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# Technical Bulletin

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## **GLOMALIN—A NATURAL SOIL AMENDMENT MADE BY VA MYCORRHIZAL FUNGI**

### ***VAM Fungi Make Glomalin***

Mycorrhizal fungi are well known for the beneficial services they perform for plants, specifically regarding increased absorption of water and mineral nutrients. A recently discovered organic substance made by VA mycorrhizal (VAM) fungi has been shown to have significant positive effects on soil structure. This material is called “glomalin”, named after the Glomales, the taxonomic order of fungi to which VAM fungi belong. So far, VAM fungi appear to be the only producers of glomalin, which was discovered in 1996 by Sara F. Wright, a scientist with the USDA Agricultural Research Service.

### ***Glomalin Increases Soil “Tilth” and Reduces Erosion***

Glomalin is a combination carbohydrate and protein molecule called a glycoprotein. It also contains from 1 to 9% tightly bound iron. Glomalin is deposited as a coating on the outside surface of the hyphae of VAM fungi. It is believed that this is how the hyphae seal themselves, so they can carry water and mineral nutrients to the roots of their host plants. When the hyphae die, the glomalin comes off and is released into the soil. There, the sticky glomalin acts as a glue, binding soil particles together forming clumps called “aggregates” of different sizes. This clumping effect reduces soil compaction because the larger clumps pack together poorly, allowing spaces for water and air to accumulate. In this way, glomalin reduces erosion and increases soil porosity, giving soil its “tilth”—a subtle texture that can be judged by feeling the smooth soil granules as they flow through one’s fingers. Porous soil holds air and water for healthy growth of roots and beneficial soil microbes.

### ***Persistence***

Glomalin is unique among organic soil components for its strength and stability. Other soil components that contain carbon and nitrogen, as glomalin does, are typically biodegraded quickly by microbes in the soil. Glomalin is long lasting. It has a unique molecular structure that biodegrades slowly, so the glue effect on soil particles hangs on for years. Carbon dating experiments have shown that glomalin lasts from 7 to 42 years, depending on climate and other soil parameters.

### ***The Major Constituent of Soil Organic Matter***

Scientists were surprised to learn that this newly discovered material is a major constituent of organic matter in soil. Studies have shown that glomalin accounts for a whopping 27% of all the carbon in soils that support VAM plants. Until now,

humic acids were believed to be the main contributor to soil carbon, supplying about 8% of total soil carbon. Since glomalin is long lasting, it is being examined as a major aspect of the carbon sink phenomenon of productive soils. Forests, croplands, and grasslands are thought to serve as valuable carbon sinks, offsetting some of the emissions of carbon dioxide from industry and vehicles. Some of the carbon dioxide consumed by plants eventually gets transferred to their mycorrhizal fungi as glucose from photosynthesis, and a lot of this carbon dioxide eventually gets turned into glomalin. The soil then stores or “banks” this glomalin for many years until it finally biodegrades.

While glomalin has been shown to be the largest known contributor to soil carbon, it also holds significant amount of nitrogen in the soil by reduced leaching, although this nitrogen remains bound for a long time.

### ***Summary***

In summary, glomalin:

- Is only known to be produced by VAM fungi
- Is the major constituent of organic carbon in productive soil
- Improves soil structure by increasing porosity, water-holding capacity, and aeration
- Is long lasting, taking from 7 to 42 years to biodegrade
- Contributes to the carbon sink effect of productive soils