Supply chain interest in climate positive farming: is it a route to net zero?

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In the brewing and distilling sectors, the evidence is mounting that the adoption of regenerative farming practices such as minimum tillage and cover cropping by malting barley growers can contribute significantly to Scope 3 emissions targets, by reducing farm-level GHG emissions and increasing soil carbon sequestration. But for this to translate at scale into 'triple win' benefits for people, prosperity and the planet, and to avoid claims of greenwashing, the supply chain must collaborate to provide consistent, robust, outcomes-based data and, by sharing best practice, give growers the confidence to embrace these practices without incurring yield penalties or high investment costs. Reliable metrics are already in place for farm-level carbon emissions, and are in development to measure soil carbon sequestration. In addition, a relentless focus on maintaining and increasing crop yields through improved soil health will be imperative to ensure the transition is sustainable in the long-term for growers, maltsters and end-processors, argues industry sustainability consultant Dr Nigel Davies.

There has been a remarkable upturn in interest in the carbon emissions and risk profiles of farming as large global retailers recognise that supply of raw materials is a major source of embedded (scope 3) emissions. Some of this is driven by a desire to minimise GHG emissions but also for many it is to comply with voluntary initiatives such as Science Based Targets and their new scope 3 focus: Forest, Land and Agriculture (FLAG). There is an expectation that FLAG emissions can be reduced by requiring companies to set FLAG reduction targets in addition to their own operational (scope 1 and 2) emissions targets being set to net zero.

It is also recognised that carbon targets alone will not achieve sustainable change unless they address the United Nations 17 Sustainable Development Goals (UN SDGs). The UN SDGs recognise the importance of climate (goal 13), clean energy (goal 7), innovation (goal 9) and responsible production and consumption (goal 12) as essential components of an action plan but also cover the impact on life below water (goal 14) and life on land (goal 15). One of the most important goals to achieve such a wide-ranging shift in sustainable development is goal 17, partnership for the goals. It is essential that supply chains cooperate to achieve improvement rather than just issuing questionnaires and codes of conduct and waiting for improvement.

The brewing and malting sectors have been exemplary in connecting their vertical supply chain from farm through maltings process to final beer production in a way that seeks to understand the pressures on farmers and to facilitate field trials of alternative production methods to determine which have the greatest effect on reducing embedded emissions in cereals and at the same time improve soil health and resilience.

The legislative requirements for reporting this type of data in annual reports is also driving interest in obtaining farm data to fully evaluate supply chain carbon and water intensity. It is not an easy challenge for the supply chain to determine the carbon intensity of inputs, but that should not stall the process. Farmers are of course suspicious at the outset of any supply chain partner who asks for use of their data, a fear driven by concerns over data security and the potential to place onerous demands on them for emissions reductions that may not be reflected in the price paid. Farmers already feel pressure from decreased income whilst the new Sustainable Farming Incentive (SFI) environment protection payment structures develop.

There is too much negative narrative around the impossibility of calculating scope 3 data. A number of tools can be used to measure carbon emissions in field. The rhetoric is that you can get any value you want to from such tools, but the reality is different. If a reputable carbon calculator is used the difference between them for cereal growing is around 20%. In business it is common to accept 80% certainty and 20% uncertainty as sufficient to make strategic or operational decisions so why should it be different for carbon emissions?

Spend based estimation can use environmentally extended input-output (EEIO) models. A list of 53 models is given in the GHG Protocol. There are others available. Are such estimates useful? IFRS S1, the new reporting standard being adopted in the UK recognises that the use of reasonable estimates 'does not undermine the usefulness of the information if the estimates are accurately described and explained' (point 79).

It is also anticipated that data may take time to emerge. The European Sustainability Reporting Standards (ESRS) S1 is the rule book to guide companies through CSRD compliance and is supported by very helpful guidance through European Financial Reporting Advisory Group (EFRAG). In that document paragraphs 69, 89 and 132 all refer to uncertainty of data and recognise that it could easily take up to 3 years to develop meaningful data and it supports the use of sector-average data and other proxies.

A number of tools were recently analysed for Defra that generally supported this position, although for other sectors the variability could be much greater. For businesses using cereals for food manufacture it would be common for the growing component to be around 60-80% of the upstream scope 3 emissions and a calculator is a desirable way to estimate such a significant contribution (Figure 1).

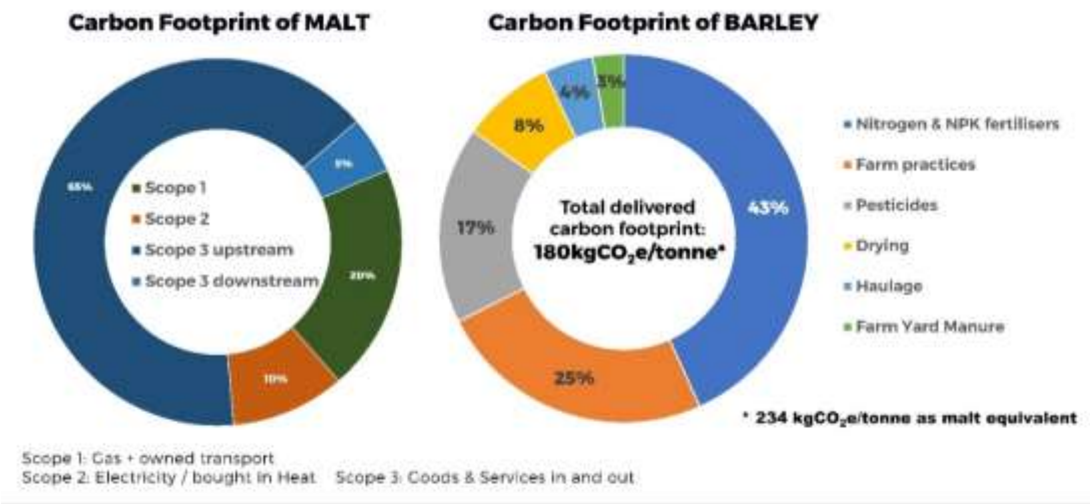

Figure 1: Typical data for the carbon footprint of Malt indicates that 65% is from upstream embedded carbon. The majority of that comes from the growing of barley to be malted. Nitrogen fertiliser production and post application emissions account for 43% of that. Newer fertiliser production methods that avoid fossil fuels and generate ammonia rather than nitric acid will dramatically reduce this contribution. Nitrogen is much more significant in terms of emissions because its global warming potential is 256 more than carbon dioxide

The tools available for carbon calculation may not be perfect but they are getting support from the supply chain. One of the most popular, the Cool Farm Tool has upwards of 40,000 users worldwide and is often chosen by international brands as a globally relevant tool. It currently does not have the capability of measuring sequestered carbon, but that is being developed. Some tools available in the UK may better represent the specific practices, climate and land types that are farmed and are still valuable as complementary calculators. Many of these systems such as Sandy (Trinity AgTech), Agrecalc, Farm Carbon Toolkit or Omnia (Hutchinsons) will gather and process farm data combining satellite imagery with in field measurements and input data to generate yield and fertiliser application maps and carbon footprint and sequestration data and are a great aid to a farmer. Other organisations such as MapofAg and Agricarbon offer to facilitate farm data capture and analysis. There is a wealth of assistance to get high quality data and present it in a way that is easily understandable and verifiable.

For other upstream input costs a spend-based calculation is a useful estimation. Again, this is met with doubt by many who believe it cannot be an accurate way to estimate emissions. Defra have through the University of Leeds made available a spend based conversion for many years. The author has found that such estimations are at worst around 10-15% higher than real data once if it can subsequently be obtained. Others report differences of up to 20%, but again such a small differential is better than having no analysis at all. The importance is not to determine the specific value, but to identify the most significant supply chain areas that are contributing to embedded carbon and work with them to understand their challenges, ultimately obtain real carbon intensity data and develop close relationships to move towards net zero together.

The approach in encouraging the supply chain to move to lower carbon farming practices can be quite different. For example HEINEKEN have a global programme to reduce FLAG emissions by 30% by 2030. The brewing company is working closely with around

15,000 farmers, supply chain partners and agronomists to obtain on farm data for soil organic matter, farming methods and sequestration and aims to be net zero across the supply chain by 2040 without the large scale purchase of offset carbon credits.

An alternative approach is taken by Carlsberg who are promoting the uptake of regenerative farming practices first through their Together Towards Zero initiative. Although they are doing baselining activities to determine the starting point for soil conditions their target is to have 30% of raw materials sourced from farms using regenerative agriculture practices by 2030 and 100% by 2040. This qualitative approach will require significant additional testing to prove that the regenerative practices have delivered benefits for the soil and genuinely reduced emissions.

Regenerative agriculture (RA) is also believed to have a contentious definition. It does not need to be so. A definition can be made complex, or rather simplified to get traction and acceptance. At many conferences it is said that there is no definition of regenerative agriculture. This is just not true as other articles in this journal have explained. One interesting piece of work (Newton et al, 2020) showed that wherever regenerative agriculture was mentioned in the scientific literature over 86% of the outcomes were to improve soil health and organic content. The methods to achieve it were predominantly cover cropping (46%) and inclusion of livestock (41%). As a working definition to say that regenerative agriculture aims to build soil organic content and protect soil health is one that should be sufficient to focus on.

Farmers practicing carbon farming can sequester significant additional carbon by planting the ground between harvest and the next drilling and use natural photosynthesis in these plants to capture and drive carbon deep into the soil through the root system. Their efforts should be seen as mitigating the impact of global warming whilst we get to a genuine net zero position by reducing emissions and not mathematically cancelling them out by buying carbon offsets, or insets as they are termed when bought within your own supply chain. This is also not a solution to global warming but is a supportive method to alleviate some of the contributing activities.

The Paris agreement set a target to improve soil carbon by 0.4% a year whereas in the UK in recent years soil carbon has decreased by 0.6%. Does sequestered carbon really stay in the soil? This is a key point and soil carbon must be measured. Interestingly if you measure the carbon emissions at the soil surface you can be fooled. Soils which cycle a lot of carbon in the top 10 cm are also excellent at driving sequestered carbon deep into the soil up to 100cm depth. This sequestered carbon is not released by ploughing hence farmers can still disc or plough just the surface 10cm to control weeds without releasing sequestered carbon. Sub-soiling of course would potentially release carbon and would not be part of such a minimum tillage sequestration system.

There are many international standards such as Verra or Gold Standard that define how and what should be tested to determine if sequestered carbon remains in the soil. Soil carbon measurement should be viewed much like stock market investments. If you check your share price every day you will likely sell at the wrong time. Taking a 3-5 year view of price trends usually results in a better decision. The same is true of soil. Soil carbon measurements are notoriously variable especially if you don't consider the depth you need to sample. Taking a baseline and then subsequent analysis over sufficient points in a field at 3 and 5 years gives a better picture and many trials have shown significant increases in soil organic matter over such time periods.

Is organic farming equally as good? The short answer is that it is not because in almost every case there is a yield penalty whereby to get the same yield you need to use twice the land area. Proponents of organic farming seem blinkered at times by their practices being legally defined to the importance of the lack of yield. Organic farming is one choice that aligns with regenerative principles and its aims are sound: improved biodiversity, minimal inorganic fertiliser use, improved soil health, good animal husbandry. The yield penalty however cannot be ignored. An analysis of the impact of the UK switching to organic farming by was made (Smith, Kirk, Jones, 2019) and the headline was: "We predict major shortfalls in production of most agricultural products against a conventional baseline." Taking yield into considerations net emissions are greater with organic methods. Only when organic farming can develop improved yields will it be a suitable method to address climate change.

There are multiple benefits of regenerative farming:

- 1% increase in soil organic matter improves drought resistance by 5-10 days
- Improved soil water retention results
- Less additional synthetic fertiliser required
- Greater resilience to flooding
- Improved soil structure
- Soil carbon increase is gained in weeks
- Much lower cost than tree planting
- No long-term land-use change
- Less run off into ditches & other water courses

This is attested to by field trials which show a 60% reduction in nitrate leaching when using cover crops (Frontier).

The supply chain is keenly interested in regenerative agriculture. Data from FAIRR 2023 from 79 agri-food companies is shown in Figure 2. The interest is high but the type of target is not matched with such force. For the same group the targets were largely qualitative based on generic statements and only a third had set quantifiable targets.

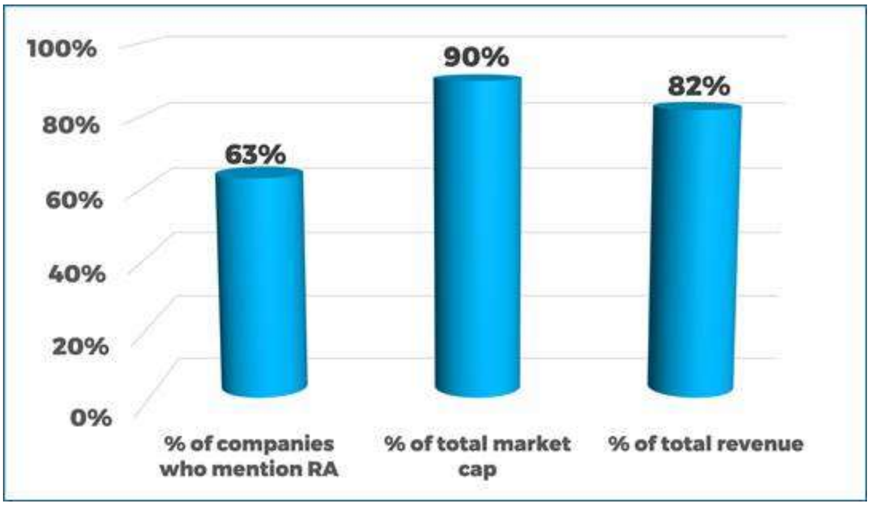

Figure 2: Companies with regenerative agriculture initiatives and related financials. Data source: Bloomberg FAIRR 2023

The type of target set is analysed in Figure 3 from the FAIRR report. Companies choose to make predominantly area or volume targets (30%) with only 12% setting outcome or farmer based targets. The latter are essential to determining if targets are being effective in sequestering carbon, reducing the use of additional fertilisers in subsequent years and making those changes permanent. If targets remain qualitative the danger of greenwashing is ever present.

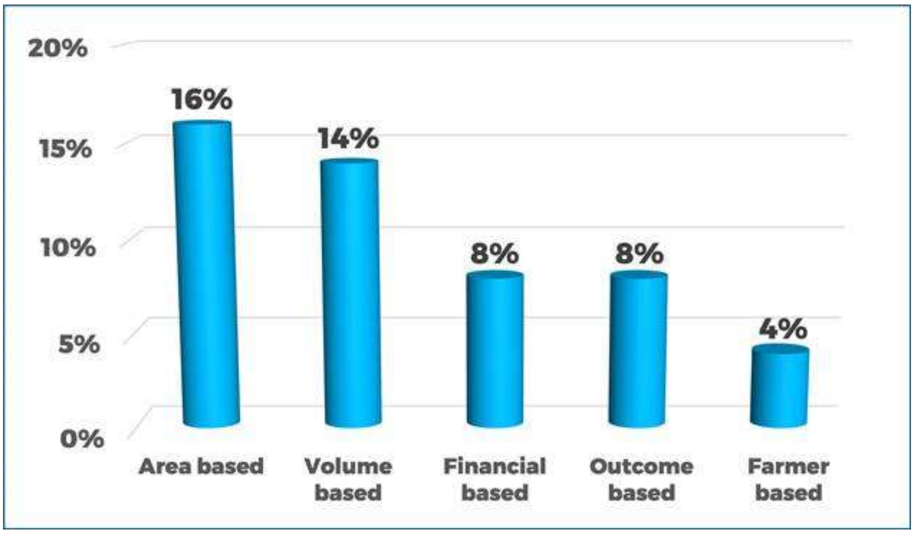

Figure 3: Where companies have a target where do they choose to act? Data source: Bloomberg FAIRR 2023

There is still a lot of unhelpful talk around regenerative agriculture in the supply chain. Some report losses as high as 40-60% when switching to regenerative agriculture. Most commonly this is a result of high mechanisation investment cost which is not always the most effective or necessary way to introduce RA practices. Cover cropping using common species like clover, vetch or Phacelia is a relatively cheap solution that has been shown to sequester carbon up to 5 times faster than trees and at a fraction of the cost. There are still barriers to moving regenerative practices at scale. Rabobank described it as "nailing jello to a wall of marshmallows with a sledgehammer". Their report cited common objections such as the presumed impacts on raised protein levels, non-defined practices, yield penalties. All of these can be refuted with good quality data by those who have a long history of farming using RA. The conclusion was that brewers, or indeed any supply chain user, interested in promoting these practices need to make a long-term commitment to their growers and provide support via technical assistance and incentives to implement these practices. There are groups of farmers around the world who are delighted with their regenerative farming practices. In the US, some insurance companies offer reduced premiums where RA is used because they receive less claims for crop losses even where it is used on quite marginal land.

The prevalence of supply chain partners claiming to be net zero is increasing. Where those claims are based on the crop becoming carbon negative caution is advised. In UK trials some farmers growing malting barley have used RA via cover cropping to reduce barley carbon footprint from 200kgCO_2e/tonne to 0-10kgCO_2e/tonne. Some of the best trials show even better results with the crop becoming carbon negative. If the crop carbon balance uses carbon credits from sequestration this should be limited because the Science Based Targets guidance is that only a maximum of 10% of a net zero claim should derive from credits. The focus must be on genuine reduction of inputs to achieve net zero and then to use any sequestration as a climate positive activity. The same is true of those who try to claim that grassland on a farm that has been in existence for many years makes their farm net zero. The sequestration in that land was already happening prior to the calculations of additional carbon sequestration required to combat climate change. Such claims in reality show a farm is mathematically zero emission but are not in reality contributing to additional carbon capture and are not true net zero operations.

Farmers are rightly nervous about any change in practice that could affect margins that are difficult to maintain. The supply chain being interested in working with them is good, but it must be aware of their concerns: they may desire to transition to regenerative agriculture but lack financing; the supply chain must share the cost of transition if yield drops; they must support peer-to-peer learning groups.

The outcome of regenerative agriculture should not primarily be about the generation of carbon credits – that's a potential bonus – it's about yield, biodiversity, and soil health.

It would be a more reliable and flexible supply chain if contracts were placed at a premium for farmers who could provide verified low carbon raw materials. If the supply chain buys carbon credits from a farmer it has to ensure that those carbon credits are locked away permanently. That is a difficult long-term commitment for a farmer to make and supplier to rely on. Contracts for carbon credits are made with minimum disturbance contracts that restrict a farmer ploughing a field that has had sequestration verified and from which he has sold the carbon credits. The safety net is that carbon sequestration that is verified over a number of fields does not all have to be sold and can be a carbon bank to bring into play credits required because a field needs to change use. For tenant farmers ownership of embedded carbon when they take over a farm or losing value from regenerative farming investment if they move on are serious barriers to entering the carbon markets.

A less problematic option is that if low carbon status is verified using an approved scheme or tool then a premium can be paid for that year only. The supplier gets a guaranteed lower carbon supply chain, the farmer receives payment and no long term sequestration issues result. A farmer who manages to introduce low carbon practices over many years will of course gain the benefit if reduced input costs, higher margins and premium payments for being a leader in this important area. If regenerative agriculture practices become common place in the future then premiums will likely cease, but the benefits accrued in the soil in terms of health and resilience provide what is perhaps a stronger incentive for farmers to adopt the practices and the supply chain to recognise their role in ensuring their raw materials are available for the long term and are sustainable and profitable.

Food and beverage supply chains are under scrutiny to provide clear, verifiable data that they follow true Environmental, Social, Governance (ESG) practices and have robust data to support net zero plans. The demand for data across supply chains will not go away. If properly managed it is a beneficial activity that builds resilience into raw material supply, improves profitability for all in the supply chain and minimise the overall impact on the supply chain. This is the so-called triple bottom line benefit that is the collective aim: benefitting people, prosperity and the planet.

Summary

- The drive to attain net zero is accelerating and expanding to address risk and opportunity
- The demand will not go away!
- Uncertainty should not stall emissions reductions – don't procrastinate due to the detractors

- We must address financial rewards for farmers and encourage and publicise good case studies where farming practices achieve verified carbon sequestration and improved profitability

Dr Nigel Davies founded Maltdoctor Ltd in 2020, a specialist sustainability consultancy in the food and drink sector, having previously been Director of Manufacturing, Technical and Sustainability with maltsters Muntons for 25 years, a research scientist in cereals and a lecturer in cell biology at London University. In 2004 he designed the world's first carbon footprint tool for malting barley. 'Pragmatic Sustainability' is how he describes his approach, and he is passionate about cutting through the procrastination and barriers that delay us getting on with climate protection. Nigel is Honorary Associate Professor at Nottingham University, School of Biosciences, and a Fellow of both the Institute of Food Science and Technology and Institute of Brewing and Distilling. He has twice been awarded the accolade of being in the top 100 leaders in sustainability in UK manufacturing, being described as 'an inspirational leader' and a 'driver of cultural change'.