National Organic Standards Board
Crops Subcommittee
Petitioned Material Proposal
Cow Manure Derived Biochar (CMDB)
August 3, 2021

Summary of Petition [link]:
A petitioner has requested an annotation to the listing at § 205.602(a) "Ash from manure burning" that would indicate that ash from manure burning does not include biochar derived from pyrolysis of cow manure. The petitioner contends that cow manure derived biochar, or CMDB, not only provides a solution to nutrient leaching and other adverse impacts to raw manure handling in large scale dairy operations but also has other benefits for organic crops that may exceed those of plant-based biochar.

The organic use of the petitioned material falls under the OFPA category for Crop and Livestock Materials and is characterized as a fertilizer and carbon storage soil amendment/soil conditioner to aid in organic crop production. In addition to CMDB, it can also commonly be referred to as cow manure biochar, dairy biochar, dairy manure biochar, dairy manure sourced biochar, manure derived char, or dairy manure char.

Biochar is defined in NOP guidance document 5034 "Materials for Organic Crop Production" as: "[…] biomass that has been carbonized or charred. Sources must be untreated plant or animal material. Pyrolysis process must not use prohibited additives."

The following annotation (in bold) at § 205.602(a) has been requested relevant to CMDB:

§ 205.602 Nonsynthetic substances prohibited for use in organic crop production.

The following nonsynthetic substances may not be used in organic crop production:

> (a) Ash from manure burning **– unless derived as part of the production of biochar from pyrolysis of cow manure.**
>
> *****
> [68 FR 61992, Oct. 31, 2003, as amended at 83 FR 66572, Dec. 27, 2018]

Subcommittee Review:
"Ash from manure burning" has been prohibited explicitly under OFPA since 1995 and reiterated every five years since then through 2015. In 2016, the NOSB unanimously denied a 2014 petition to annotate the prohibited use of ash from manure burning at §205.602(a) "[…] where the combustion reaction does not involve the use of synthetic additives and is controlled to separate and preserve nutrients" or the basis of the fact that it reduces the carbon and nitrogen present in the feedstock and thus does not contribute to soil-building processes. Around the same timeframe (fall 2015 NOSB meeting), the Board reiterated this position during the review of substances due to sunset in 2017 (in keeping with the position of the NOP), stating, "ash from manure burning was placed at §205.602 based on its incompatibility with organic production; burning these materials is not an appropriate method to recycle organic wastes."

In response to the current petition in early 2020, the Crops Subcommittee requested a Technical Report (TR) of the petitioned substance, both to understand the implications of the process of pyrolysis in the context of the prohibited "ash from manure burning" (in other words, is pyrolyzed manure the same thing as ash?) and to understand more fully the potential carbon storage benefits of crop systems that utilize biochar, and more specifically CMDB, given member interest in more fully evaluating the potential to improve the contributions of organic agriculture to climate stability.

The Crops Subcommittee received a draft TR and requested additional information in an updated draft including the following questions. That draft was received in March 2021 and deemed sufficient in April 2021.

The substance does not appear – at least by the name referenced here – on Canadian, EU, IFOAM, Codex, or Japanese lists of accepted materials, although biochar is referenced indirectly on Canadian, CODEX and Japanese lists.

Category 1: Classification

1. For CROP use: Is the substance ___X____ **Non-synthetic** or _____ **Synthetic?**
   Is the substance formulated or manufactured by a process that chemically changes a substance extracted from naturally occurring plant, animal, or mineral sources? [OFPA §6502(21)] If so, describe, using NOP 5033-1 as a guide.

   CMDB derives from the manure of dairy cows and the combustion in the absence of oxygen (i.e., pyrolysis) of that manure. It does not undergo a chemical transformation. NOP has previously categorized biochar as non-synthetic and classifies transformations of "heating or burning of biological matter (e.g., plant or animal material)" as "a natural process that does not result in the classification of ash as synthetic."

2. Reference to appropriate OFPA category:
   Is the substance used in production, and does it contain an active synthetic ingredient in the following categories: [§6517(c)(1)(B)(i)]; copper and sulfur compounds; toxins derived from bacteria; pheromones, soaps, horticultural oils, fish emulsions, treated seed, vitamins and minerals; livestock parasiticides and medicines and production aids including netting, tree wraps and seals, insect traps, sticky barriers, row covers, and equipment cleansers; or (ii) is used in production and contains synthetic inert ingredients that are not classified by the Administrator of the Environmental Protection Agency as inerts of toxicological concern?

   CMDB does not contain any active synthetic ingredients. The only related question that has been raised about the substance is whether there are residues from dairy cow husbandry that persist in manure and further into CMDB. As reported in the TR, the presence of any such residues has not been documented.

Category 2: Adverse Impacts

1. What is the potential for the substance to have detrimental chemical interactions with other materials used in organic farming systems? [§6518(m)(1)]

   It does not appear that detrimental chemical interactions can occur from the use of CMDB in organic farming. However, agronomically, some crops are appropriate for applications of

biochar and CMDB and others may not be.

2. What is the toxicity and mode of action of the substance and of its breakdown products or any contaminants, and their persistence and areas of concentration in the environment? [§6518(m)(2)]

   It appears that CMDB does not meet any relevant criteria for toxic persistence in the environment and may even contribute to the reduction of other toxics in the soil and the environment. Additionally, the expectation of biochar applications is that they can remain stable in the environment for hundreds or thousands of years, hence their potential value as a means of sequestering permanent carbon.

   That said, biochar can harbor toxics such as polycyclic aromatic hydrocarbons (PAH), which are typically formed using high-temperature production methods and heavy metals that are typically carried over from the feedstock, as noted in the TR, and can vary depending on the temperature at which the biochar was produced. According to the TR, "there have been reports of bio-accumulated PAH in food crops that were grown in biochar-amended soils," as well as localized accumulation of pollutants in biochar contexts over time.

3. Describe the probability of environmental contamination during manufacture, use, misuse or disposal of such substance? [§6518(m)(3)]

   Documented evidence appears to suggest that the production of biochar and CMDB results in net negative carbon emissions due to slower decomposition than raw biomass sources. The larger question about manufacturing impacts relates to the kind of scaled dairy operation from which the manure derives. This raises questions about the fundamental climate/water, environmental, and animal welfare impacts of those operations as well as whether or not organic agriculture should have a role in reducing or neutralizing negative aspects of those operations.

   While the TR clearly asserts that carbon is sequestered through the use of biochar, it does not cite data on the net carbon emitted or sequestered through the use of whatever energy feedstock is required to achieve optimal heat for carbonization.

   The TR also points out the net positive benefits of recycling "waste" material that would otherwise need to be disposed of were it not being pyrolyzed into CMDB. Recycling of manure-based feedstocks, as such, could attribute to reduced impacts typically associated with the disposal of such waste.

4. Discuss the effect of the substance on human health. [§6517(c)(1)(A)(i); §6517(c)(2)(A)(i); §6518(m)(4)].

   There do not appear to be any documented human health impacts from the petitioned substance.

5. Discuss any effects the substance may have on biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms (including the salt index and solubility of the soil), crops and livestock. [§6518(m)(5)]

The TR suggests that biochar and CMDB can lead to a less dense soil structure that can promote root growth and that it can have mixed results related to water retention in the soil (wood-based biochar is more porous than manure and thus can support more water retention). The TR also suggests that biochar and CMDB can improve the Cation Exchange Capacity (CEC) of soil which effectively improves the retention of nutrients in the soil. Nutrient bioavailability can vary in biochar-amended soil, depending on the feedstock, with CMDB being more nutrient-rich than other forms of biochar. CEC benefits can also lead to the sequestration of heavy metals, effectively immobilizing or neutralizing them.

The TR also indicates that most biochar has base pH which can be beneficial in acidic soils, with CMDB having a higher pH than other biochar. It can also increase the solubility of nutrients and other substances, for example aluminum which the TR notes is toxic to plants.

Sources cited in the TR indicate the biochar can have a wide range of positive and negative impacts on soil microbial communities but is most generally thought to improve microbial growth: "Grass and manure feedstocks and biochar with low production temperatures (<500 ˚C) typically result in positive priming due to their relatively high nutrient content and bioavailability (Verheijen et al. 2010, Zimmerman et al. 2011, Tenic et al. 2020)." (Priming is increased or decreased microbial activity resulting from changes to physical and chemical properties of the soil, "specifically the availability of nutrients.") TR sources suggest this combination of attributes of biochar and CMDB are what help with its contribution to crop resilience.

The TR also points out that biochar can sequester "pesticides, herbicides, antibiotics, and pharmaceutical compounds" and that there is inconsistency as to whether biochar can neutralize and/or degrade those substances. It reduces nutrient cycling soil and retains nitrogen in soils as ammonia and ammonium. This can reduce soil acidification and climate-polluting N_2O emissions.

6. Are there any adverse impacts on biodiversity? (§205.200)

   The substance does not appear to have any biodiversity impacts, other than the soil microbe considerations noted above.

Category 3: Alternatives/Compatibility

1. Are there alternatives to using the substance? Evaluate alternative practices as well as non-synthetic and synthetic available materials. [§6518(m)(6)]

   In appropriate crop applications, wood-derived biochar can be an alternative to CMDB. CMDB and biochar in general are petitioned as soil amendment for their potential crop benefits as a soil amendment and for the unique role they can play in sequestering carbon and climate-polluting substances. It is unclear from the petition or the TR that biochar or CMDB are more effective at soil building than other common practices, such as cover cropping, manure and compost applications, and reduced tillage.

2. In balancing the responses to the criteria above, is the substance compatible with a system of sustainable agriculture? [§6518(m)(7)]

This is perhaps a more complicated petition than the history of NOSB decisions on this substance would indicate. The TR is quite comprehensive about the potential for all forms of biochar to play significant roles in storage soil-based carbon and neutralizing pollutants that could otherwise adversely affect the environment. At the same time, it appears the viability of this petitioned material at scale is contingent upon access to manure deriving from a wide range of dairy operations, including but not limited to conventional operations and CAFOs.

The argument as to whether pyrolyzed manure is the same as ash produced from burning manure is complex. However, the presumed production of ash appears to be the primary issue for previous board actions on related topics. The issue with biochar is that what could be considered "ash" is actually part of the substance and is contained by the substance and is not a byproduct of the substance. So, by tightly restricting use of ash from manure burning, organic agriculture may be losing a useful soil amendment and may be limiting its ability to serve as a climate solution. Following that argument, the use of biochar – for its recycling benefit, for its soil building benefit, and for its stable carbon sequestration – could be considered to be not only compatible with sustainable agriculture but promoting it.

Most consulted sources suggest biochar and CMDB can be produced in a net negative carbon emissions content, presumably relying on the source material itself to be the primary fuel. However, sources are clear about this, and as the TR suggests, highest heat produced biochar (>500°C) – coming from vegetative sources – offers many of the key soil nutrient retention benefits. Manure-sourced biochar typically is produced at lower temperatures. It may be important for the subcommittee and the Board to understand more about necessary fuel sources – if any – required to produce CMDB. It has been difficult to document pyrolysis fuel sources clearly, but the assumption is that fossil sources would be necessary to achieve the heat required to produce an optimal biochar/CMDB product.

Precedent would follow that this petition should be denied, but a careful review and discussion is merited. The NOP has as recently as 2016, articulated a position that pyrolysis is not its own unique mode of processing but in fact should be viewed as analogous to burning or combustion, and thus a source of ash.

Classification Motion:
Motion to classify cow manure derived biochar (CMDB) as nonsynthetic
Motion by: Wood Turner
Seconded by: Rick Greenwood
Yes: 8 No: 0 Abstain: 0 Absent: 0 Recuse: 0

National List Motion:
Motion to annotate the listing of ash from manure burning at § 205.602(a) to read "Ash from manure burning **– unless derived as part of the production of biochar from pyrolysis of cow manure."**
Motion by: Wood Turner
Seconded by: Steve Ela
Yes: 5 No: 3 Abstain: 0 Absent: 0 Recuse: 0

Approved by Rick Greenwood, Crop Subcommittee Chair, to transmit to NOP August 3, 2021.