ECN
Compost and Digestate for a Circular Bioeconomy

ECN Position Paper

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ECN Position Paper on the Role of Organic Waste derived Soil Improvers and Organic Fertilizers within Carbon Farming Initiative

The EC Communication on Sustainable Carbon Cycles published on 15th December 2021[1] focuses also on carbon farming as a business model incentivising practices on ecosystems in order to increase carbon sequestration. The EU Commission announced in its 2022 Work Program a proposal for the certification of carbon removals with the view of scaling up the development of sustainable carbon removals and creating a new business model for land managers and companies, in line with the European Green Deal and European Climate Law objectives. The carbon farming initiative[2] (CFI) refers to the carbon pools and GHGs streams management at farm level, aiming to mitigate climate change. This can involve the management of land, livestock, all the carbon pools in soils (materials and vegetation), besides the streams of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). In this frame, the EU recently published a technical guidance handbook[3] which is intended to support the development of result-based payment schemes for CFIs in the EU.

The handbook gathers the possible carbon farming schemes under few main topics, amongst which the one called "*Maintaining and enhancing SOC in mineral soils*", to be achieved by the adoption of management practices that benefit the Soil Organic Carbon (SOC), including cover cropping, improved crop rotations, agroforestry, preventing conversion to arable land and conversion to grassland.

When reading the eligibility criteria of CFI, it is quite surprising the explicit exclusion of the application of organic fertilizers (OFs), with the motivation (see "annexes - case-studies") that the "Application of organic fertilizers result in translocation of carbon from one part of the system to another"; the family of OFs include the organic waste derived organic soil improvers such as compost and solid digestate, possible nutrients and carbon sources for crops and agricultural soils. ECN wishes to clarify the role OFs can play within a carbon farming initiative, wishing that the organic fertilization of soil and plants

[1] COM(2021) 800 final - Communication from the Commission to the European Parliament and the Council - Sustainable Carbon Cycles

[2] https://ec.europa.eu/clima/eu-action/forests-and-agriculture/sustainable-carbon-cycles/carbon-farming_en

[3] COWI, Ecologic Institute and IEEP (2021) Technical Guidance Handbook - setting up and implementing result-based carbon farming mechanisms in the EU Report to the European Commission, DG Climate Action, under Contract No. CLIMA/C.3/ETU/2018/007. COWI, Kongens Lyngby

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with carbon-rich and carbon-stable fertilizers and soil improvers within a balanced fertilization system can be included among the sustainable measurements (Text box 1).

Text box 1

Benefits of compost and solid digestate use

The application of compost and solid digestate from organic waste separate collection and recycling not only allows carbon increase in soil, but also additional benefits that influence the GHG emissions savings, such as water holding capacity, improved soil workability, soil biological activity, plant nutrient uptake and soil nutrient storage).

The majority of agronomic experts acknowledge that compost and solid digestate which have undergone proper production processes are biologically stable soil improvers in which the organic component has a high degree of maturation, and which can be safely used for improving the quality, health and fertility of soil.

The main benefits of compost and solid digestate application to agricultural soils are effective in the medium- to long-term, mainly reflecting on further source of carbon savings, like:

- Replenishing the fertile layer of stable organic matter in the soils. With every ton of compost (fresh basis) applied to soil with sub-optimal levels of organic matter, between 60-150 kg of carbon dioxide equivalents can potentially be sequestered. Moreover, a soil rich in stable organic matter has an improved structure for better aeration and increased water holding capacity, which reduces the risk of erosion.
- Improving the health and productivity of agricultural and horticultural soils provided with low levels of organic matter.
- Increasing soil aggregate stability and soil pores, thereby reducing compaction.
- Helping soil to store water, therefore reducing the need for irrigation.
- Improving the buffering capacity of the soil, and helping it to hold onto the nutrients for longer and thus preventing them from being washed into watercourses.
- Increasing the number, diversity and activity of soil organisms, including microbes and invertebrates such as earthworms. Soil biota helps plants resist disease and farmers to use fewer pesticides.
- Providing plant nutrients, including nitrogen, phosphorus and potassium. As nitrogen in compost is bound up with other compounds, it is released slowly over time and helps from a nutrient ‘bank’ in soil so that the nutrients are present for plant growth over a number of years.
- Having an alkaline pH, which means that it can help to reduce soil acidification.

The richness in organic matter, active microbial flora and, to a lesser extent, macro- and microelements makes compost and solid digestate excellent products suitable for a wide variety of agricultural uses, from horticulture to open field crops.

NUTRIENTS

As far as nutrients are concerned, the impossibility of exploiting those contained in organic fertilizers (see Text box 2) clashes with the fact that accounting GHGs emissions resulting from fertilizers utilization is requested in the general frame of CFI. It is widely recognized that crop cultivation requires important nutrient supplies (N; P; K) to sustain an economic productivity. It is also recognized that the utilization of manufactured fertilizers to achieve this goal is responsible for relevant direct and indirect GHGs emissions (from the industrial production processes and/or mining, to their utilization in soils). It is therefore evident that the utilization of OFs (including compost and solid digestate), can contribute to the reduction of mineral fertilizers utilization for crop cultivation, as required by the farm to fork strategy, thus reducing the GHGs emissions.

The exclusion of these products in fertilization plans obviously promotes the use of manufactured fertilizers, therefore bringing negative impacts on the long run for in terms of GHGs emissions.

Text box 2

Compost and digestate: a repository of nutrients and organic matter

ECN's latest data report[1] (2022) identified around 60 million tonnes of bio-waste having been recycled through composting and anaerobic digestion across the EU27 in 2019/20, with over 60% of this coming from municipal sources.

This recycling resulted in the manufacture of 18 million tonnes of compost*, and in the region of 258 thousand tonnes of stable organic matter were sequestered in agricultural soils. This equated to just under a million tonnes of carbon dioxide equivalents, which had a trading value of EUR 76 million. Overall, this compost could be applied to 2% of the EU's arable land at a rate of 10 tonnes per hectare, rising to a maximum potential of 4%. Notably, it could be used to improve 13% of the EU's moderately/severely water eroded soil, with potential to improve up to 28%.

Looking at the major plant nutrients nitrogen (N), phosphorus (P) and potassium (K), on average, each tonne of compost contained a total of 1.2% N, 0.5% P and 0.7% K on a fresh mass basis. Across the EU27, this resulted in the recycling of 142 thousand tonnes of nitrogen, 53 k tonnes of P (as P_2O_5) and 84 k tonnes of K (as K_2O). As of March 2022, this was equivalent to EUR 724 million in manufactured fertiliser value.

* Estimates for anaerobic digestate were not possible due to its variable composition and lack of data.

[1] ECN 2022: ECN Data Report, https://www.compostnetwork.info/wordpress/wp-content/uploads/ECN-rapport-2022.pdf

ORGANIC CARBON

Compost and solid anaerobic digestate provides organic carbon that increases organic carbon stocks when applied to soil. The assumption that "organic fertilizers result in translocation of carbon from one part of the system to another" is true only for those products manufactured on-farm. However, the main benefit stems from the recycling of organic waste, which is a valuable resource that would otherwise be lost to soil through disposal in landfill sites or incineration/waste-to-energy plants. Recycling organic waste is in accordance with the waste hierarchy, enshrined in the EU Waste Framework Directive (2008/98/EC, as amended).

An estimated 138 million tonnes of bio-waste are generated annually across the EU, with only 60 million tonnes recycled through composting and anaerobic digestion (see Text box 2); an estimated 40% is thought to be disposed of to landfill where it generates methane gas.

In other words, the organic carbon contained in organic waste needs to be accounted as a net additional contribution to the offset of CO_2 emissions, but only if the derived organic fertilizers or soil improvers are directly applied to soil or used to replace peat in growing media.

Carbon farming initiatives are the actual carbon sink generators for the organic waste compost and solid digestate, and the carbon contained in these fertilizers is not simply "a translocation of carbon from one part of the (farm-) system to another". According to ECN data, around 60 million tpa of bio-waste are separately collected and recycled in the EU27 through composting and/or anaerobic digestion processes, producing soil improvers and organic fertilizers that otherwise would be lost as CO_2, CH_4 and N_2O emissions from landfills and incinerators. An additional 40 million tpa remain in the residual waste and need to be collected and treated by 2035.

Moreover, the agricultural utilization of organic waste compost and solid digestate within the CFI framework can provide soil organic matter preservation/increase in addition to the proposed agronomic approach (cover crops; rotation; reduced tillage; residues management), promoting also an overall "soil health" improvement, that is amongst the main EU goals according to the recently adopted EU Soil Strategy[4]. The role of this "additional" carbon provided to the soils with these types of organic fertilizers is then strengthened within the (farm-) system" (Text box 1).

The specific role of organic waste derived organic fertilizers and soil improvers should be recognized, pushed forward and increased in value within all possible EU granting instruments, including the CFIs, as however already put in place by several Member States in their national policies for the promotion of soil health and/or fight against climate change (see Text box 3).

[4] COM(2021) 699 EU Soil Strategy for 2030. Communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Reaping the benefits of healthy soils for people, food, nature and climate

Text box 3

Compost and solid digestate in carbon removal schemes

Several examples of economic compensations for compost and solid digestate application to soils have been collected in the ECN info paper "Survey on national/local plans allocating resources for soil management practices that include the utilization of compost"[5]. Moreover recently implemented initiatives implemented in **Flanders** consist is both a private market-initiative (Claire) and a Common Agricultural Policy (CAP) measure aiming to compensate actions that increase SOM by, amongst others, applying compost.

1) Claire

Claire started in 2021 as 'the Belgian digital marketplace' with the ambition to reduce CO_2 emissions and accelerate the storage of CO_2 to stop global warming'. It brings together Belgian companies that want to reduce their CO_2 emissions with local farmers who store CO_2 through carbon farming techniques. This way, these farmers can be compensated for their carbon storage efforts. The underlying calculation methodologies were developed by BDB and Boerenbond ISP. Compost is one of the 10 possibilities for farmers to store CO_2 for a fee. Compensation is paid from the funds a party pays to offset their emissions. The farmer who uses compost in this system is compensated via a hybrid system with

- fixed compensations over 2 x 3 years based on the impact of the vfg[6]- or green compost on carbon storage [based on findings of a long-term compost trials], and
- a possible extra compensation if, at the end of the period (6th year), the organic matter content of the soil increases by more than 0.3% in absolute terms (compared to the measurement in the 1st year).

2) Common Agricultural Policy: Eco-scheme 'soil organic carbon content in farmland' as proposed in Flemish CAP (intervention 5.1.7)

This intervention aims to stimulate the build-up of organic carbon (OC) in the soil by applying good practices and by rewarding farmers for plots with good results in terms of soil OC content and soil pH. A good pH is essential for good carbon build-up and soil structure. Conditions for receiving CAP-support under this intervention is that the parcel was arable land in 2 previous years, in use by the farmer and with a good pH. Two specific actions of this invention are 'action 2' and 'action 3'

- 'Action 2' (stimulating and facilitating the use of products with high carbon content at plot level)

[5] https://www.compostnetwork.info/download/survey-on-national-local-plans-allocating-resources-for-soil-management-practices-that-include-the-utilisation-of-compost/
[6] Vgf = Vegetable, fruit and garden waste

- the application of (stable) products with a high C content, amongst which compost (from approved composting facilities, or farm compost),
- minimum compost application of 10 tonnes/ha,
- compensation: 130 EUR /ha arable land for the supply of at least 10 tonnes/ha compost on the parcel.

- 'Action 3' (rewarding farmers for plots with good results in terms of soil OC content and soil pH)
  - Based on soil sample & analysis from the year of application
  - each arable plot can receive the premium once every 5 years.
  - this action can only be applied for in combination with previous 'action 2' or with 'action 1' (EOC-increase through annual cultivation plan)
  - compensation: additional payment per hectare with good results: 60 EUR/ha

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About the ECN

The ECN is the leading European membership organisation promoting sustainable recycling practices by composting and anaerobic digestion of organic resources and guarding over the quality and safe use of the recovered organic fertilisers and soil improvers. With 66 members from 29 European Countries ECN represents more than 4500 experts and plant operators with more than 45 million tonnes of biological waste treatment capacity.