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MAINTAINING VIABILITY OF BIOLOGICAL PRODUCTS

Quality control of biological products is a tricky matter. After all, such products involve live ingredients. So not only is there concern about proper formulation, one must also be concerned about *viability*, that is, the survival of the living organisms in the mixture during production, packaging, shipment and prolonged storage. You can mix the product faithfully according to a prescribed recipe. But if the living components are dead by the time the customer opens the package, all that careful attention to formulation goes right down the drain.

Commercial Formulators with No Biological Expertise

Too many formulators have little or no biological training. They make fertilizers or biostimulants, or potting soil, and then suddenly decide to add mycorrhizal fungi to their mix. It sounds easy. Since they do not make mycorrhizal fungi inoculants, they simply go to the open market and buy mycorrhizal fungi propagules. When they purchase mycorrhizal fungi ingredients, they receive a package of fine powder or ground fibrous material. It neither moves nor breathes, and it does not look like a plant or an animal. So it is too easy to treat it just like any other chemical or mineral ingredient: They might store it in a very hot or a freezing cold warehouse until they are ready to make product. They might even grind it up into a finer powder to increase their "propagule" counts. Then they mix these hopefully living organisms into a recipe that includes all sorts of fertilizer minerals, soluble and insoluble, as well as organic biostimulants and the whole gamut of possible mixtures. They might even compress them into a tablet under heat and pressure. Not once does anyone question whether the *viability* of the living organisms is affected by either the storage conditions, treatment, rough handling or whether the other ingredients in the mix might be detrimental and kill or reduce the shelf life of live mycorrhizal fungi.

Testing of Formulations for Viability

Sadly, that is the state of the commercial inoculum business today. Most commercial mycorrhizal fungi products are made by formulators with little or no education in fungal biology, and in some cases, with very little biological training at all. As a result, there is often no testing of formulated products to verify that the fungi are still alive at the ultimate end point of production and marketing: the consumer's hand. Formulators treat these living fungi as though they were mineral ingredients that can be mixed with anything without concern for possible detrimental biological effects. No one bothers to ask such questions as: "Are my fungi still alive in my product if I store them this way?" or, "Do these other ingredients kill the fungi or reduce their shelf life?" Even if they did ask such questions, they would have no idea how to go about testing these things. It takes a professional fungal biologist, not a slick business man or a fertilizer formulator, to answer these questions with proper laboratory testing.

Examples of Things that Reduce Viability

Adverse Conditions

Numerous things can kill or reduce the viability of fungal propagules. VAM fungi in particular are much more sensitive to ambient storage conditions than ectomycorrhizal fungi spores. You need to avoid excessive heat and prolonged freezing conditions. Also, light exposure, especially sunlight can kill VAM fungi propagules.

Desiccation

Desiccation can also kill propagules, particularly when it is caused by osmotic effects. This happens when propagules are mixed with ingredients that draw water from the spore or cell. Numerous water-soluble ingredients can do this, and have been shown to greatly reduce the shelf life of VAM fungi propagules. As a result of various tests, Plant Health Care, Inc. limits the amounts of certain soluble ingredients in its formulations, or uses 2-part packaging to prevent desiccation of the spores. This is based on QC internal tests done by PHC, tests which we have recognized as essential, despite our competitors' failure to even consider them. The reason PHC does not formulate VAM fungal spores with soluble inorganic fertilizers is the concern with their desiccation, and thus, shelf-life. Tests are currently underway to determine the short-term and long-term viability of VAM fungi spores mixed with a soluble inorganic fertilizer.

Excess Moisture

Excess moisture can reduce shelf life of VAM fungi propagules, because it triggers spores to pregerminate, or it causes root fragments to biodegrade. This is particularly common in potting soils formulated with mycorrhizal fungi inoculants. Such soils typically have very high water content, so the shelf life of the fungal propagules is greatly diminished. It is important to keep the moisture content of a product low enough to prevent biodegradation and spore germination, but not too low as to cause desiccation. Yet, in the commercial inoculum industry, only PHC seems to be aware of this, as numerous companies are selling formulated products with no regard to moisture content, amount of soluble organic ingredients, storage considerations, or any other factors that affect viability.

In summary, the customer should be aware that mycorrhizal fungi are living things. Therefore, products containing them need to be handled carefully to avoid killing these live organisms. Concerns include:

- Age of the Propagules
- Excess Heat
- Prolonged Exposure to Freezing Temperatures
- Exposure to Sunlight
- Desiccation
- Excess Moisture
- Mixture with Incompatible Ingredients

Check the Label on Mycorrhizal Fungi Products

Always check the product label. It absolutely must have an expiration date so you know whether the product is still viable based on age considerations. Also, the label should present storage and handling advice, addressing temperature and light. If these things are lacking on the label, then you can be sure that the manufacturer is nothing more than a formulator with little or no understanding of fungal biology or product viability.