soil processes remain more stable and don't increase to the same degree as they would if the soil was turned over (as in ploughing) and fully aerated. Cultivation (soil disturbance and aeration) stimulates an increase in mineralisation - Summerhill Farm carries out cultivations in the Spring so that nitrogen is available to support the peak growth of the crop and the risk of losses to the environment are reduced.

Over winter, land used for cereal production is left as stubbles and then grazed - over winter soil cover is vital in ensuring nitrogen losses via leaching and volatilisation are minimised. The grazing of stubbles reduces the need for mechanical cultivation and associated carbon emissions, benefitting the nutrient and soil organic matter content of the soil.

A harrow drill is used within the cultivation regime to control weeds - organic methods of weeding such as this, reduce the farm's potential footprint by removing indirect emissions associated with herbicide production and application. Mechanical removal of weeds also leaves organic matter residues within the soil which are not chemically treated and do not affect the health of soil biology and subsequent activity.

Energy use

Energy and fuel use at Summerhill Farm accounts for approximately 10% of the farm's emissions. Renewable energy is one aspect of the efforts the farm is

making in moving towards a low carbon system. A photovoltaic system installed on the barn roof uses solar radiation to generate electricity reducing the farm's reliance on the National Grid and cutting CO₂ emissions attributed to the production of electricity. Energy from the photovoltaic system is also used to heat water for the farmhouse and camping facilities.



Photovoltaic cells are an important part of the farms' low carbon activities

The installation of wind turbines has also been considered which would require a large financial investment but holds potential in terms of farm income stream through the Feed in Tariff scheme. Ben is also looking into the possibility of a wood-fuelled boiler at the farm which would integrate well with the coppice management programme and offer a sustainable source of heat for brooding chicks and goslings – brooders are currently gas fuelled. This would also have potential within the new Renewable Heat Incentive (RHI) programme which would pay the farm for generating heat from a renewable source. The use of renewable heat would further reduce the farms reliance on non-renewables such as gas and oil and improve the carbon balance.

Small-scale, low powered machinery is used for on farm activities, matching suitable machinery to the job required to increase fuel use efficiency and minimise

emissions. Summerhill Farm concentrates on producing meat and eggs within the local area. Eggs are sold locally for retail, processing and box schemes. Beef is sold through a Cornish co-operative. The geese are sold as meat birds, directly to 2 wholesale customers within the Southwest. All farm produce is also for sale through the farm website which avoids the energy costs and other overheads associated with running and maintaining a shop on-site. These market routes, along with the use of a local abattoir and butcher, create a short supply chain, reducing associated emission and financial costs.

Potential Development

The strengths of Summerhill Farm include the production of renewable energy through photovoltaic cells, the use of low-input cattle and on-farm animal feed production; and the potential of the farm as a carbon sink. These are significant factors in low carbon farming which demonstrate the effective utilisation of on-farm resources and production systems which are maintained to naturally reduce inputs and subsequent emissions.

Ben is currently investigating the potential for installing a rainwater harvesting system on the farm. This would be significant in extending the farm's sustainability as well as reducing indirect emissions and other environmental impacts associated with mains water and sewage. Ben intends to have a 50-100,000 litre storage capacity - the system will collect water from the roofs of the animal housing and be used on the farm. It is planned that the water will chiefly be used for livestock drinking water and irrigating the polytunnel.

Many thanks to Ben Moseley for his time and input into the production of this case study.

For more information on low carbon farming and how you can reduce greenhouse gas emissions and increase carbon sequestration on your farm visit www.soilassociation.org/lowcarbon



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