

## **Low Carbon Farming – A Case Study of Home Farm, Kingscote, Tetbury, Gloucestershire**

### **Background**

Graham Nichols owns Home Farm near Kingscote, which is near Tetbury in Gloucestershire.

The conventionally managed farm grows seed potatoes over 85 hectares of Cotswold brash soil, on contract for a UK ware potato company. These are then marketed to the retail sector. The seed potatoes are grown within a 10 mile radius of the farm or on rented arable ground, in rotation with other crops such as wheat and oilseed rape. Currently seed potatoes comprise 85 hectares of the farm area, with 90 hectares of winter wheat, 90 hectares of oilseed rape and 40 hectares of winter barley.

The soil ranges from Cotswold brash to medium loam across the farm. The seed potatoes are planted in a minimum of 1 in 6 rotation, which is a DEFRA requirement, used to prevent the spread of disease in the crop. Winter wheat tends to be used as a major crop in the rotation with oilseed rape and winter barley. Pest and disease pressures such as aphids and potato blight are controlled chemically with regular weekly applications of pesticides. The need for tractor-mounted spraying is a consideration for the carbon balance of the farm due to the associated carbon emissions.

Aphid traps are used for the monitoring of aphid levels throughout the growing season and these can aid pesticide

application decisions and reduce the need to apply pesticides.

The farm has 10 hectares of woodland comprising spruce trees, originally planted in the 1960s, which is used as recreational area for locals. This woodland area is utilised as a renewable source of energy, with the wood used by the farm in wood-burning boilers. The woodland represents a long-term carbon-sink with sequestration by the trees and the wood providing a renewable energy source.



**Seed potato production is one of the main farming activities**

There are also 35 hectares of permanent pasture near the woodland, used to graze cattle by a neighbouring farmer and this represents another area of carbon sequestration. The management of grassland is important to its ability to sequester carbon most efficiently, with the roots providing a source of biomass contributing to the carbon balance of the soil. As long-term pasture, the more dense rooting system will therefore provide more

potential for building soil carbon. As the soil is left undisturbed it reduces the emissions of carbon dioxide and nitrous oxide to the atmosphere. There are, however, limited hedgerows with more stone walls surrounding the fields on the farm, so crops tend to be cultivated to the field boundary. This will compromise the ability of the farm to sequester carbon in the long-term, through lack of hedgerow and field margins, both of which are potential carbon sinks.

### **Farming Activities**

There is no crop irrigation carried out on the farm. A natural spring provides water on the farm for the tank mixing for all the necessary spraying of the seed crop. This avoids the need to pump water from other areas and the associated energy required. However, although small ponds exist around the farm-land, there are no significant wetland areas that contribute to carbon sequestration.

Pesticides are applied regularly particularly to control potato blight, a major threat to the potato crop. Potato varieties grown and supplied as seed potatoes will depend on customer requirements and will include Estima, Charlotte and Maris Pier destined for different commercial markets.



**Some of the farm buildings at Home Farm**

Weed control is carried out by herbicide application applied at the pre-emergence stage. This is carried out through tractor-mounted spray applications. Ploughing, bed-forming and then destoning is carried

out in the field prior to the mechanical planting of the seed potatoes. These activities require fuel to power machinery and also release sequestered carbon from the soil to the atmosphere. This is likely to affect the carbon balance of the farm.

Fertiliser soil tests are carried out around the farm with agronomists advising on levels of input required. This usually comprises phosphates and potash to the soil in a granular form applied by a mechanical spreader. This is a slow release means of fertilisation to the crop, but as an inorganic supply of fertiliser, would represent a source of N<sub>2</sub>O emissions both through manufacturing process and subsequent degradation within the farming system. The nutrient use efficiency of the crop will be critical to the net emissions from fertiliser applications. Timings and applications of fertilisers are also critical to reducing carbon emissions such that input meets the crops demands and leaching and volatilisation is avoided.

Straw from cereal production is baled on the farm and sold to other local livestock farmers. The manure from the livestock animals is imported back to the farm and is also applied to the fields prior to crop cultivation. The manure is stock-piled and kept outside uncovered which could be a source of Nitrous Oxide (N<sub>2</sub>O) release. N<sub>2</sub>O losses could be reduced by covering the manure, such that volatilisation is reduced, particularly during the early stages of decomposition. This is currently not considered cost-effective for the farm. Nitrous oxide emissions can also be limited by application timing, such that it is readily taken up by the crop. Emissions from solid manure systems tend to be lower than liquid, it therefore provides a preferred form of input compared to slurry, as it is a more stable form of fertiliser, and will promote the formation of soil organic matter.

The amount of methane produced during decomposition of manures will be influenced by climate and the way in which it is managed. Farmyard manure (FYM) contains compounds more resistant to decay than liquid sources, and provides a good source of organic matter. It is also locally-sourced which reduces carbon emissions associated with transportation. Poultry manure from a local unit is also used on the farm as a form of organic fertiliser. This is a source of organic fertiliser which will increase the carbon content of the soil.

Ploughing of the field prior to cultivation is required for black grass control. This would be a source of carbon release from the soil through machinery use. It could, however, also help balance emissions from energy required to apply pre-emergence herbicides.

Harvesting of the seed potatoes is only carried out after careful monitoring of the crop every week. The crop is sprayed with a desiccant and left for 3 weeks prior to harvest. The crop is then lifted with a 2 row potato harvester and placed on trailers for transport to the store. A grading line is used to remove stones and soil. Energy usage is therefore a consideration during this stage of harvesting of the seed potatoes.

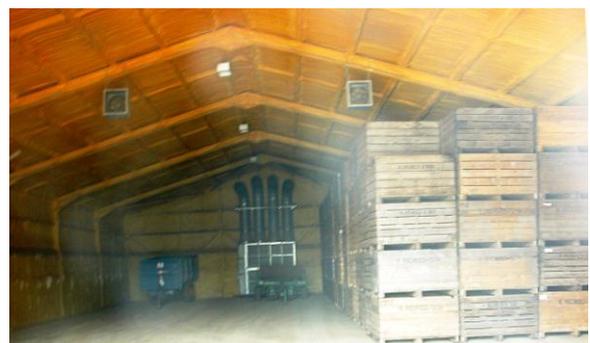
Outgraded seed potatoes are utilised for stock-feed and are transported to local farmers for this purpose. This minimises waste, decomposition and associated methane emissions to the atmosphere, by using it as an animal feed source. The farm utilises local trade routes for inputs and outputs on the site, which will be beneficial to the carbon balance of the farm.

One of the major activities on the farm during the winter months is potato grading. This is carried out in house using a potato-grading device, which sorts the

seed potatoes by size. Size specification of the seed crop is very strict for the growing market and is set between 35-55mm.

The crop is lifted with a 2 row potato harvesting machine and trailers are used to bring the crop back to store. The grading line also allows the removal of stone and soils from the seed potatoes. All machinery is owned and maintained on-site with no external contractors used. This avoids the need for contracted machinery to travel to and from the site, the associated energy usage and carbon emissions.

Produce storage facilities chiefly comprise grain drying, which is oil powered and potato cold storage which is powered by electricity. Boxes of seed potatoes are stacked 5 high during storage and cooled air circulates throughout the storage area. The prolonged cold storage of potatoes at 40C will account for most of the energy use on the farm. The stores are lined with 75 ml foam insulation to reduce energy losses and comprise an important part of carbon emissions on the farm. Electricity usage is therefore a significant part of the farms carbon balance with refrigeration required for a prolonged period of time.



**One of the main energy requirements is for temperature-controlled storage of seed potatoes**

## **Resource Use**

Recycling activities are carried out on the farm, with metal and plastics forming the bulk of this. A major recycling consideration is fertiliser and potato bags,

which are transported to local contractors for this reason.

The natural spring on the farm is important to the farm operations and is used for the mixing of pesticides for subsequent application. This avoids the need to source water from elsewhere or to store water on the farm. The availability of spring water will reduce the farm's water footprint and benefit the carbon balance of the farm generally.

## Renewable Energy

Photovoltaic cells have recently been added to a south-facing roof of one of the out-buildings. The solar photovoltaic (PV) array consists of 42 panels, each of approximate dimensions 1.66m x 0.99m. Each panel is rated at 235 W with a total array of 9.87kW. The panels are laid out in 2 blocks each containing 1 row of 21 panels. This reduces the need for the farm to import electricity from the national grid. It is too early to establish the financial benefits as yet as the PV cells were installed in early 2012.



**The installation of photovoltaic cells on outdoor buildings will help offset energy usage.**

It is likely that the electricity generated would make a significant saving to the costs of running the storage facilities on the farm and the general carbon balance of

the farming practices. It also offers a potential income stream via the feed-in-tariff from renewable energy, whereby electricity is sold back to the national grid. Other roofs on the farm comprised of asbestos, do not provide a suitable surface for expansion of these solar panels at present.

There are 2000 tonnes cold storage and 1000 tonnes ambient storage on the farm site and so significant savings are anticipated.

## Potential Development

The fuel/electricity prices are a major concern in terms of cost-efficiency on the farm and an extension of the solar-panelling, should sufficient benefits be realised, would be considered if further installation space could be found. Asbestos roofs do not provide sufficient suitable space and the use of field would compromise areas currently used for crop growth. The elevation of the farm would however provide opportunity to utilise wind power as a form of sustainable energy. At 700 ft above sea level this has potential for the farm but the high initial investment involved, does not make this an immediate priority.

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Many thanks to Graham Nichols 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](http://www.soilassociation.org/lowcarbon)



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