



Producing the Fungi *Trichoderma* and *Beauveria* at Home

ECHO Asia Auxiliary Document

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Background

Typically if someone were to tell us, “My plants are infested with a fungus,” we would cringe and then advise them to do something about it. Perhaps, encouraging them to spray a copper or sulfur compound, or other times pulling the plants and burning them. That is, unless they are a mushroom grower, in which case they are telling a joke.

In nature, there are dozens of harmful fungi that can quickly kill a plant. Fungi are not able to produce nutrients on their own, so they must find another source; sometimes that source is old bread, orange peels, a rotting tree trunk, or unfortunately, a plant’s translocation tissues. Common fungal diseases include: damping off, leaf spot, anthracnose and rust. These fungi thrive in conditions of poor air circulation, slow water drainage, over-irrigation or too much rainfall. These poor conditions can often be prevented by proper plant spacing and irrigation schedules, as well as removing fungal-prone sites, such as old plant material and weeds. No matter what we do, there is a good chance that fungi will infect our plants at one time or another.

Fortunately, the Fungi Kingdom is not only populated by evil-intentioned intruders, dwelling unpoliced in the murky corners of the invisible world. Indeed, we know this because we eat mushrooms on our pizza. Two particular heroes of the fungal world are *Trichoderma spp.* and *Beauveria bassiana*.

Beauveria bassiana is a common soilborne fungus occurring worldwide. It is an insect-pathogenic fungus, producing spores that, when contacting the skin or shell of the insect, will penetrate the skin and begin producing a toxin called Beauvericin, which weakens the host’s immune system until death. Eventually the fungus will fill the entire body cavity and, under high humidity conditions, will grow through softer body parts, creating the characteristic “white bloom” appearance of the fungus covering the body. The whole process is slow, happening over a 3-7 day period, so it will take time to suppress the insect population.

Trichoderma sp is a genus of fungi also commonly occurring worldwide with different species native to different areas; thus the ‘*sp.*’ designation above. The species are frequently isolated from

agricultural soils or are seen as green spots on bark and deteriorating wood. Several strains of species have been developed as bio-control agents, attacking harmful fungi with various mechanisms, including living inside the host plant symbiotically. However, this anti-fungal activity can make *Trichoderma* harmful in the vicinity of mushroom production (and sometimes in onions).

Strains of both *Beauveria* and *Trichoderma* fungi have been studied in lab conditions. Strains with the most effective beneficial properties have been separated, reproduced and are commercially available in Southeast Asia. Enzymes produced by these fungi differ depending on the strain; therefore, the effects are unpredictable. For this reason, it is not recommended to attempt finding and reproducing your own 'local' variety. We do recommend, however, creating soil conditions to promote the growth of these beneficial fungi in your soil by practicing minimal or no-till, mulching and refusing to spray chemical fungicide.

Fortunately, producing your own *Beauveria* or *Trichoderma* spray at home is possible and quite easy. First, purchase a commercial strain, usually available in a dry powder. It is important to keep this as your only source for growing more fungus because fungi can evolve easily over many generations. So, if you continually inoculate your substrate with spores from your previous batch of production, after only a few generations, you may have something quite different (and much less effective) than the original. It is worth the cost to use the commercial strain each time you create a new batch.

Supplies

It could be quite dangerous to get any fungus, no matter how beneficial it is in nature, into your lungs or eyes. We recommend wearing goggles, a dust mask and gloves when inoculating the growing media. This holds especially true for *Beauveria*, which can affect humans in extremely rare cases.

Other supplies needed are: rice or sorghum, water, a rice cooker and spoon, large clear plastic bags, rubber bands, a needle, and your *Trichoderma* or *Beauveria* powder.

Procedure

1. Mix three parts rice to two parts water (3:2) in the rice cooker. Sorghum can be used in place of the rice. Make enough to fill your rice cooker. Let cook.
2. Add 2-3 large spoonfuls (serving spoons) of cooked rice into a new plastic bag. Pack rice down and flatten the bag and fold the bag over itself to prevent air (containing foreign spores) from getting in while it cools. Let the rice cool until it is comfortable to hold against skin.
3. Open the bag and sprinkle ½ teaspoon of *Trichoderma* or *Beauveria* powder on the rice. Close the bag and seal tightly with a rubber band at the top of the bag. Don't try to force all the air out of the bag but let it balloon. Mix the rice around to spread the spores among the rice. Then pat down rice again.
4. With a needle, poke 10-15 holes in the upper part of the bag where there is no rice.
5. Store bags in a clean (preferably disinfected) place indoors at room temperature. Don't store in a dark place with no artificial or natural light.

6. After 2 days, mix the rice again and pat down.

7. After 7 days, the fungi should take over the whole bag. It is now usable but can live in the bag for 3-4 weeks longer. Healthy *Trichoderma* should have a sweet coconut odor and is most often dark green but can be white or light yellow. *Beauveria* is scentless and should be white.

If you have problems with your bags being infected by other fungi, don't use any of the mixture, even if part of it looks pure. Discard the whole bag. A few changes can be made to the procedure to improve prevent contamination. Instead of poking holes in the bags with a needle, thread the bag through a 3 cm section of thin PVC pipe and use cotton balls or shreds of cloth to fill the hole.

If problems persist, try completing the entire process under a biohood or a similar biosanitary machine. Directions for building a homemade biohood are available from ECHO.

When your *Trichoderma* or *Beauveria* bags are finished, dilute 1 kg of inoculated rice into 200 liters of water. Make sure to rinse the bag and rice clean to get all the possible spores. The *Trichoderma* solution can be added to compost piles or used as a soil drench before planting and every 2-3 weeks during the growing season. Both *Trichoderma* and *Beauveria* can be sprayed onto leaves 1-2 times per week for fungi and insect control, respectively.

Conclusion

Many "Natural Farming" methods encourage the use of nature's processes to replace potentially harmful chemical or inorganic pesticides, fungicides and fertilizer. Many of these methods are not yet widely recognized in the Western agriculture or academic worlds. However, the effects of the fungi *Trichoderma* and *Beauveria* as beneficial biocontrol agents are widely researched and are commercially available worldwide. Both fungi are easy to reproduce at a low cost, and their potential makes them deserving of the attention they are receiving.

Sources

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