"Scientific Overview of Agricultural Carbon Research & the Implications for Climate"

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The webcast is archived at:
http://www.extension.org/pages/70468/scientific-overview-of-agricultural-carbon-research-the-implications-for-climate

Can you give some specifications for the compost, such as rate tons/ac, amount of total nitrogen and available N, P, K?

Jeff: See Ryals et al, 2014 (in prep) and Delonge et al, 2013, Appendix A, for a description of the compost, which was a green waste compost from Feather River Organics, Marysville, CA, with a N concentration of 1.87% and a C:N ratio of 11. Compost was applied as a thin surface dressing approximately 1.3 cm thick, equivalent to 1.42 kg C m^{-2}, 129 g total N m^{-2}, and 7.0 kg dry matter m^{-2}. P and K were not reported. Target application rate was 1/2" per acre, or about 33 cubic yards per acre (roughly 15 tons/acre; see metric values above for more precise rates). Model results suggest we could cut this in half and achieve comparable results.

Do you expect similar results using dairy manure rather than compost? How do you balance N or P over applications with the benefits of C sequestration?

Jeff: Dairy manure applications definitely can lead to increases in soil C. However, manure itself can be a significant source of green house gas (GHG) emissions, including methane and nitrous oxide. We conducted a full lifecycle assessment (Delonge, 2013), which revealed that while compost application to rangelands has a powerful net GHG benefit, manure, and inorganic nitrogen fertilizers, are both net sources of GHGs. Composting manure aerobically, rather than storing it in anaerobic lagoons, offers a significant greenhouse gas benefit, while applying that finished compost to rangelands or permanent pastures leads to ongoing carbon sequestration through enhanced plant photosynthesis.

N and P in compost are in organic form, so that leaching or entrainment of these nutrients from finished (emphasis is on finished here!), biochemically stable compost to surface water is much less likely than from uncomposted manure, for example. There still needs to be monitoring of soil and crop nutrient status of course, but water quality particularly is likely to benefit when manure is co-composted with enough carbon materials prior to land application to achieve a starting C:N ratio of 30 or 40 to one (30/1-40/1). We are planning future research around the hypothesis that there is an optimum range for starting C:N ratio and O_2 content within the compost environment that will minimize emissions, maximize N conservation and stabilize nutrients in organic form. A complicated question, but tractable within some range of parameters (we expect).

What do you see as the largest barrier(s) for producers to adopt carbon farming practices in California?

Jeff: First, I believe, is a general lack of understanding of the carbon cycle and the role of carbon in agriculture and ecosystem dynamics more generally. This points to an important gap in our agricultural and natural resource management education curricula. This in turn results in a failure to include an emphasis on carbon cycle management within the missions of the various agencies that support agriculture. Fortunately, this is changing, as NRCS has begun to adopt a carbon-based soil quality agenda over the past decade or so. We are just starting to see the fruits of that new focus emerging now. Our challenge is to accelerate this understanding and encourage its spread throughout agricultural support agencies including the Extension Service, Resource Conservation Districts, water and air resource agencies, natural resource agencies, etc. This will hopefully lead to the allocation of increased technical, financial and informational resources from all these sectors for carbon-farming support, so that the work on the ground can actually get done.

In the carbon life cycle analysis was the carbon emitted from fossil fuel combustion for creating and applying the compost considered?

Jeff: Yes, the LCA is very comprehensive (Delonge et al, 2013). It can be found via a link on the MarinCarbonProject.org web site.

Was basic soil testing done?

Yes, detailed soil analysis was carried out on baseline and subsequent soil conditions. See Ryals and Silver 2012 and Ryals et al, 2013 (linked to Marin Carbon Project web site).

Don't we need to be careful with composting that we don't increase N_2O emissions?

Jeff: Yes, it is critical that composting be done well to minimize both N_20 and CH_4 emissions. We measured these from both the "finished" compost applied to our experimental plots and during the composting process during subsequent compost production trials. We found minute traces of both gases associated with compost production, however, the net GHG benefit of the practice greatly outweighed those small GHG costs. Poorly managed compost operations could, however, lead to significant GHG emissions from composting, however, it is not clear that those emissions would be any worse than emissions resulting from the same materials handled without composting.

Suggested Websites from Live Webcast Participants:

Carbon Cycling - Global Impacts http://www.globalchange.umd.edu/research-areas/carbon-cycle-science/

Agricultural Emissions in the United States http://www.c2es.org/technology/overview/agriculture

7 U.S. Code § 6711 - Carbon cycle research http://www.law.cornell.edu/uscode/text/7/6711

Chapter 4. Practices that influence the amount of organic matter
http://www.fao.org/docrep/009/a0100e/a0100e07.htm

Rangeland Soil Quality http://urbanext.illinois.edu/soil/sq_info/RSQIS6.pdf

Sheep Craft Pre-School Link http://www.ehow.com/info_12097058_sheep-craft-preschool.html

Sheep Crafts and Activities for Kids http://www.daniellesplace.com/html/sheepcrafts.html

Grazing Goats Help Control Invasive Weed Species
http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_029102.pdf

Types of Wool Link http://www.woolcrafting.com/types-of-wool.html

Carbon Footprint Calculator http://www.nature.org/greenliving/carboncalculator/index.htm

Ecological Quiz on the Personal Carbon
Footpringhttp://www.myfootprint.org/en/your_carbon_footprint/

Carbon to Nitrogen Ratios of Various Materials http://www.planetnatural.com/composting-101/c-n-ratio/

Calculation of Carbon to Nitrogen Ratio for Three Materialshttp://compost.css.cornell.edu/calc/2.html