Growing food, absorbing carbon

Jonathan wrote this for *The Organic Grower* summer 2010 edition. It gives a good sumation of the need for and uses of carbon calculators and the major carbon sinks to be found on farms.

Growing food, absorbing carbon

This new series of articles will explore the links between horticulture and climate change, and the measures that growers can take to actively reduce the carbon footprint of their businesses.

In total the food chain, from field to plate, is responsible for over 30% of the UK's emissions of greenhouse gases (GHG) that are driving climate change. The UK Government have committed to reducing national carbon emissions by 80% by 2050, which can't be achieved without agriculture and horticulture playing a central role.

Carbon footprint

GHG are more commonly referred to, albeit inaccurately, as “carbon emissions”. This is however helpful in relating to carbon footprints and becoming converse in the new global currency and language – carbon.

A carbon footprint is a measure of the amount of carbon a person, business or organisation emits during a year. On average, each person in the UK emits around 10 tonnes(t) of CO2 per year, from activities such as powering their homes, domestic and international travel, food consumption, manufactured goods and a share of public services.

To put this in a global context, an American emits around 20t/year, a Chinese person 2.2t/year and someone from Uganda less than 0.2t/year (Source:UNEP). Per capita emissions are strongly linked to income, living standards and culture.

An important principle to establish is that whilst every responsible business should be concerned in measuring and minimising its carbon footprint, all carbon emissions are passed on to its customers through the goods and/or services they sell. So, for example, a potato grower calculates their business emits 10t CO2/year, and produces 10t of potatoes a year. That grower would

attach a “carbon tag” of 1kg CO2 per kg of potatoes they sell. At the end of the year the growers' carbon footprint would be 0.

Producing food with a low carbon footprint

An equitable and sustainable global carbon emissions target is 2.2t per person per year, so everyone should be aiming to decrease their personal Carbon footprint to this level. Because businesses don't accumulate carbon (people do) consumers should be looking to buy food, goods and services with a low carbon footprint, and its up to businesses to supply these.

So where do growers come in to this? A carbon footprint is applicable to every item of food as all agricultural and horticultural operations emit GHG, from diesel in tractors to ruminants belching methane and the CO2 created in plastic manufacture used for all sorts of applications on farm. Reducing the levels of these gases from food production is critical in reducing the effects of climate change, but this will be the focus of future articles.

Stewards of land are in an almost unique position in not just being able to minimise carbon emissions but to sequester (absorb) carbon in the soils and biomass of the land they manage. The rest of this article will look at the sequestration potential of various assets on farm, with a numerical value to see the relative benefits of each asset.

Trees

When they're growing, trees absorb vast amounts of CO2 which is held in the woody material of the plant until it does or is cut down. At this point the carbon is either decomposed by micro-organisms (subsequently becoming humus), stored in wood (like furniture) or released as CO2 when burnt.

Trees also store carbon in the soil that their roots inhabit and this stays locked away until the soil is cultivated or eroded. Broadleaf and coniferous woodlands absorb in the order of 10t CO2/ha/year in both soil and biomass.

Hedges should, in carbon terms, be viewed as lines of small coppiced or pollarded trees. Growth rates can be staggering in a well managed hedge and hence its ability to absorb CO2 is substantial. A 100m length of mature hedgerow can sequester in the order of 120kg (0.12t) CO2/year.

Stands of short rotation coppice, such as Willow can absorb vast

amounts of CO2 because their growth is so vigorous. Indeed sequestration rates of over 20t CO2/ha/year have been recorded.
Orchards are also a potentially large carbon sink, particularly those with large mature trees. Rates of up to 3t/ha/yr are possible and of course this is coupled, unlike other trees, with a significant food crop!

Grassland

This is less applicable to horticultural growers, but permanent grassland can sequester vast amounts of carbon, most of it held in the soil. But don't discount grass pathways and headlands that aren't cultivated. A 100m length of a 2m permanent grass margin could sequester over 75kg (0.075t) CO2/year.

Soil

Here is perhaps one of the most remarkable and overlooked carbon sinks that the planet has. Organic matter is over 50% pure carbon, and that carbon has two fates - either it can become stabilised in the soil as humus, or it can be oxidised in to CO2 when cultivated or eroded.
Truly sustainable land management will continue to build humus, at varying rates, for many years. Most cultivated UK farmland has less than 3% organic matter, yet a mature broadleaf woodland would have soils of over 10% organic matter.
Building organic matter levels in the soil requires a two pronged approach. Firstly, by adding organic matter in the rotation in the form of composts, manures and green manures as appropriate.
Perhaps more important is to exercise very sensitive soil management to hold on to what organic matter you have, oxidising as little as possible and building a stable and resilient soil structure. Covering the soil for as long as possible is so important, whether by annual crops, green manures, grasses or perennial crops.

Measuring soil organic matter is quite easy, cheap to have analysed (about £7 per sample) and very good practice. The implications of concentrating the mind on organic matter levels in the soil run right to the heart of good growing and good business. A soil with rising organic matter levels will be well managed and healthy. Healthy soil makes for healthy plants, which means good yields and

(hopefully) financial profit.

Rates of sequestration in soil is staggering. 1 ha of soil that raises its organic matter level by 0.1% per year – which should be easily attainable, can sequester 900kg (0.9t) CO_2/year.

The wider picture

What this article aims to outline is the range of living assets that a grower has to reduce the carbon footprint of their business. By carefully managing soils and biomass, and making informed plans for the future, its certainly possible that a sustainable horticultural business can absorb more carbon than it emits. That's a very exciting concept and makes “carbon neutral” look paltry in comparison to “carbon negative”. Or should that be “carbon positive”...?!

Source: http://www.farmcarbontoolkit.org/resources/articles/growing-food-absorbing-carbon