Impacts of compost and manure applications on soil C in managed grasslands

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Compost and manure amendments are often applied to grasslands to improve soil conditions, enhance net primary productivity, and sequester carbon (C). Due to the global prevalence of grasslands, and degraded grasslands in particular, this strategy could contribute to climate change mitigation. The mitigation potential of organic amendments likely depends on several factors, including amendment quality (i.e., C, C:N). To investigate the ecosystem response to different soil amendments, we established research plots on three separate grazed annual grasslands in California. In October 2011, before the rainy season, we applied a thin layer of organic amendments to the study plots. At each site, replicate plots were treated with fresh manure, commercial plant-waste compost, or left untreated. At one site, additional plots were treated with compost with a relatively lower N concentration. The plots were sampled for soil chemical and physical properties (bulk density, temperature, and moisture), plant community composition, and net primary productivity prior to and following treatment applications. Additionally, plots were sampled for greenhouse gas emissions (N_2O, CH_4, and CO_2) following rain events. Results indicated that different amendments had variable impacts on soil C pools. Also, although dry amendments were associated with negligible trace gas fluxes, these fluxes increased after rain events. Nitrous oxide emissions peaked in treatment plots following the first rain event during two consecutive years post-treatment. Lower N2O emissions were observed following rain events later in the rainy season. These field observations will be employed to validate and improve the DayCent biogeochemical model, and to estimate the long-term C sequestration potential of managed California grasslands.