



CORNMEAL AND CORN GLUTEN MEAL APPLICATIONS IN GARDENS AND LANDSCAPES (HOME GARDEN SERIES)

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Cornmeal and corn gluten meal, both products from corn milling, are readily available to home gardeners. This fact sheet reviews the horticultural science behind each of these products and explains whether they have a legal and practical use in home gardens and landscapes. Alternative strategies are suggested for situations where neither product should be applied.

What is the difference between cornmeal and corn gluten meal?

Both cornmeal and corn gluten meal are extracted from the endosperm of corn (*Zea mays*). During processing, the endosperm (which is the food source for the embryo) is separated into carbohydrate and protein fractions. Cornmeal (Figure 1a) is made from the carbohydrate portion, while corn gluten meal (CGM, Figure 1b) is made from the protein fraction. Technically, these proteins do not contain gluten (which is a protein in cereal crops, such as wheat) but “corn gluten meal” is the accepted term for this product.

The chemical differences between these two corn products are important, as they determine what

effect, if any, each might have when applied to garden and landscape soils. As a source of carbohydrates, cornmeal provides energy to soil organisms such as microbes and earthworms. Corn gluten meal has a significant protein component, meaning that it serves as a source of nitrogen. NPK ratios of CGM can vary, but are typically 10-0-0. The legal difference between the two corn products is that cornmeal is not a component of any registered fungicide, but CGM is a component of several herbicides registered in Washington State.

How are these corn-based products applied in gardens and landscapes?

Cornmeal application

While popular gardening websites and personalities promote cornmeal as a powerful (unregistered) fungicide, there is no legal basis nor published research supporting its use for this or any other horticultural purpose. Do not use cornmeal as a fungicide. Rather than acting as a fungicide, the opposite happens: cornmeal encourages growth of many fungal species, and it is routinely used to culture common plant pathogens such as *Rhizoctonia*



Figure 1. Cornmeal (a) and corn gluten meal (b) are both made from corn milling but are chemically different. (Photos courtesy of Wikipedia and Karen Jeannette, respectively.)

(Trivedi et al. 2005), *Sclerotium* (Azhar et al. 2003), and *Sclerotinia* spp. (Garcia et al. 2012; Figure 2).

A review of the relevant literature suggests that cornmeal proponents may have misunderstood the research. In 1947, Sanford reported that an application of cornmeal reduced the incidence of *Rhizoctonia solani*. However, the author was clear in explaining that the suppression was not due to the cornmeal. Rather, “the reduction of the disease and the apparent decline of the pathogen in the soil are attributed to antibiotic effects from the associated soil fungi and bacteria.” In other words, the cornmeal was a food source that enhanced populations of microbes which were antagonistic to *Rhizoctonia solani*.

Further work identified *Trichoderma* spp. as one of these antagonistic fungal groups (Gul and Fazli 2005) that grow vigorously on cornmeal agar. Use of *Trichoderma* species for suppressing common plant root pathogens has been so successful that several species are now EPA registered as fungicides and are commercially available as preventative biocontrol agents. So it is these fungal antagonists—not cornmeal—that suppress pathogenic fungi.

Corn gluten meal application

Unlike cornmeal, corn gluten meal has a legal and horticulturally legitimate use as a pre-emergent organic herbicide (Figure 3). This application was developed by researchers at Iowa State University who found that CGM could inhibit seedling growth by desiccating the emerging root. Germination may also be inhibited by protein-related compounds in CGM (Liu and Christians 1994).

While early research on CGM proved successful in greenhouse studies, its application and success under real world conditions has been inconsistent. There are several reasons for these inconsistencies.

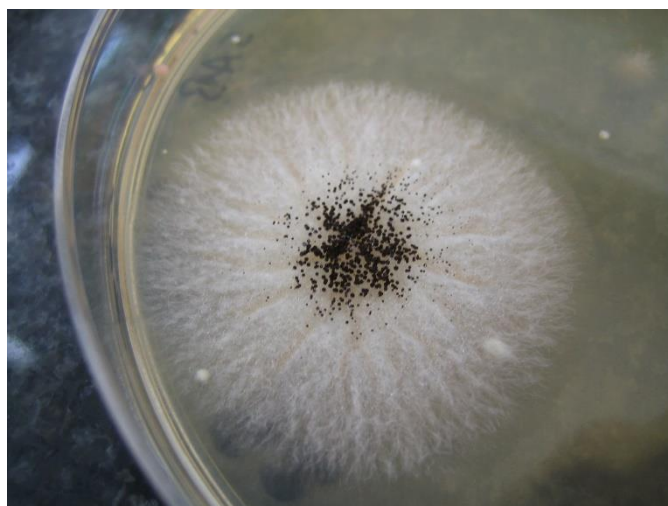


Figure 2. Cornmeal agar is a common growth medium for fungal culture. (Photo courtesy of Wikipedia.)



Figure 3. Corn gluten meal application on an ornamental bed. (Photo courtesy of Pamela Cook.)

1. Water availability:
 - a. Water must be available for seed germination, but then restricted for CGM to be effective.
 - b. Controlling water availability is easy in a greenhouse but difficult in open landscapes and gardens.
 - c. Too much water will eliminate CGM's activity and seedling growth will continue.
2. Seasonal considerations:
 - a. Spring weed control by CGM is most effective in regions with infrequent spring rainfall and least effective where spring rainfall is abundant.
 - b. CGM is a broad-spectrum herbicide, killing desirable as well as weed species.
 - c. Not all weed species are affected by CGM (Figure 4).
3. Other confounding factors:
 - a. CGM has no herbicidal effect on established plants.
 - b. CGM is a high-nitrogen compound (Figure 5) and will enhance, rather than inhibit, the growth of established plants.
 - c. Weed seeds can germinate throughout a growing season, requiring a constant re-application of CGM, which has no residual activity.
 - d. CGM is an expensive product.



Figure 4. Corn gluten meal has a fertilizing effect on crabgrass (*Digitaria* spp.), a persistent lawn weed. From left to right, CGM levels are 0, 40, 80, and 120 pounds per 1000 ft². (Photo courtesy of Tom Cook.)



Figure 5. Corn gluten meal is primarily nitrogen and will have a fertilizing effect on established plants.

Relevant research for home gardeners

There is no research on cornmeal that has demonstrated application value for home gardens and landscapes. Legally, it cannot be used as a

fungicide. On the other hand, a variety of researchers have tested corn gluten meal as an herbicide and a fertilizer under conditions that are relevant to gardening situations.

Container plants:

- CGM used in containers of potting media was more effective in weed control than when applied to containers of sandy soil (Abouziena et al. 2009).
- Container plants treated either with CGM or left untreated had similar levels of weeds. This is not surprising as container plants must be watered on a regular basis. Furthermore, weeds in CGM-treated containers weighed more than those in untreated containers, possibly due to the high nitrogen content of CGM (Wilen et al. 1999). Avoid CGM use in containerized plantings.

Lawns and roadsides:

- CGM had little to no effectiveness on most weed species in turfgrass (Wolfe et al. 2016).
- CGM is an effective fertilizer: of all organic fertilizers tested, it had the greatest impact on turfgrass color and growth (Cheng et al. 2010). Avoid CGM use on lawns and roadsides.
- Over time, CGM was less effective than any mulch materials tested for roadside weed control (Barker and Probst 2009).

Gardens:

- CGM was less effective than other weed control methods in newly transplanted blackberries (Takeda et al. 2005).
- CGM did not reduce total weeding time in strawberry fields and could increase it. The high nitrogen content made for more robust weeds (Figure 6) that took longer to remove (Miller et al. 2013).
- CGM provided good weed control when used as “grit” in a process similar to sandblasting. When blown at high pressure on weed seedlings, CGM abraded foliage and killed the seedlings of susceptible species (Forcella et al. 2010).

Action items for gardeners

- **Use integrated pest management principles to manage pests** (Integrated Pest Management, n.d.).
- **Avoid application of any unregistered pesticide.**
- **Use woody mulches**, such as arborist chips, to suppress weeds. Not only are mulches more effective than corn gluten meal (Wilen et al. 1999), they also help maintain soil moisture, provide slow-release nutrients, and support a variety of beneficial microbes (Chalker-Scott 2015; Figure 7).



Figure 6. Spring application of corn gluten meal to strawberry fields did not control weeds. (Photo courtesy of Tim Miller.)

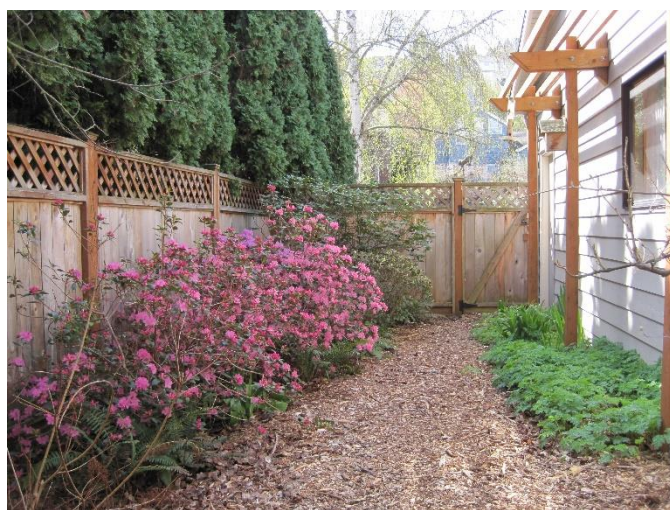


Figure 7. Coarse arborist wood chips are an ideal method of controlling weeds and nurturing landscape plants.

- **Use sub-irrigation methods** (such as buried soaker hoses) to deter weeds where woody mulches are not practical (Wilén et al. 1999).
- **Maintain optimal soil health** by mulching properly, eliminating unnecessary additions of fertilizers and pesticides, and reducing soil tillage and compaction. The microbes that flourish in these soils can help control pathogenic species.
- **Plant mixtures of lawn grasses and other ground covers** rather than growing monocultures (Figure 8).
- **Rotate plant placement** in your vegetable garden every year to reduce local buildup of plant root pathogens.

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