# PLFA Interpretation

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Explanations of functional significance of PLFA response variables in relation to hull/shell amendments and reduced soil disturbance (Ward Laboratories, Inc., Kearney Nebraska).

| Response Variable | Significance and Functions |
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| Total microbial biomass | Does the treatment create conditions and resources that lead to more microbes? Total microbial biomass indicates to what degree soil can generally support microbial life and biomass production. Treatments that supply carbon (and nitrogen) are more likely to increase total microbial biomass. |
| Fungi:bacteria ratio | Bacteria tend to dominate systems with lower organic residues, dry conditions, or after soil disturbances. Fungal-dominated communities tend to be more resilient to environmental stressors. Fungi tend to be considered good soil health indicators. Lower disturbance and increased organic residues tend to promote fungi. |
| Predator:prey ratio | This represents protozoa:bacteria. As protozoa feed on bacteria, they release nutrients, especially nitrogen. The higher the ratio, the more active the community where base level nutrients are great enough to support higher trophic levels. |
| Gram (+):gram (-) ratio | Higher gram(+) levels are common when the bacterial community is stressed or coming out of dormancy. Since they can form spores, they survive better under environmental stressors such as drought or extreme temperatures. Higher gram(-) levels may be due to anaerobic conditions or other stressors. The soil bacterial community tends to become more balanced (1.0-2.0 ratio) as soil conditions become more favorable during the growing season. Gram(+) bacteria have many-layered thick cell walls, while gram(-) have thinner cell walls. This ratio can help indicate relative carbon availability for soil bacteria: gram(-) are more dependent on simple C compounds from plants, while |

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| | gram(+) are more dependent on complex C compounds in organic soils. |
| Actinomycetes (bacteria) | Gram(+) bacteria that cycle organic matter and decompose complex mixtures of polymers such as cellulose and hemicellulose. They resemble fungi because they have long branching filaments (smaller than fungi), but they are bacteria. Some can fix nitrogen on legumes. |
| Rhizobia (bacteria) | Gram(-) bacteria that form root nodules on legumes and fix nitrogen in symbiosis with plants. |
| Arbuscular mycorrhizae (fungi) | Plant symbiont that enhances nutrient and water uptake and can increase plant stress tolerance. |
| Saprophytes (fungi) | Decomposers that drive nutrient cycling, availability, and $CO_2$ flux. They provide a “powerful cocktail” of lignocellulolytic enzymes that can deconstruct complex C compounds (Crowther et al. 2012). They transfer nutrients through hyphae. |
| Protozoa | The presence of protozoa indicates sufficient base level nutrients to support higher trophic levels beyond bacteria. |
| Undifferentiated | Most soil microbes still await identification. |
| Saturated:unsaturated ratio | Reflects how bacteria may be altering their membranes under environmental stressors to maintain optimal fluidity and waste transport, so higher saturated fatty acids may indicate a more well-adapted community to present environmental conditions (temperature and moisture). A higher ratio means a healthier and more stable bacterial community. |
| Monounsaturated: polyunsaturated ratio | Higher ratio indicates less stress. Lower ratio indicates higher levels of prolonged stress due to conditions such as temperature, moisture, pH, or nutrient availability (starvation). |