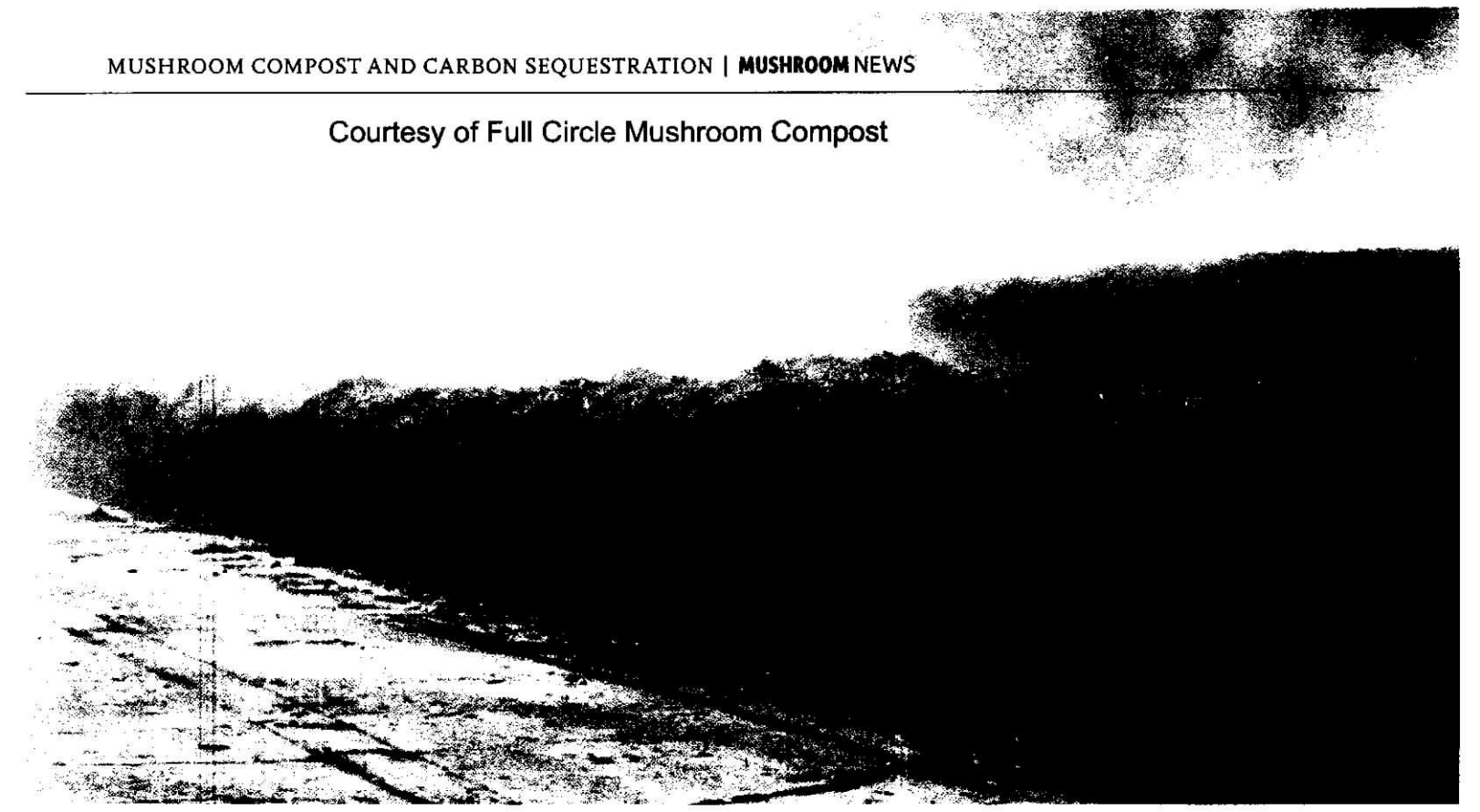
Courtesy of Full Circle Mushroom Compost



Mushroom Compost and Carbon Sequestration

RACHEL ROBERTS American Mushroom Institute

Researchers continue to investigate ways to reuse mushroom compost after the completion of the mushroom growing and harvest cycle. This mushroom compost is applied in various ways for environmental benefit: runoff mediation and riparian buffer projects, green roofs, artillery fungus suppression, evergreen farms, environmental improvement and creation of athletic fields, landfill caps for establishing vegetation, restoration of degraded coal mine lands for wildlife vegetation, myco-remediation, and neutralizing acid mine drainage, metals in soils and oil contamination, among others. In the highly controlled mushroom composting process, those in the mushroom farm community are also providing a valuable service by recycling byproducts from other agricultural sectors.

Over the past year, AMI partnered with Mowery Environmental Services (MES) and Laurel Valley Soils to develop and conduct a carbon sequestration study of mushroom compost. **The result:**

- **One cubic yard of SMC sequesters some 10 pounds of CO2e per year when used instead of a traditional fertilizer in the Northeast, some five pounds in the Western U.S.**
- **This generally comes to 240 pounds sequestered per acre spread in PA and 120 per acre in California.**

These geographically representative calculations can be modified for other states where production and geography affect sequestration.

MES developed a consistent calculation and guidance for application by which carbon sequestration can be predicted based on square foot per mile hauled. This assessment of the environmental benefits of spent compost to carbon sequestration can assist the states in which mushrooms are grown and mushroom compost is used by other sectors to achieve their greenhouse gas emissions goals. This can also provide incentives for other horticultural and agricultural industries to haul and utilize mushroom compost, especially where there is a high concentration of mushroom growing.

Currently, the sequestration result is based on the following calculations.

In Pennsylvania, Mowery used 2019-20 NASS data regarding the total fillings in PA to calculate the cubic yards of mushroom compost generated in PA per year. Nine samples of fresh mushroom compost (MC) were taken to measure the bulk density, the average of which was 822 lbs/

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cubic yards. With this figure, the total tons of MC generated in PA per year were calculated.

Two assumptions were applied: 1) that MC can be land applied in PA eight months out of the year due to either crops going in the fields or winter conditions (i.e., snow covered ground) so MES divided the total MC generated per year by 66% and 2) that a certain percentage of the MC is applied on crop fields and a certain percentage is applied on pastures.

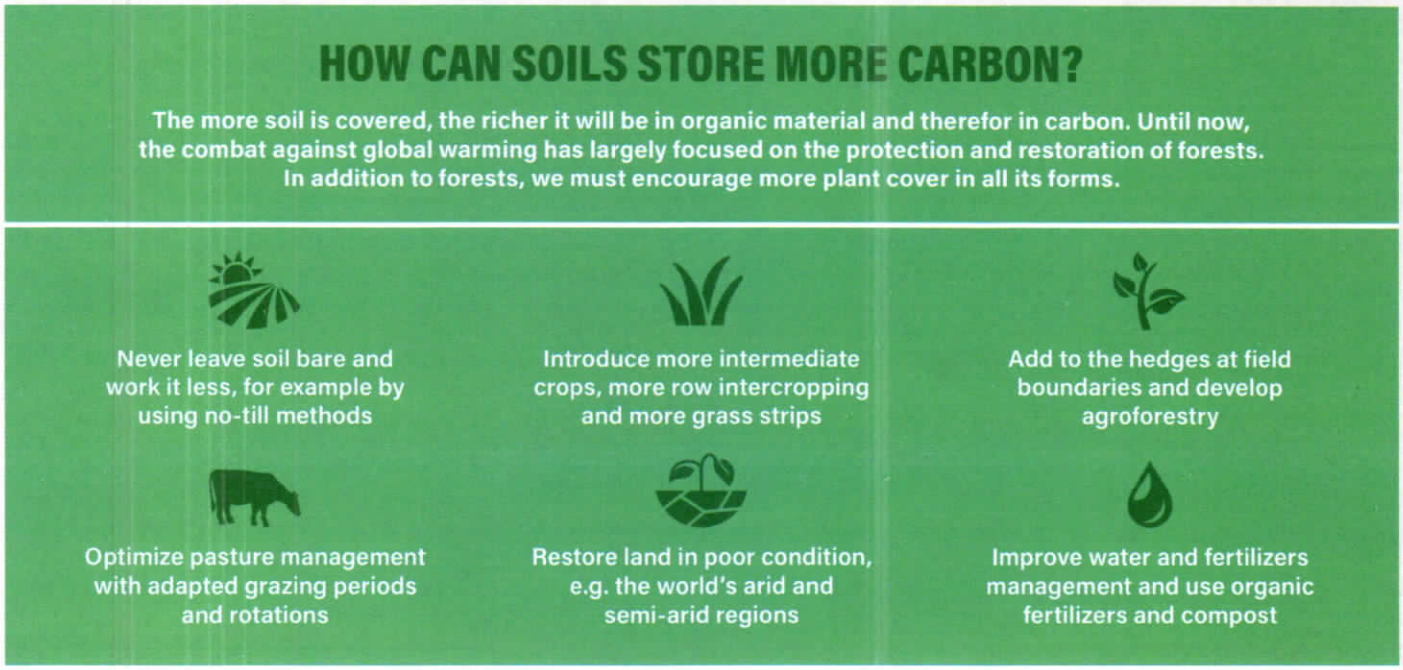
The MC samples collected were analyzed for nutrient content as well, and, using those values, MES developed Nutrient Balance Sheets to determine the appropriate application rate. On average, an application rate of 10 tons of MC per acre applies what the crop needs, without overapplying for Phosphorus. Given an application rate of 10 tons/ac and knowing how much MC is generated, the total number of acres MC could be applied on per year was determined.

Next, the COMET Planner tool (*http://comet-planner.com/*) was used to figure out the total CO2e that are sequestered through the land application on crop fields and pastures as a replacement for a synthetic N source. COMET Planner provides two options—10:1 and 15:1 CN ratio—whereas MC has a CN ratio of 12.5, so both scenarios were run determine the average. The CO2e value was then converted to US tons.

In California, the five lbs of CO2e sequestered in western U.S. was determined by running the COMET Planner for California, including the land application and usage of the MC variations there, generally.

As part of the research, MES factored in data from "A life cycle assessment of *Agaricus bisporus* production in the USA," which determined that MC provides a 'credit' of -7.94 x 10-3 kilograms of CO2e per kilogram of mushrooms produced. This converts to 2.86 lbs CO2e sequestered per cubic yard of MC. One inconsistency in that article that had to be corrected was an assumption that MC contains 0.29% Phosphorus, likely because they did not convert it to P2O5, which would have shown that the value is actually closer to 0.55%, which is what was determined taking actual samples. When MES multiplied their value (2.86) by 1.89, he came up with five lbs of CO2e sequestered per cubic yard of MC land applied, which was aligned with the COMET Planner results. Further work will be done to refine this information and develop user-friendly soundbytes about mushroom compost carbon sequestration for all to repeat proudly.

The "4 per 1000" initiative (www.4p1000.org) is an example of a latest initiative that cites spreading of compost as an important environmental strategy to mitigating climate change and its impacts because of its carbon sequestration capacity.



"This international initiative can reconcile the aims of food security and the combat against climate change, and therefore engage every concerned country in COP21."

Stéphane Le Foll

Vice Chair of the "4 per 1000" Initiative Consortium and former French Minister of Agriculture, Agrifood and Forestry