California Environmental Protection Agency

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May 15, 2020

Sami Osman
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Dear Mr. Osman:

Thank you for the opportunity to review the Soil Enrichment Protocol (SEP).The California Department of Resources Recycling and Recovery (CalRecycle) is concerned that compost and mulch were not specifically identified as land management practices that can help store carbon in the soil. Compost use provides benefits that can further the SEP's goals of sequestering soil organic carbon (SOC) and reducing greenhouse gas (GHG) emissions. Therefore, CalRecycle encourages the inclusion of stand-alone applications of compost as well as the combined application of cover crops and compost, which recent research suggests is a viable way to increase SOC by a measurable amount.

In 2019, The University of California, Davis (1) reported results specific to SOC sequestration from an ongoing long-term agricultural research project. Using deep soil measurements, 19 years apart, they were able to compare the long-term effects of different farming practices. The results showed that applying compost in tandem with cover cropping increased SOC by 12.6% across the 2-meter soil profile, the most of any set of practices measured. Applying synthetic fertilizer, pesticides, and cover crops increased SOC by 3.5% in the 0-30 cm layer, but decreased SOC by 10.8% in the 30-200 cm layer. Stand-alone use of cover crops resulted in a 5.6% decrease in SOC across the 2m profile (Tautges, Scow et al., 2019).

According to this study, the practice of applying compost in tandem with cover cropping increased SOC by 0.66% per year, exceeding the benchmark of a 0.4% annual increase of SOC championed by the "4 per 1,000" initiative. It was the only practice to increase SOC throughout the 2-meter soil profile. Many practices appeared to increase SOC when measuring only the top layer, but in fact, there was an overall decrease in SOC when examining the full soil profile.

The University of California, Berkeley (2), with funding from the Marin Carbon Project, studied the impacts of compost on SOC in an arid rangeland environment. The project applied a one-time surface application of a ¼-inch-thick layer of compost in two grassland regions in California, one near the coast and another in the Central Valley, where it is hotter and drier. The study found that soil C increased by 26% at the Valley

grassland and 37% at the coastal grassland. Ecosystem C balances in grassland are highly variable over time, but in these cases the total net ecosystem carbon storage increased by 25-70%, not including the carbon from the compost applied. There were also large increases in net primary productivity, 78% in the valley grassland and 44% in coastal grassland after 3 years. Researchers measured no significant changes in nitrous oxide or methane fluxes in the soils treated with compost. Plant carbon sequestration offset any GHG emissions from the compost, the vast majority of which were carbon dioxide. The study measured to 50 cm deep and concluded that compost additions to rangelands appear to be viable pathways for carbon sequestration.

CalRecycle is a department of the California Environmental Protection Agency, working to protect public health and the environment by regulating solid waste and ensuring the highest and best use of previously landfilled materials. Because organic materials make up the largest segment of the disposed waste stream, and generate methane once landfilled, CalRecycle focuses on reducing landfill disposal of organics. Composting is a key pathway toward that goal, and building new markets for compost made from recycled organics is part of that effort.

Thank you for your consideration of our points.

Sincerely,

Kyle Pogue

Kyle Pogue, Environmental Program Manager
Statewide Technical and Analytical Resources Branch

Cc: Amrith Gunasekara, CDFA

Citations

1) Tautges, NE; Chiartas; JL, Gaudin, ACM; O'Geen, AT; Herrera, I; Scow, KM. Deep soil inventories reveal that impacts of cover crops and compost on soil carbon sequestration differ in surface and subsurface soils. Glob Change Biol. 2019; 25: 3753–3766. https://doi.org/10.1111/gcb.14762

2) Ryals, R. and Silver, W.L. Effects of organic matter amendments on net primary productivity and greenhouse gas emissions in annual grasslands. Ecological Applications. 2013; 23: 46-59. https://doi:10.1890/12-0620.1

Suggested edits for the protocol:

1. On page 4, Section 2.2.1, please insert compost as one of the land management practices considered for soil enrichment projects like the following:
   - *Compost application*; and /or
   - *Fertilizer (organic or inorganic) and/or compost application; and/or*
   - *Compost application and cover cropping as an integrated strategy*

2. On page 67, change "Sample depth- Minimum of 30cm" to *"Sample depth- Minimum of 30 cm but up to 200 cm."*

3. On page 91, compost is included within the definition of organic nitrogen fertilizer. This definition is overly broad and may lead to missed opportunities to improve SOC and decrease GHG emissions. Fertilizer regulators do not typically classify compost as a fertilizer, and farmers do not use compost for its relatively minor nitrogen content. However, compost contains a wide range of macro- and micronutrients, as well as significant amounts of carbon and soil microorganisms. Compost can help replenish micronutrients depleted from agricultural lands over time that may not be replenished with conventional fertilizers, and can jumpstart the sequestration process with its organic matter and biology. We recommend providing a separate definition for compost, as it differs from other fertilizers, animal manure and sewage sludge in its properties and in its lesser potential to emit GHGs. Please insert the following separate definition for compost:
   - *Compost is the finished product of the managed aerobic decomposition of organic matter. Compost is a pathogen-reduced soil amendment that contains macro and micronutrients and organic matter. Compost does not mean feedstocks such as raw or dried manure, biosolids, sludges or slurries, or fresh ground plant materials of any kind. Feedstocks should not be discernable in finished compost. Finished compost should be tested according to the protocols established by the U.S. Composting Council."* https://www.compostingcouncil.org/page/CertifiedCompostSTA

4. On page 98, we suggest adding a second paragraph to A.3:

   In California, there has been growing interest in soil health following the publication peer-reviewed research from UC Berkeley, funded by the Marin Carbon Project, outlining the effect of compost application to increase the Soil Organic Carbon storage and net primary productivity of rangelands. This was followed by the implementation of a State Healthy Soils Program, which offers grant funding for activities that build soil health, reduce GHG emissions and adapt for a changing climate. Results from those grants are pending and include replicates of the Marin Carbon work. In 2019, researchers at the University of California, Davis published new information

from a long-term agricultural research project showing that a combination of compost use and cover cropping was the only strategy studied which resulted in consistent, long-term carbon sequestration in a 200-cm deep soil profile. The results showed SOC increases of .66% annually, exceeding the goals of the '4-per-1000' initiative. California's draft Natural and Working Lands Implementation Plan calls for compost application on hundreds of thousands of acres of rangelands.

5. On page 100, the following changes are suggested for Table B.1.
    - Under Use of Cover Crops, add: *Cover cropping in tandem with compost application*
    - Under Fertilizer management, add *Apply Compost*

6. In the Model Calibration, Validation, and Verification document, on page 3, Table 2.2, please insert a new row. This change continues the new definition of "compost," and commensurate understanding that compost is fundamentally different than organic or inorganic N fertilizers:

Application of compost, as defined	*Comparison of compost application to no compost application, all other treatments remaining equal, or in tandem with cover cropping.*