

Environment, Food and Rural Affairs Committee Call for Evidence: Soil Health

The Anaerobic Digestion and Bioresources Association (ADBA) is the trade association that represents the range of interests and matters related to the anaerobic digestion of organic materials (AD) across the UK, including the collection of waste for use as feedstock. ADBA is at the forefront of the AD sector, promoting the potential of AD to cut GHG emissions and in the hardest to decarbonise sectors of heat, transport, waste management and agriculture. ADBA has around 300 members from across the AD industry, including plant operators and developers, farmers, local authorities, waste management companies, supermarkets, food processors, energy and water companies, equipment manufacturers and suppliers, consultants, financiers and supporting service companies.

The ready to use technology for the hardest-to-decarbonise sectors

The next 10 years present the greatest challenge for governments around the world to respond to the urgent climate crisis we are facing. AD already reduces the UK's carbon emissions by over 1% and has the potential to reduce them by as much as 6%. The Committee on Climate Change (CCC) has consistently identified biomethane as a "low regret option", advising that greater quantities of the green gas are urgently required, and that AD needs to be used more widely on farms if the UK is to meet its fifth carbon budget between 2028 and 2032. AD is the ready-to-use technology to cut emissions in the hardest to decarbonise sectors of heat, transport, waste management and agriculture by reducing emissions from rotting food and farm wastes, providing low-carbon biofertiliser, and displacing fossil fuels with green gas.

AD at the heart of a circular economy

AD closes the loop, developing a circular economy by drawing value from waste and feeding its value back to the system. Organics processed through AD produce renewable energy, green CO₂ and biofertiliser which, in turn, can be returned to the land to grow more plants. AD increases efficiency of farms, cities, and businesses – nothing is wasted.

Circular cities can recycle their food and garden waste and wastewater into fuel for local buses; power and heat for homes; digestate for urban gardens; and bio-CO₂ for urban farming, industrial processes or carbon storage. Circular farms can capture the methane emissions from manure and farm wastes to provide community energy to rural areas; generate clean fuel for tractors; diversify rural incomes; and help replenish depleted soils. Circular business can recycle inedible organic residuals through AD to fuel transport fleets, heat, and power industrial processes, replacing fossil energy needs, using bio-CO₂ in industrial processes, and recovering nutrients to spread back to soil.

Digestate benefits to soil health

AD digestate provides many benefits to soil health which artificial fertilisers do not. Aside from ensuring nutrients are properly recycled, it can also contain organic matter which further contributes to the integrity of the soil. The addition of soil organic matter improves the structure of soils, increasing porosity which means that soils can retain water easier. Furthermore, the addition of organic matter increases biological activity by providing habitats for microbes, increasing the biodiversity of soils, as well as providing an organic alternative to pests such as blackgrass.

A study completed by Voltr et al. (2021) in the Czech Republic examined 68 farms over a ten-year period to assess the state of soil organic matter after applying digestate. It was found that digestate increased hot water extractable carbon rates by 15% and that over long periods of time, the effect of applying digestate on soil organic matter was either positive or neutral, especially when supplementing carbon with crop residues. Not only does increasing soil matter increase the integrity of our soils, but there is a potential (though the science is still emerging) that the use of certain organic manures can help sequester carbon and could provide a significant service.

The mineral content of the digestate depends on the feedstock, however, digestate is often processed further into liquor and fibre which will have different nutrient levels (see figure 1).

Nutrient values of digestate

Typical total nutrient contents for food-based digestate							Typical total nutrient contents for farm-sourced digestate						
Type	Dry matter %	Total N	Total P ₂ O ₅	Total K ₂ O	Total MgO	Total SO ₂	Type	Dry matter %	Total N	Total P ₂ O ₅	Total K ₂ O	Total MgO	Total SO ₂
kg/m ³ or kg/t							kg/m ³ or kg/t						
Whole	4.1	4.8 ^{ab}	1.1	2.4	0.2	0.7	Whole	5.5	3.6 ^{ab}	1.7	4.4	0.6	0.8
Separated liquor	3.8	4.5 ^{ab}	1.0	2.8	0.2	1.0	Separated liquor	3.0	1.9 ^{ab}	0.6	2.5	0.4	<0.1
Separated fibre	27.0	8.9 ^a	10.2	3.0	2.2	4.1	Separated fibre	24.0	5.6 ^a	4.7	6.0	1.8	2.1

© Nutrient Management Guide (RB209)

Figure 1: excerpt adapted from AHDB Nutrient Management Guide (RB209) in WBA Pathways to 2030 report.

Digestate improves soil health and can still provide similar crop yields to using artificial fertiliser. High levels of readily available nitrogen, which is taken up by plants easier, are available in digestates, rendering it an effective fertiliser. With good practice to avoid over-application of nitrogen, the concerns about nitrogen leeching and runoff into water bodies can be mitigated.

While factors such as climate, soil properties, digestate composition, crop species and time will dictate the effectiveness of digestate use, a study by Doyeni et al. (2019) found that when comparing the use of mineral nitrogen fertilisers to digestate from chicken, cattle and pig manure after three years of proper application:

1. There were no negative effects on soil chemical properties
2. Crop yield and grain quality were similar, with some levels of better efficiency than mineral fertiliser
3. Nitrogen use efficiency increased over the three years for chicken and cattle based digestates compared to artificial nitrogen fertiliser
4. Mid- to long-term use of digestate on agricultural soils is the most beneficial to crop productivity

Finally, in the current economic climate, the cost of artificial fertilisers has increased to, in some cases, over £900 per tonne. Therefore, with farmers increasingly under pressure to provide food security and meet environmental targets, digestate as a fertiliser should be backed as a credible alternative.

1. ~~How can the Government measure progress towards its goal of making all soils sustainably managed by 2030? What are the challenges in gathering data to measure soil health how can these barriers be overcome?~~
2. Do current regulations ensure that all landowners/land managers maintain and/or improve soil health? If not, how should they be improved?

Many pre-existing regulations that are in place to protect water and soil quality inadvertently make it more difficult to spread digestate as a fertiliser and so reduce the opportunity to use it as a fertiliser and soil improver simultaneously. As such, farmers and land managers may be inclined to continue the use of artificial fertiliser on land. Indeed, we are seeing a significant increase in certain representatives of the industry considering incineration as an alternative. This is a serious concern and contravenes the efforts to move away from linear waste management towards circular economies.

Currently, most regulations in the UK are of the 'stick' approach when it comes to encouraging the maintenance of soil health through using digestate.

Most anaerobic digestors need to be permitted through the Environment Agency which comes with a host of compliance checks including reports, assessments, inspections and reviews. Additionally, the Environment Act (2021) sets targets on improving air and water quality as well as biodiversity and resource efficiency/ waste reduction. And so, the government are legally required to set binding targets on these areas, implement improvements plans and monitor progress. Targets relevant to AD include:

Water quality

- ❖ By 2037: Reduce nitrogen, phosphorous and sediment pollution from agriculture to water by at least 40%

- ❖ By 2037: Reduce phosphorous loadings from treated wastewater by 80%

Runoff of nutrients from digestate into water bodies is a concern and so the Code of Good Agricultural Practice for nitrates and phosphates stipulates that digestate cannot be spread within 10m of a surface body of water (reduces to 6m if certain techniques are used) or 50m of a well or borehole. While these guidelines do pertain to soil health and nutrient loading, they do not account for wider soil health factors such as levels of soil organic matter.

Air quality

- ❖ By 2040: Annual mean concentration target of 10µg m⁻³ of PM2.5
- ❖ By 2040: Reduce population exposure to PM2.5 targets by 35%

In 2019, the Clean Air Strategy was published which recommended that to reduce ammonia emissions, digestate users are required to cover digestate stores by 2027, use low emission spreading techniques by 2025 and for solid fibre digestate to be rapidly incorporated within 12 hours.

Protecting the environment is crucial if we are to meet the targets laid out under the Environment Act. However, the benefits of digestate use for soil health are yet to be fully accounted for within these regulations. So, while these provide regulatory 'sticks', regulatory frameworks that promote the uptake of digestate use are less apparent.

The main ways that the use of digestate is encouraged through regulation and policy are through the Countryside Stewardship Organic standards, and the ELMS Soil Health standard.

From the organic standards of Countryside Stewardship, payments with the code OR and OT relate to organic conversion and organic land management respectively. The organic standards stipulate that a parcel of land must be registered with a Defra-licensed organic control body some of which include the use of organic fertilisers, such as digestate, in their standards. For example, the control body OF&G, who certify over 50% of organic farmland in the UK, lay out their conditions on using digestate in Technical Leaflet 129. They permit the use of crop derived digestates, digestates that meet PAS110 requirements*, and digestates from manures and slurries that aren't intensively farmed to be used on organic farms. The maximum payment is for £1254 per hectare for three years (conversion for top fruit), however, the Anaerobic Digestate Quality Protocol only permits digestate to be used in the agricultural and land restoration markets. Therefore, payments for waste derived digestate are capped at £296 per hectare per year for up to two years (OR3 Organic conversion- rotational land). OT3 then pays farmers £132 per hectare for subsequently managing rotational land organically.

The issue with accessing payments through the organic certification standards is that some farms may not be able to meet the other requirements necessary to achieve organic status and receive the payments. With the cost of installing a digester and transporting digestate, some smaller farms may need payments to incentivise the switch to using digestates. Therefore, a Countryside Stewardship standard specific to digestate use could incentivise land managers to use digestates to improve soil health.

*PAS110 is a BSI standard setup to ensure the quality of digestates derived from waste materials. If a digestate is PAS110 compliant, it will meet the 'end of waste' criteria set out in the Anaerobic Digestate Quality Protocol (ADQP), meaning it can be spread to land with confidence that is not harming the environment so long as it fulfils the other requirements within the ADQP and other regulatory guidance and requirements.

3. Will the standards under Environmental Land Management schemes have sufficient ambition and flexibility to restore soils across different types of agricultural land? What are the threats and opportunities for soil health as ELMs are introduced?

Under the ELMS Sustainable Farming Incentive, there is a soil health standard which pays farmers to undertake actions on arable land and land with permanent crops to improve soil health. Action 3 of this standard pays farmers to add organic matter to the land at least once during the agreement, including the addition of digestates.

While these payments are welcomed, it does not go far enough to encourage the full or partial switch to using digestates regularly. A higher tier under this standard which defined 'adding soil organic matter' as using digestate alternatives more regularly (subject to best practise guidelines) may encourage farmers to increase their usage of digestate as fertiliser, while reaping the soil health benefits.

Announced on the 26th of January 2023, the new nutrient management standard would have been an ideal opportunity to advocate for the use of digestates to manage nutrients sustainably. However, two out of three actions focus on legume cover while the third is to complete a nutrient management assessment and a review report. This stipulates that a qualified adviser must identify and discuss "opportunities to increase efficiency of your nutrient usage and maximise the use of natural sources of crop nutrients on that land", again this is ambiguous in whether the advisors would call for the use of digestates to match crop need on arable lands.

The industry has generally considered ELMS as an opportunity missed by the government to provide an income for farmers and land managers that wish to meet food security needs and environmental targets on soil health by using digestate.

4. What changes do we need to see in the wider food and agriculture sector to encourage better soil management and how can the Government support this transition?

Due to the immense financial pressures that farmers and land managers are facing, ultimately, they will only begin using digestate if there is financial value identified. While market forces do exist to nudge some towards using digestates, the consultation response on Reducing Ammonia Emissions from Urea Fertilisers published by Defra suggested that very few farmers were considering switching to using organic fertilisers such as digestates. A lack of awareness/ knowledge and financial barriers are often cited as barriers to uptake by our members.

Some of the biggest issues that would help transition to the use of digestates as fertiliser and to improve soil health include storage and transportation issues.

Owing to the relatively low dry matter content, digestate is difficult to transport compared to mineral fertilisers. Even separated fibre still has a dry matter content of 20-30% and so to improve the market for digestate, financial and technical support for digestate drying or innovation for further separating/ drying technologies would help to support the market. While there are some drying technologies already in use, these are expensive and less accessible to farmers and land managers who would benefit most from marketing and transporting their digestate. Furthermore, the regulations need to be amended to ensure that further processing of digestates is feasible within end of waste definitions.

Additionally, storing digestate for long periods of time is necessary due to the closed period stipulated by Cross Compliance regulations. The future regulation to cover digestate stores by 2027 under the Clean Air Strategy adds an additional burden on farmers wishing to use digestate, particularly as little is known about the types of covers that will be stipulated under this requirement. Funding has been made available for slurry infrastructure under the Slurry Infrastructure Grant however while much of the infrastructure required to store digestate is similar to that used to store slurry, digestate was specifically excluded under the scheme. If the grant could be extended to include digestate storage, more farmers would feel supported in transitioning to using digestates.

The current support scheme for the AD industry is the Green Gas Support Scheme which was setup to provide 15-year tariff guarantees for biomethane producers to inject their gas into the national grid. While this scheme was greatly welcomed by the industry, it is based on energy generation potential rather than environmental benefit. As a result, the scheme has led to larger plants being built to supply maximum energy yield. While the nutrient cycling and environmental benefits of the scheme still stand, it is uneconomical for smaller producers to apply, especially as smaller scale AD usually keeps energy on site or exports it very locally.

Therefore, the government could either help smaller producers financially as outlined above, or setup a support scheme or standard that supports the expansion of small scale AD. Particularly as this will keep biogenic carbon from the farm within the system and support productivity of soils.

5. What does UK Government need to do to tackle other stressors on soil health such as soil contamination?

Food waste

Digestate that comes from food waste can be returned to land through the Anaerobic Digestate Quality Protocol (ADQP). This ratifies the PAS110 standard by allowing 'end of waste' status for digestates derived from source segregated organic wastes. Within this, minimum contamination levels are set as seen in Figure 2. Currently, the ADQP is being reviewed to find the reasonable minimum contamination level of digestates.

While the AD industry is hugely supportive of minimising contaminants going to land, the expected lowering of permitted contamination levels in the ADQP will likely incur some cost for organic waste processors. The link between lowering the threshold, the cost incurred on operators and the benefits that digestate provides to land needs to be understood by the government. After all, farmers and land managers are looking after public goods and providing food security to the country.

It was hoped that the Extended Producer Responsibility reforms would lead to some operators receiving payments to help remove contaminants, however the industry was disappointed that this was not considered. AD operators could be included in ERP or a similar such scheme to help mitigate potential costs from recycling food waste through AD, the optimal technology for recycling unavoidable food waste under the waste hierarchy.

The technology to de-package food waste is well established in the industry as well as a range of other pre-treatment processes. However, the government could assist in generating stricter packaging guidelines around troublesome items such as cardboard with laminated films, and compostable packaging that is not compatible with the parts of an anaerobic digester. While some packaging is harmful to the digester, ultimately, it would be preferred that a biodegradable material went to land than a plastic one.

An educational piece for the wider public would be a useful way to reduce contaminants, especially with the upcoming rollout of separate food waste collections in 2025. If upstream contaminants can be reduced as much as practicably possible, the issues of contamination will be reduced throughout the waste processing chain.

Sewage sludge

The wastewater sector is coming under increasing pressure from both the Environment Agency and Ofwat to reassess the levels of contaminants that are being spread to land. The upcoming Sludge Strategy has cast huge doubt over whether it will be technically or economically unfeasible to continue spreading sludge to land which would be a problem for the sector as it currently sends 96% of sludge that is processed through AD to land. The fear is that wastewater companies may begin incinerating these sludges, meaning that the nutrient recycling element of the process will be lost or severely diminished.

Instead, the government should work alongside the wastewater sector to identify and mitigate the contaminants of concern in order to support rather than disintegrate this well-established process. The industry is already completing much of its own research, but the uncertainty cast over the industry at the moment is neither practical nor helpful.

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