myths, miracles…or marketing

Coffee grounds—
will they perk up plants?

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Here I am, a Washington native living in Seattle, and I don't drink coffee (Earl Grey tea is my brew of choice). Nevertheless, I do most of my writing in a coffee shop where coffee and coffee byproducts surround me—most notably the bags of used grounds that are free for the taking. Many people use them as part of their compost pile, but increasing numbers of people are using them straight up as mulch, claiming they repel cats, kill slugs, prevent weeds, aerate and acidify the soil, provide nitrogen, attract earthworms ... the list goes on. Since I'm an organic mulch advocate, I investigated the science behind using coffee grounds in the garden and landscape.

There's actually a lot of research out there on reusing coffee wastes—but much of it relates to what's generated through coffee production and coffee bean harvesting. These wastes include coffee pulp and peel (from the coffee fruit or "cherry"), coffee hulls and husks (covering the coffee seed or bean), and coffee effluent (the waste water used in several of the stages of coffee manufacture).

Since most of us don't have access to these coffee byproducts, and because they are physically and chemically different from the beans, I only reviewed articles that examined used coffee grounds.

Research

From coffee shops to the instant coffee industry, spent coffee grounds can be generated in massive quantities. Enterprising researchers have investigated using coffee dregs for:

- growth media for lab insects and earthworms;
- sileage and herbal remedies for livestock, including cattle, buffalo, sheep, pigs, and chickens;
- biofuel and biogas production;
- composite building materials;
- controlling mosquito larvae (albeit with variable success);
- treating wastewater;
- a natural antioxidant for treatment of diabetes and cardiovascular disease; and
- compost and mulch materials for gardens and landscapes.

Before discussing these last studies, let's consider the chemistry of your used coffee grounds.

Chemical composition

Not everything contained in a coffee bean makes it into your morning coffee. Nitrogen-rich proteins needed for seed germination and growth comprise over 10% of coffee grounds. In fact, the carbon-to-nitrogen ratio of coffee grounds can be as low as 11:1, an ideal ratio for plant and soil nutrition. Since coffee is extracted in water, most of the hydrophobic compounds, including oils, lipids, triglycerides, and fatty acids remain in the grounds, as do insoluble carbohydrates like cellulose and various indigestible sugars. Structural lignin, protective phenolics, and the wonderful aroma-producing essential oils are also left over from the brewing process. It's this last group of chemicals that are reported to have antioxidant and antimicrobial properties.

Decomposition

Over the course of several months, specialized bacteria and fungi break down the various chemical components of coffee grounds. Some larger consumers, including earthworms, are also able to use this food source. The fact that earthworms pull coffee grounds deep into the soil may account for noted improvements in soil structure such as increased aggregation. Humic substances, which are important chemical and structural soil components, are produced through coffee ground degradation. Carbon-to-nitrogen ratios change as well, generally starting out a bit higher than ideal (e.g. 25-26) and decreasing to 21, 13, 11, or even 9.4 in a year's time.

Less straightforward are the changes in pH that occur during decomposition. A commonly held assumption states that coffee grounds are acidic, but this does not hold true experimentally. While two studies on coffee ground composting reported mildly acidic pHs of 4.6 and 5.26, others have measured neutral (7.7) to somewhat alkaline (8.4) pH levels. One researcher found that the pH of soil treated with coffee compost increased after 14 to 21 days of incubation, gradually decreasing thereafter. Obviously the pH of decomposing coffee grounds is not stable and one shouldn't assume that it will always, or ever, be acidic.

Disease suppression

As they decompose, coffee grounds appear to suppress some common fungal rots and wilts, including *Fusarium*, *Pythium*, and *Sclerotinia* species. In these studies, coffee grounds were part of a compost mix, in one case comprising as little as 0.5 percent of the material. Researchers suggest that the bacterial and fungal species normally found on decomposing coffee grounds, such as non-pathogenic *Pseudomonas, Fusarium,* and *Trichoderma* spp. and pin molds (Mucorales), prevent pathogenic fungi from establishing. A similar biocontrol effect was noted on bacterial pathogens including *E. coli* and *Staphylococcus* spp., which were reduced on ripening cheeses covered with coffee grounds.

Currently, disease suppression from coffee grounds has only been demonstrated under controlled conditions on a handful of vegetable crops, including bean, cucumber, spinach, and tomato. Their efficacy in gardens and landscapes is unknown, as is any protective activity on other plant materials such as trees or shrubs.

Effects on plant growth

Given their antimicrobial activity, it's not surprising that attempts to cultivate mushrooms in coffee grounds have been variable and species-specific. Likewise, their effects on plant growth are unpredictable.

Coffee ground composts and mulches have enhanced sugar beet seed germination and improved growth and yield of cabbage and soybeans. It's been an effective replacement for peat moss in producing anthuriums. Increases in soil nitrogen as well as general mulching benefits, such as moderating soil temperature and increasing soil water, are proposed mechanisms for these increases.

Not all get a jolt

Not all plants get a jolt from coffee grounds. Seed germination of alfalfa (*Medicago sativa*) and white and red clovers (*Trifolium repens* and *T. pratense*) was inhibited by water leached through coffee grounds. Growth of crops such as Chinese mustard (*Brassica juncea*), komatsuna (*Brassica campestris*) and Italian ryegrass (*Lolium multiflorum*) were all inhibited by coffee grounds, as was that of ornamentals including inch plant (*Tradescantia albiflora*), geranium, and asparagus fern. One investigator speculated that toxic substances released from decomposing coffee grounds were responsible for their inhibitory effect. This effect also reduces weeds, and perhaps in a landscape dominated by large shrubs and trees, only germinating seeds and seedlings would be injured. But as there has been no experimental research on coffee grounds and woody plants, this is only speculation on my part.

Recommendations

Given the incomplete and conflicting scientific data so far, the scientific jury is still out reviewing the evidence. Nevertheless, I do feel comfortable in making some general observations and recommendations for those of you who would like to try coffee grounds as part of your compost pile or as a mulch:

In compost

- Percentages of 10 to 20 percent of total compost volume have been reported as optimal for compost quality and effectiveness, while over 30 percent can be detrimental.
- Only small amounts of coffee grounds are required for effective disease suppression. Therefore, I recommend using no more than 20% by volume of coffee grounds in a compost pile. A diverse feedstock will ensure a diversity of microorganisms.
- Don't assume coffee grounds will make an acidic compost; pH levels will undoubtedly change over time.

For mulching

- Coffee grounds are finely textured and easily compacted.
- Compacted coffee grounds create a barrier to moisture and air movement, especially when applied in thick layers.
- Therefore, I recommend against using pure coffee grounds as a mulch; instead, try using a thin layer (no more than half an inch) of coffee grounds and cover with a thicker (four inches) layer of coarse organic mulch like wood chips. ■