

# Going with the Grain:

## Malting Barley Emissions and Bulky Organic Manure Use

### Introduction

The Scotch whisky industry has pledged to be Net Zero by 2045<sup>1</sup>. Along with other industries, governments, and wider society, they recognise climate change is a significant threat. This project investigates actions the supply chain can take to reduce malting barley emissions.

Malting barley is a key ingredient of Scotch whisky. It is arguably Scotland's most economically valuable and important crop because of its use in whisky and beer production. Whisky is one of the country's most valuable and well-known exports, contributing £5.3 billion to the Scottish economy in 2022<sup>2</sup>.

The project focused on crop fertilisers; specifically bulky organic manures (BOMs) produced locally from wastes. Synthetic fertilisers make up a large part of a crop's carbon footprint. Some farmers can use BOMs as an alternative to synthetic fertilisers, taking a circular bioeconomy approach to crop production. This approach has many potential benefits, but there are barriers to increasing use including market perceptions and logistics. This project aimed to quantify BOM's potential for emissions reductions and identify and investigate barriers to increasing their use. It focused on green anaerobic digestate with farmyard manure and compost as comparisons. The supply chain collaboration has built an evidence base to support supply chain actions that can drive change.

### Background

Previous trials and reviews considering the use of digestates, composts and other forms of renewable waste show they have potential to improve crop yields, improve soil quality, and reduce reliance on synthetic fertilisers. Their use can help with key sustainability drivers such as reduced waste and reduced carbon footprints.

Uptake of BOMs has been limited by a perceived lack of acceptability to key markets, with concerns over public acceptability and perceptions of possible risk to soil health being cited by key stakeholders for certain types of digestate. At the same time there is a lack of compiled and

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<sup>1</sup> <https://www.scotch-whisky.org.uk/industry-insights/sustainability/>

<sup>2</sup> Scotch Whisky Association (2024). Scotch Whisky's Economic Impact 2022. Retrieved from <https://www.scotch-whisky.org.uk/media/2170/scotch-whisky-economic-impact-report-2024>.

quantified evidence on their sustainability and productivity benefits that would allow key stakeholders such as the Scottish Malting / Distilling Industry to consider the inclusion of these types of renewable fertilisers. Now, with global concerns around climate change, the drive to net zero, increased focus on soil health, ongoing rising fertiliser costs, fertiliser supply issues and the potential impacts to crop production and supply, industry must consider change which will support and enable the use of alternative sources of soil fertility.

In 2019, arable farms in Scotland accounted for 3.8% of Scotland's total GHG emissions. The spring barley crop accounts for 55% of Scotland's cereal growing area (258,702 hectares) with half being used for the drinks sector and nearly the rest destined for animal feed. Crucially, 28% of arable crops' GHG emissions is attributed to fertiliser manufacture. Not only is the use of synthetic nitrogen fertiliser a high carbon emitter it is also a costly input for arable farmers. This project identified and clarified barriers to increasing bulky organic manure use, built an evidence base to support actions to drive change, identified opportunities and risks to businesses, including supply chain logistics, and produced concrete recommendations for the supply chain to implement.

Long term collaboration is the key ingredient to building solutions designed to spread the cost and reward of an accelerated transition to net zero. The project also aims to strengthen relationships, communication and understanding across the supply chain, paving the way for future work on new decarbonising initiatives that will involve trade-offs. The project was authored by the Scottish Agricultural Organisation Society (SAOS), with significant input from SAC Consulting. Project partners include: Scottish Quality Crops (SQC), The Scotch Whisky Association (SWA), and the National Farmers' Union of Scotland (NFUS).

Anaerobic digestate was the focus, with farmyard manure and compost also investigated as comparison BOMs. They were identified as potentially viable sources of fertiliser and carbon for growing cereals used for distilling in Scotland. The review of the regulatory and policy environment extends to other BOMs to give a comprehensive overview of the requirements of their use and provide further information to support the report's findings and recommendations.

## Project Aims, Scope and Methodology

The aims of the project were to identify and clarify the barriers to increasing the use of bulky organic manures, including distiller and market perceptions, regulatory and policy barriers, and land-bank logistics and supply chain barriers.

The project identified opportunities and risks to businesses across the supply chain. Including potential cost savings throughout the supply chain, environmental and business risks, and potential unintended consequences.

The project partners, SRUC and SAOS, carried out desk research and interviews with supply chain stakeholders including AD Plant operators, digestate spreaders, farmers, and distillers.

The outputs of the project included:

- Distiller focus groups and surveys to narrow and refine the scope of the project.
- A literature review to summarise the types of bulky organic manures, availability in Scotland, benefits and risks to soil health and identification of knowledge gaps.
- Analysis of opportunities and risks. Focusing on potential for on farm emissions reductions and financial savings potential of replacing synthetic fertiliser with green digestate (and farmyard manure and compost for comparison). The potential for emissions reduction was determined using AgreCalc.
- An overview of digestate production, spreading and other logistics requirements. Based on interviews carried out with an AD operator and spreader.
- Innovations in Processing Digestate Case study. The AM-Power biogas plant, Flanders, Belgium
- Review of policy and regulatory landscape. Including the existing requirements mitigating environmental risks, the anaerobic digester sector regulatory requirements and horizon scanning.
- A detailed standards comparison of PAS100, PAS110, SQC Approved Digestate Accreditation Scheme, and the Biosolids Assurance Scheme (BAS).

### **Bulky organic manures in scope**

Bulky organic manures or materials (BOM) include farmyard manures, composts, biosolids, green digestates, other digestates, distillery effluent, and paper crumble. They are a potentially valuable source of plant available nutrients which, if applied to agricultural soils appropriately, can provide savings on purchased inorganic nitrogenous fertilisers.

Focus groups with distillers investigated perceptions, thoughts, and concerns around the use of seven specific groups of BOM some of which are beyond those currently accepted by the SQC approved amendment list. A key finding from these focus groups was that any BOM applied to the landbank must be of “known and green” origin to be acceptable for growing cereals intended for use in the distilling sector. Anaerobic digestate was highlighted as the primary acceptable alternative to more traditional fertiliser applications. Provided the origin and composition of the feedstocks were known. Of those BOMs deemed “acceptable” the following were selected for a further assessment of knowledge base and understanding:

- **Farmyard manure**

- **Compost**
- **Green anaerobic digestate**

## Findings and Recommendations

This project developed an evidence base to support the malting barley supply chain to take a clear and coherent position on digestates. The section below provides a summary of the project's findings, along with recommendations to reduce emissions from malting barley production.

### **Greenhouse gas emission reductions when using green digestate**

- The use of bulky organic manures can reduce greenhouse gas emissions and contribute to a circular economy approach to malting barley production.
- The scale of potential reductions could be around 5.5% if chemical nitrogen is switched to digestate (calculated by Agrecalc using standard figures).
- There is potential to increase this reduction figure further by using low emissions spreading equipment.
- The embedded emissions from bulky organic manure production (including digestate and compost) are unknown.
- Nutrient management planning, accounting for nitrogen in bulky organic manures, and applying optimum rates of nitrogen can contribute to further emissions reductions and cost savings.
- It is clear there are greater potential cost savings from using livestock manures and composts compared to digestate.
- It is recommended further research should be carried out to explore additional ways to reduce emissions in the malting barley supply chain over and above using BOMs including digestate as a fertiliser. Currently, the potential scale of reductions identified from the use of AD as a crop fertiliser are not enough to meet industry and government targets. A supply chain approach is needed to understand the trade-offs required to reduce arable farming emissions, and support changes needed.
- Distillers should engage with farmers to highlight the importance of Scottish malting barley production in the long-term, the changing requirements of the market in this period, and the need to collectively understand the win-wins and trade-offs such changes will bring.

### **Wider environmental benefits and risks of using green digestate**

- The land application of BOMs will likely benefit and increase, or at least maintain, soil fertility, health, crop yield, and quality.
- However, there is a risk of loss of nitrogen to the environment, including as the greenhouse gas nitrous oxide, if digestate is applied inappropriately.
- A suite of regulations and farm assurance requirements limit these risks, but there are opportunities to do more.
- There are also supply chain concerns about microplastics in (PAS 110 certified) digestate and other (PAS 100 certified) bulky organic manures processed from unknown feedstocks.
- It is recommended the malting barley supply chain should promote best practice for BOM applications, placing emphasis on nutrient management planning.
- Scottish Quality Crops (SQC) farm assurance standards relating to nutrient management planning and bulky organic manures should be reviewed to consider their presentation to members.
- The SQC Approved Digestate scheme should also be reviewed and extended to include other bulky organic manures and consider all feedstocks. This is needed to give confidence to end-markets and mitigate the risk of nutrient losses to the environment and could use findings from this project as evidence. A reviewed scheme should mitigate nitrogen loss risks and fill regulatory gaps including application requirements for spreading contractors.
- Good spreading practices adopted by the BAS (Biosolids Assurance Scheme) standards, and a mechanism to assess feedstocks, should be included in the review. This will have notable cost considerations.

### **Digestate as a fertiliser (volume)**

- There is uncertainty as to the future volume of digestate.
- The feasibility of large-scale anaerobic digesters is determined by the price of energy and the eligibility of feedstocks for support schemes depending on their categorisation as wastes or products.
- This project has estimated that if all draff is used as a feedstock for anaerobic digesters it could theoretically provide a significant amount of nitrogen for malting barley production.

- Further work should be carried out to determine future volumes to assess how much arable land could use digestate as a fertiliser (and so better quantify emissions reduction potential).
- Anaerobic Digestion plants should be encompassed by SQC assurance, to give supply chains confidence on feedstocks.

### **Digestate as a fertiliser (logistics and processing)**

- There is a limited viable distance of c.15 miles that digestate can be transported from AD plants to fields.
- The effect of additional processing and transportation on emissions is unknown and a wide range of farm types and crops in the area surrounding an AD plant are necessary to maximise digestate utilisation.
- This project has found that there are processing technologies that can be used for BOMs and their end products have environmental and logistical benefits. However, further work is needed on a case-by-case basis to identify their cost-effectiveness.
- In the case of pelletisation technology, this can be used to significantly increase the distance that digestate can be transported for spreading; reducing transportation costs. Pelletisation can also produce a high phosphate product and a high nitrogen liquid fraction, and this can mitigate the risk of building excess soil nutrients (specifically phosphate) in soil. Despite these benefits, the cost of pelletisation remains relatively high. Excess thermal energy was noted as being a particularly important factor in determining its financial viability.
- Supply chain stakeholders should also consider how the short travel distance and inconsistent nutrient profile challenges of digestate can be addressed through further processing.
- The financial feasibility of pelletisation technology at different scales as noted above should be investigated further, along with their implications for emissions, and policy support for this innovative technology should be considered to address market failures and deliver identified climate change policy outcomes.
- A full lifecycle assessment of digestate use on Scottish farms beyond this project's farm gate analysis should be carried out using on-farm carbon accounting assessments.

### **Policy and market context**

- Agricultural policy change could incentivise the use of bulky organic manures, including digestate, but there are currently no emissions reductions targets for agriculture.
- The energy policy focus on output has driven interest in large-scale anaerobic digester plants. There is a policy of increasing the percentage of biomethane and hydrogen in Scottish gas, but with no target.
- As a proportion of the total energy mix, bioenergy and wastes is predicted to be a small component compared to electricity generation in Scotland.
- It is recommended that the malting barley supply chain should remain closely engaged with Scottish agricultural policy development to understand how it will support future emissions reductions through arable farming practice changes.
- In the absence of policy, farm assurance should be used as a mechanism to ensure that digestate, and other bulky organic manures, are applied effectively to reduce emissions and increase nutrient use efficiency. It should favour or require the use of digestate and BOMs produced with known feedstocks and should consider the risks of using those produced with unknown or inconsistent feedstocks.
- In addition to the above observations, it is recommended that the malting barley supply chain should develop a route-map which brings the entire sector together as part of a commitment to continuously improve sustainability. The UK dairy industry has previously carried this out and can provide a template to consider. In this manner, organisations such as the AIC, MAGB and SWA can better work collaboratively towards a more sustainable future.

## Next Steps

The findings are being used by project partners on an ongoing basis:

- Informing SQC feasibility study on redeveloping and relaunching the SQC Approved Digestate Scheme
- Informing and providing a direction of travel for AgreCalc's development, raising the complexity of anaerobic digestate's embedded emissions, feedstock sources, and where emissions are allocated
- Informing the work of the NFUS and SAOS to drive promotion and awareness of using co-products and digestate effectively
- Informing the work of the SWA Net Zero Cereals Working Group

## Further Information

The information above summarises the findings of the *Going with the Grain* project. If you are interested in finding out more about the findings, then contact the main authors of the report:

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