MATERIAL NAME: *Beauveria bassiana*

MATERIAL TYPE: Biological (fungus)


USDA-NOP: considered nonsynthetic, allowed. Preventive, cultural, mechanical and physical methods must be first choice for pest control, and conditions for use of a biological material must be documented in the organic system plan (NOP 2000).

MATERIAL DESCRIPTION: *Beauveria bassiana* is a fungus that is commonly found in soils worldwide. Insects vary in susceptibility to different strains. Strains have been collected from different infected insects and cultured to create a particular product for commercial use. There are two commonly used strains, GHA and ATCC 74040. These products are produced through fermentation. The spores (conidia) are extracted and formulated into a sprayable product.

HOW IT WORKS: *Beauveria bassiana* kills the pest by infection as a result of the insect coming into contact with fungal spores. An insect can come into contact with the fungal spores in several ways: by having the spray droplets land on its body, by moving on a treated surface, or by consuming plant tissue treated with the fungus (the latter is not a major method of uptake). Once the fungal spores attach to the insect’s skin (cuticle), they germinate sending out structures (hyphae) that penetrate the insect’s body and proliferate. It may take 3-5 days for insects to die, but infected cadavers may serve as a source of spores for secondary spread of the fungus. Insects can also spread the fungus through mating (Long et al. 2000). High humidity and free water enhance activity of the conidia and the subsequent infection of the insect. Fungal spores are readily killed by solar radiation and infect best in cool to moderate temperatures (Goettel et al. 2000, Wraight and Ramos 2002).

Because the spores may have a short life, it is important that the spray or spray deposit has sufficient opportunity to contact the insect. Therefore,
good coverage is essential with a large number of droplets containing a high concentration of spores. Care should be taken to apply the material to the undersides of the leaves or wherever the pest species primarily occurs. For insects that bore into a plant (e.g. the European corn borer), control will be very difficult. For best results, applications should be made during the early growth stages of the insect before much damage has occurred, as it may take several days for the insect to die. Speed of kill depends on the number of spores contacting the insect, insect age, susceptibility and environmental conditions.

One formulation of *B. bassiana*, Mycotrol™, is reported to be sensitive to high temperatures with best results at application temperatures between 70 and 80°F. Slow growth at warmer temperatures may make this a poor option for growers in southern states (Kuepper 2003).

**TYPES OF PESTS IT CONTROLS:**
Commercial products containing different strains of *Beauveria* are commonly labeled for insects such as thrips, whiteflies, aphids, caterpillars, weevils, grasshoppers, ants, Colorado potato beetle, and mealybugs.

**FORMULATION AND APPLICATION GUIDELINES:** Both liquid and powder formulations are available. In one study, an ES (emulsifiable suspension) formulation showed better ability to withstand rain than the comparable WP (wettable powder) form. Read labels for specific application guidelines including determination of reentry interval (REI) and pre-harvest interval (PHI).

For some pest species, a baited formulation may be most effective (Bextine and Thorvilson 2002). However, no baited formulations are currently commercially available.

**GENERAL GUIDELINES:** Range of efficacy will depend on the susceptibility of species in question, pest population levels, and environmental conditions at time of application. However here are some points to keep in mind:

1) **Look before spraying.**
   Apply only when the insect is seen on the plant and do not apply as a preventative spray since the residue may be gone in a few days.

2) **A single application may not be sufficient.**
   Multiple applications may be required to provide adequate control since the fungus is rapidly broken down by sunlight and washed off the plant by rain. The product is best used as a suppressant rather than an eradicant and thresholds (treatment guidelines) developed for other products may not be appropriate. However, there is evidence that the fungus can overwinter and repeated applications may enhance efficacy for some insects (Groden et al. 2002).

3) **Use against earlier stages of the insect.**
   *B. bassiana* is more effective on younger stages of the insect than on older stages (e.g. large larvae or adults).
4) **Consider compatibility.**
Do not tank mix with any fungicides not allowed on the label (note: the Mycotrol™ label states it is compatible with 'some fungicides'). Applying subsequent fungicide sprays within 4 days after a *B. bassiana* application may also reduce its efficacy. Note other label cautions about tank-mixing with adjuvants or other materials.

5) **Humidity is a factor.** *Beauveria* is likely to be more effective in farm microclimates with high relative humidity, such as valley bottoms (Lo et al. 1999).

6) **Watch for phytotoxicity.** There have been some reports of phytotoxicity to young tomato greenhouse transplants with an ES formulation, so it is advisable to test first before large-scale application.

**AVAILABILITY:**
Widely available from garden and/or farm supply mail order companies. Be sure to verify registration status in state where it will be used.

**OMRI LISTED PRODUCTS:**
- Mycotrol O (Emerald BioAgriculture) *Beauveria bassiana* strain GHA
- Naturalis H&G (Troy BioSciences) *Beauveria bassiana* strain ATCC 74040
- Naturalis L (Troy BioSciences) *Beauveria bassiana* strain ATCC 74040

**EFFECT ON HUMANS AND THE ENVIRONMENT:**
- **Humans:** There are no expected health risks to humans who apply this insecticide or to people who eat the crops that have been treated with the fungus. The two commercial strains of *B. bassiana* (GHA and ATCC 74040) have been tested against rats and rabbits and the results indicate they are not considered to be pathogenic, infective or toxic. However, precaution should be taken since they can be irritants to the skin, eyes and lungs.
- **Wildlife:** Considered non-toxic to mammals, birds and plants.
- **Natural enemies and bees:** Since this product is used to control a broad range of insect types (including beetles and ants), predators in these insect classes could also be affected. Caution should be used when applying it when honeybees are actively foraging.

**EFFICACY:**
While *B. bassiana* affects a wide variety of insect groups (beetles, caterpillars, thrips, aphids, etc.), the variability of control of any one insect can be large and depends on environmental factors, timing of sprays, and the stage of the insect, as well as the insect’s inherent susceptibility to the fungus. *Beauveria bassiana* products have not shown consistently effective pest control in recent university trials. Some studies conducted in the Northeast have shown promise. Control of the diamondback moth on cab-
bgage seedlings was achieved by well-timed sprays with good coverage (Shelton et al. 1998). Additional field trials have indicated that fair to good season long control of the caterpillar complex on cabbage can be achieved with multiple sprays (Vandenberg et al. 1998). In areas where insects like the diamondback moth and Colorado potato beetle have become resistant to Bt, B. bassiana can be used as part of an integrated control program by organic growers. Control of the Colorado potato beetle has met with variable success, largely dependent on the population pressure and application methods, as well as the factors mentioned above (Wraight and Ramos 2002).

Studies conducted in the mid-1990s on a major pest of strawberries, the tarnished plant bug (TPB), indicated that TPB populations and their damage could be reduced to about half by four applications of a product containing B. bassiana (Kovach and English-Loeb 1997). However, it probably needs to be applied early in pest population development as most damaging TPB problems occur around bloom, and the usual IPM treatment thresholds are not appropriate since the material is slow acting. The authors suggest that it may work best in settings that have moderate TPB populations such as in strawberry plantings that include cultivars that are more tolerant to TPB damage such as ‘Honeoye’.

A summary of recent university field trials of Beauveria bassiana products on vegetable crops commonly grown in the Northeast was compiled for this fact sheet. These trials typically test products with untreated buffer rows and other conditions that create unusually severe pest pressure. The level of pest control is likely to be higher on fields in which a good program of cultural controls has also been implemented.

In the table below, “good control” means statistically significant reductions in pest numbers or damage of 75% or more, compared to an untreated control. “Fair control” includes those with significant reductions of 50-74%, and any non-significant reductions of over 50%. The “poor control” group includes any results with less than 50% reduction.

Variable results in these studies indicate more testing is needed, particularly for beetles, thrips, and aphids. Western flower thrips are not very susceptible to the GHA strain, according to lab studies (Wraight and Ramos 2002).
REFERENCES


Groden, E., S. P. Wraight, and F. A. Drummond. 2002. Microbial control of Colorado potato beetle in potatoes in rain-fed potato agroecosystems in the Northeastern US. Proceedings, International Colloquium on Invertebrate Pathology and Microbial Control, Foz do Iguacu, Brazil. 8: 265-269.


