Using Spent Brewery Grain in the Alaska Compost Pile

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With the increasing popularity of microbreweries, a useful resource is now available to enterprising Alaska composters. As part of the process, brewers steep a mixture of grains in hot water to extract the carbohydrates that will be fermented into beer. After the wort — the liquid that contains the carbohydrates — has been drawn off, the remaining spent grain is now a waste product to the brewer. This spent grain is a great source of nitrogen and organic matter for the compost pile.

Spent grain was collected from several microbreweries in Alaska and from the largest brewery in the state. The samples were dried and analyzed for long-term nutrient contribution to the compost pile.

Although beer brewing is an art, the production process is quite consistent when producing the same type of beer. To determine how uniform the spent grain was between batches, a sample from the morning batch was analyzed along with a sample of the afternoon batch of the same recipe. The analysis of both batches was very similar, indicating that the brewery's extraction process is fairly uniform and that the analysis of one batch should be fairly indicative of the results of that recipe. The nutrient analysis between the samples from the different microbreweries was also quite similar, indicating only minor differences in the spent grain.

The additional extraction processes done by the larger brewery, which included grinding the grain, resulted in noticeable nutrient differences between its spent grain and that of the microbreweries. The processes extracted more carbon, thus concentrating the other nutrients relative to the spent grain of the microbreweries.

Spent grain from a microbrewery, dried for lab analysis.

Nutrient Content in 1000 pounds of Spent Grain

	Average of Microbrews	Large Brewery
Moisture	720.0 lbs	24.0 lbs
Nitrogen	9.1 lbs	41.4 lbs
Phosphorus	1.3 lbs	5.9 lbs
Potassium	0.2 lb	0.7 lb
Calcium	0.5 lb	4.0 lbs
Magnesium	0.7 lb	2.4 lbs
C:N Ratio	15:1	12:1

Moisture Level: At 66–77 percent moisture, the spent grain from the microbreweries is quite wet. Although this is good for the composting process, it also means that composters will be shoveling a lot of water. Essentially, of every 100 pounds of fresh spent grain, only 28 pounds are the nutrient-bearing grain and the rest is water. At 2.4 percent moisture, the spent grain from the larger brewery has been dried to reduce shipping costs, and the nutrients are more concentrated on a per weight basis.

Carbon-to-Nitrogen (C:N) Ratio: With C:N ratios ranging from 17:1 to 12:1, spent grain clearly is considered a source of nitrogen to the compost pile. Many people mistakenly believe that it is a source of carbon, a "brown" material. Because the carbohydrates in the grain are removed for use in the brewing process, the spent grain has a higher concentration of nitrogen (proteins) than does unprocessed grain. This confusion also explains why so many composters notice foul odors when grass clippings, another high nitrogen (or "green" material), are added. Spent grain needs to be mixed with high carbon materials (browns) to compost efficiently.

Nitrogen: The spent grain from the microbreweries had about 1 pound of nitrogen in each 100 pounds of product while the spent grain from the large brewery contributed about 4 pounds of nitrogen per 100 pounds of product.

Other Plant Nutrients: As indicated in the chart, spent grain is not a very effective source of phosphorus, potassium, calcium or magnesium. One thousand pounds of spent grain from the microbreweries would only contribute a total of about 3 pounds of these essential nutrients and 1,000 pounds of spent grain from the large brewery would contribute about 14 pounds of these nutrients. These minerals will eventually be available for the plant to take up. It may be better to think of the phosphorus, potassium, calcium and magnesium contributions as a slight bonus associated with using spent grain in the compost rather than as a significant source of these essential nutrients.

Addition of Bulking Agents: The spent grain from all sources studied will require a significant bulking agent to get proper aeration throughout the pile. The microbrewery grain should be diluted by a coarser material, or the resulting "oatmeal-like" consistency will cause anaerobic pockets in the compost pile since the air cannot move between the tightly packed grain kernels. If oxygen is not available, the microbes breaking down the carbon will produce undesirable odors. This potential issue is even greater when using the ground spent grain from the large brewery. Air cannot move through the compost pile made from the finely ground grain without the addition of a bulking agent. If building the pile as a "layer cake," a thin layer of spent grain should be matched with a thicker layer of coarse carbon material, such as wood chips. If you are mixing the layers together, they still need the appropriate ratio of bulking agent to spent grain to facilitate good airflow through the pile.

Compost Calculators: Using online compost calculators to determine the proper amount of carbon material to add is a challenge since spent grain is not listed as a feedstock or composting material choice. Because most calculators have a "food waste" or "kitchen waste" choice, which has a similar moisture content and carbon-to-nitrogen ratio, those options will provide a reasonable estimate of the ratio of composting materials.

Analyzing Your Spent Grain: If composters want to analyze the spent grain that they have access to, they should have the lab analyze the material using animal feed analysis techniques rather than using soil analysis techniques. Soil analysis techniques underestimate the nutrients that will be available over the long term.

Sources of Further Information:

Klicktat County. Compost Mix Calculator. www.klickitatcounty.org/SolidWaste/fileshtml/organics/compostCalc.htm.

Cornell Waste Management Institute. Cornell Composting. http://compost.css.cornell.edu/Composting_Homepage.html.

Natural Resource, Agriculture, and Engineering Service. 1992. *On-Farm Composting Handbook*, NRAES-54. Ithaca, New York.

National Sustainable Agriculture Information Service, ATTRA. Farm-scale Composting Resource List. http://attra.ncat.org/attra-pub/farmcompost.html

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