

BACILLUS SUBTILIS



ALL NATURAL MICROORGANISMS FOR AGRICULTURE AND HORTICULTURE

MATERIAL NAME: Bacillus Subtilis

MATERIAL TYPE: Microbial.

USDA-NOP: Is considered non-synthetic, 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.

MATERIAL DESCRIPTION

Bacillus subtilis is a ubiquitous naturally occurring saprophytic bacterium that is commonly recovered from soil, water, air and decomposing plant material. Under most conditions, however, it is not biologically active and is present in the spore form. Different strains of B. subtilis can be used as biological control agents under different situations. There are two general categories of B. subtilis strains; those that are applied to the foliage of a plant, and those applied to the soil or transplant mix when seeding. The B. subtilis is a naturally occurring strain that was isolated from soil and is applied either as a foliar, seed treatment or directly to soil and is not considered a genetically modified organism.

How it works: B. subtilis bacteria produce a class of lipopeptide antibiotics including iturins. Iturins help B. subtilis bacteria out compete other microorganisms by either killing them or reducing their growth rate. B. subtilis are made for many uses. For plant disease control, these include foliar application and products applied to the root zone, compost, or seed. When applied directly to seeds, the bacteria colonize the developing root system, competing with disease organisms that attack root systems. B. subtilis inhibits plant pathogen spore germination, disrupts germ tube growth, and interferes with the attachment of the pathogen to the plant. It is also reported to induce systemic acquired resistance (SAR) against bacterial pathogens.

As a seed treatment **BACILLUS SUBTILIS** gives protection against disease pathogens through three distinct modes of action:

1. Colonies of B. subtilis take up space on the roots, leaving less area or source for occupation by disease pathogens.
2. Feeds off plant exudates, which also serve as a food source of disease pathogens. Because it consumes exudates, it deprives disease pathogens of a major food source, thereby inhibiting their ability to thrive and reproduce.
3. Combats pathogenic fungi through the production of a chemical that inhibits the pathogen's growth.

TYPES OF PESTS IT CONTROLS:

Iturins are reportedly active against the fungus *Sclerotinia fruticola*, which causes rots of harvested stone fruit. B. subtilis has been used in conjunction with *Streptomyces gramicifaciens* for control of root rot in cucumber, corky rot of tomato and carnation wilt. It also suppresses diseases caused by *Fusarium* spp. and *Rhizoctonia* spp.

Formulations application guidelines:

The labels require use of personal protective equipment (long-sleeved shirt and long pants, gloves, shoes plus socks, dust/mist filtering respirator) to mitigate the risk of dermal sensitivity and possible allergic reactions.



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OMRI Listed Product: ACTIVATE 1005 Bacillus subtilis mixed with other Bacillus: Activate PMSLA, NRG's Jump Start.

Non OMRI listed Products: Activate 2004, Activate 2005, Activate SP, and Slap.

Reentry interval (REI) and pre-harvest interval (PHI): The EPA Workers Protection Standard requires a minimum of 4 hours before reentering a treated field. PHI (days to harvest) is zero.

Effect on the environment: The microbes used in these products are not genetically modified, and this combination has been used in the past by farmers with no reports of negative impacts on crops. B. subtilis is non-toxic to birds or insects and no aquatic exposures are anticipated. No adverse effects to fish or wildlife resources are likely through labeled use of this product and no impact to groundwater is anticipated.

Effect on human health: in terms of human health, reviewers found the B. subtilis bacteria to be relatively benign. It is not a known pathogen or disease causing agent. B. subtilis produces the enzyme subtilisin, which has been reported to cause dermal allergic or hypersensitivity reactions in individuals repeatedly exposed to this enzyme in industrial settings.

References: Backman, PA, M. Wilson and J. F. Murphy. 1997. Bacteria for Biological Control of Plant Diseases un Rechigl and Rechigl, eds., Environmentally Safe Approaches to Crop Disease Control. Pp. 95-109, CRC Press. NOP. 2000. National Organic Program Regulators, 7CFR 205, 206 (e) <http://www.ams.usda.gov/nop>. NY DEC. 2000, M. Serafini. NY State Dept. of Environmental Conservation. http://pmep.cce.cornell.edu/profiles/fing-nhemat-aceticacid-etridazole/bacillus_subtilis/Bacillus_subtilis_900.html. NY DEC. 2001. M Serafini, NY State Dept. of Environmental Conservation. http://pmep.cce.cornell.edu/profiles/fing-nhemat-aceticacid-etridazole/bacillus_subtilis/bacillus_label_401.html