

Spinach Production

Field, Greenhouse, and High Tunnel

ROOT DISEASE CONTROL

RootShield[®] PLUS⁺ WP | OMRI Listed

RootShield PLUS⁺ WP (*Trichoderma harzianum* strain T-22, *Trichoderma virens* strain G-41), a preventative biofungicide for control of *Pythium*, *Fusarium*, *Rhizoctonia* and *Phytophthora* can be applied as a drench to transplants or larger plants, used in a suspension to dip transplants into before transplanting in the high tunnel, greenhouse, or field, or applied through drip irrigation systems.

RootShield PLUS⁺ WP Rates:

- Drench: 6 oz/100 gal of water. Apply this at the rate of 50 gal to 800 sq ft of transplant trays. For plants in 4-inch square or larger rockwool blocks, use 100 gal of drench suspension per 800 sq ft. For plants in large pots, drench at the rate of 10–12 fl oz per gal of pot size.
- In-furrow spray or transplant starter solution: For transplants use 16–32 oz/acre and apply with in-furrow spray equipment or in transplanting equipment, including water wheels.
- Transplant dip: 1.6 oz suspended in 20 gal of water. Maintain agitation of the dip suspension. Submerge for 30 seconds. The whole transplant or plug tray can be dipped, if desired. Change out dip solution as it is used up or becomes difficult to use because of fouling with organic matter. Can be tank mixed with ON-Gard[®] for dipping of transplants.
- Drip irrigation application: 6 oz/100 gal or 1–2 lb/acre. Ensure that all filters are in place. Run RootShield PLUS⁺ towards the end of the irrigation cycle, flush irrigation lines with clear water after application.
- 8-10 week residual. 0-hour REI (drench or drip irrigation), 4-hour REI (dip), 0-day PHI.

RootShield PLUS⁺ Granules Rates:

- Growing Mix: 1.5–3 lb/cu yd
- Field: 5–12 lb/acre. Apply granules using a metering device mounted to deliver granules into the furrow just behind the furrow opener. Apply at seeding, transplanting or to established crops as a side dress and incorporated into soil.

T-22 HC | OMRI Listed

T-22 HC (*Trichoderma harzianum* strain T-22) is a wettable powder preventative biological fungicide for control of *Pythium*, *Rhizoctonia*, *Fusarium*, *Cylindrocladium* and *Thielaviopsis*. T-22 HC can be used for commercial seed treatment of spinach seed.

T-22 HC Rates:

- Commercial seed treatment: 1–3 oz per hundred weight (cwt) of seed

FOLIAR DISEASE CONTROL

BotryStop[™] | OMRI Listed

BotryStop is a Biofungicide used for the preventative control of *Botrytis* and *Sclerotinia* diseases. The active component, *Ulocladium oudemansii* U3 strain, is a non-pathogenic saprophytic fungus that aggressively competes for the same physical space as the plant pathogens, thus preventing crop damage. BotryStop is non-invasive and causes no harm to live plant tissue. With this mechanism of action, it is highly unlikely that resistance to BotryStop will develop.

BotryStop Rates:

Foliar Spray: 2–4 lb per acre in at least 50 gal of water. The most commonly used rate is 3 lb/acre.

- Use sufficient water volume to provide good coverage, wetting and saturation of the plant.
- Fill tank halfway, begin agitation, add desired amount of BotryStop and then add a compatible non-ionic surfactant for proper product wetting and spreading. Refer to the “BotryStop Compatibility Sheet” for product compatibility.
- Use spray mixture immediately. Do not allow spray mixture to stand overnight or for prolonged periods.
- For spinach, begin applications when conditions are conducive to disease development and repeat on 7 to 10-day intervals as needed.

Storage and Shelf Life:

- Product must be stored refrigerated. Do not freeze. During storage, keep the bag closed, with excess air removed and away from non-compatible products.
- Under proper storage conditions, shelf life is 12 months
- 4-hour REI, 0-day PHI

CEASE[®] | OMRI Listed

CEASE (*Bacillus subtilis* QST strain 713) is a dependable preventative biological fungicide and bactericide to add to a program for enclosed space production (greenhouse and high tunnel). It can be applied to foliage or soil for control of a broad spectrum of diseases. CEASE is compatible in a tank mix with MilStop for foliar applications.

CEASE Rates:

- CEASE can be applied in as often as 3-day intervals. It is recommended to spray at 7-day intervals for prevention when conditions are optimum for disease. For downy mildew, CEASE should be used as part of an overall control program for prevention. Under conditions conducive to downy mildew, CEASE applications should be increased to twice a week. While the rate range for CEASE is from 2–8 qt/100 gal, the most commonly used rate is 4 quarts.
- Tank mix with MilStop: CEASE/MilStop tank mixes have shown excellent control of *Botrytis*, and other foliar diseases. Use MilStop at 1.25 lb/100 gallons plus CEASE at 2 qt/100 gal/acre (preventative), increasing the rate to 3 lb/100 gal MilStop plus 6 qt/100 gal CEASE for curative control of *Botrytis*.
- 4-hour REI, 0-day PHI.

MilStop[®] | OMRI Listed

MilStop (potassium bicarbonate) is a broad-spectrum foliar fungicide that can prevent *Botrytis* and other foliar diseases. MilStop is an excellent tank mix partner with CEASE for greenhouse and high tunnel spinach to increase disease prevention effectiveness. For outdoor spinach, Serenade ASO can be used as an alternative to CEASE.

MilStop Rates:

- Outdoor foliar spray: Application rates start at 2.5 lb/100 gal/acre for preventative application and up to 5 lb/100 gal/acre for curative.
- Enclosed space application: Rates can be as low as 1.25 lb/100 gal for preventative applications. Apply weekly during periods of high disease potential. Use up to 3 lb/100 gal for curative applications.
 - Tank mix with CEASE: CEASE/MilStop tank mixes have shown excellent control of *Botrytis* and other foliar diseases. Use MilStop at 1.25 lb/100 gal plus CEASE at 2 qt/100 gal (preventative). Increase the rate to 3 lbs/100 gal MilStop plus 6 quarts/100 gal/acre CEASE for curative control of powdery mildew.
- 1-hour REI, 0-day PHI (4-hour REI when mixed with CEASE).

INSECT CONTROL**BotaniGard**[®] / **Mycotrol**[®]

BotaniGard, or for organic use, Mycotrol (WSDA Certified Organic), can be utilized in rotations or tank mixes for outdoor production. This effective biological insecticide, containing *Beauveria bassiana* strain GHA, is used to control, aphids, early stage caterpillars, thrips, and other pests. BotaniGard 22WP, or Mycotrol WPO (WSDA Certified Organic) for organic use, are reliable options for enclosed space production, such as greenhouse or high tunnel

BotaniGard ES/Mycotrol ESO Rates:

- Outdoor foliar spray: At first detection of target pest, apply ¼ - 1 qt/acre in 5 - 100 gal of water. Spray to wet, trying to avoid runoff. Repeat application at 5–10-day intervals. Shorten interval to 3–5 days when populations are high, especially with whiteflies and aphids. Repeat applications for as long as pest pressure persists.
- Enclosed space production (greenhouse and high tunnel) foliar spray: At first detection of target pest, apply ½ – 2 qt/100 gal of water. Spray to wet, but avoid runoff. Repeat application at 5-10-day intervals. Shorten interval to 3-5 days when populations are high, especially with aphids and whiteflies. Repeat applications for as long as pest pressure persists.
- 4-hour REI, 0-day PHI.

BotaniGard 22WP/Mycotrol WPO Rates:

- Enclosed space production (greenhouse and high tunnel) foliar spray: at first detection of target pest, apply ½–1 lb/100 gal of water per acre. Spray to wet, but avoid runoff. Repeat applications at 5–10 day intervals. Shorten interval to 3–5 days when populations are high, especially with aphids and whiteflies. Repeat applications for as long as pest pressure persists.
- Transplant dip: 1.5 oz suspended in 5 gal of water (or 6 oz/ 20 gal). (NOTE: Do not use BotaniGard ES or Mycotrol ESO for dipping.) Maintain agitation of the dip suspension. Submerge for 30 seconds. Transplants or the whole plug tray can be dipped, if desired. Change out dip solution as it is used up or becomes difficult to use because of fouling with organic matter. Can be tank mixed with ON-Gard® and RootShield PLUS⁺ WP.
- 4-hour REI, 0-day PHI.

Tank mix or rotation with Molt-X:

- Both BotaniGard/Mycotrol formulations can be tank mixed with Molt-X as an effective combination on the labeled pests. Use the recommended rates of BotaniGard/Mycotrol indicated above and add Molt-X at 4 fl oz/100 gal. When tank mixing, include Molt-X in every other application.
- In rotation, use the 8–10 fl oz rate of Molt-X, 5–7 days after a BotaniGard/Mycotrol application.

BotaniGard[®] MAXX

BotaniGard MAXX is a unique combination product containing natural pyrethrins and *Beauveria bassiana* strain GHA. This combination represents the latest generation of biorationals for insect control. The dual active ingredient formulation offers both synergy and multiple modes of action that work to kill damaging insect and mite pests. BotaniGard MAXX is an excellent rotation partner with BotaniGard. When insect pressure is high, use BotaniGard MAXX for quick knockdown, then follow up with typical BotaniGard use.

BotaniGard MAXX Rates:

- Enclosed space production:
 - Whiteflies, Aphids, Thrips, and other labeled pests: ½ - 1 quart of BotaniGard MAXX/100 gallons spray volume depending on insect population and foliage density.
 - **DO NOT WET PLANTS TO POINT OF RUNOFF OR DRIP.**
- Field spinach production:
 - Apply ¼–2 quarts BotaniGard MAXX/acre in sufficient water to thoroughly cover foliage infested with insects, typically 5–100 gal of water per acre.
 - Final spray volume can be up to 400 gal/acre. Water volume depends on spray equipment, crop canopy and target pest.
 - **DO NOT WET PLANTS TO POINT OF RUNOFF OR DRIP.**
 - Apply BotaniGard MAXX up to a maximum of 2 qt/acre for extreme insect pressure or high plant density.
 - BotaniGard MAXX can be applied aerially at ¼–1 qt/acre. See label for more details.
- Apply BotaniGard MAXX at 5–10-day intervals. High insect populations, especially aphids and whiteflies, may require application at 2–5-day intervals.
- 12-hour REI, 0-day PHI.

Molt-X[®] | OMRI Listed

As an insect growth regulator, Molt-X (azadirachtin) slows or disrupts the development process which can increase insect susceptibility to either a tank mix partner or the next rotated insecticide(s).

Molt-X Rates:

- 8–10 fl oz/100 gal/acre. Maintain tank solution pH between 5.5–6.5. Repeat application for as long as pest pressure persists.
- When tank-mixing Molt-X reduce rate to 4–5 fl oz/100 gallons.
- 4-hour REI, 0-day PHI.

NemaShield[®]

NemaShield is effective for control of root-damaging fungus gnat larvae (commonly *Bradysia* species) in greenhouse production. NemaShield contains the beneficial nematode *Steinernema feltiae* that is ideally suited for fungus gnat larvae control. It will also control thrips species that spend a portion of their life cycle in the soil or potting media. A properly applied application of NemaShield will kill fungus gnat larvae that are feeding on plant roots.

NemaShield Rates:

- One unit of NemaShield containing 100 million infective stage *Steinernema feltiae* on a clay/gel carrier will treat 1100–3400 sq ft, depending on insect pressure. NemaShield is available in 100 million, 500 million and 2 billion nematodes per unit. See the NemaShield label for more details on proper rates and usage.

Plant nutrition continued on the next page.

PLANT NUTRITION

ON-Gard® 5-0-0 | OMRI Listed

ON-Gard is an innovative complement to your current fertilizer program. It is 100% plant-derived, 100% water soluble, and consistent in composition. ON-Gard also provides a broad array of plant-based amino acids for increased plant health.

ON-Gard Rates:

- Transplant dip: ON-Gard can be used alone or combined with RootShield *PLUS*⁺. Use 0.25% v/v (1.6 fl oz/5 gal) as a dip solution.
- Foliar spray or through drip irrigation: Use ON-Gard at 0.25–0.5% v/v (1–2 qt/100 gal) as a foliar spray during production or mixed with fertilizers run through a drip system.
- ON-Gard is tank mixable with most crop inputs. Test (jar test) to ensure physical compatibility.

Verdanta® EcoVita® 7-5-10 / N-Vita® 9-4-3 Organic Fertilizers | OMRI Listed

EcoVita is a general purpose organic fertilizer suitable for many crops. N-Vita is a higher nitrogen mix (9-4-3). The increased nitrogen promotes foliar growth in some crops. EcoVita and N-Vita are derived from 100% organic sources. These organic nutrient sources provide slow, but continuous release of nutrition to vegetable crops. They are produced using proprietary MINIGRAN® Technology which creates a uniform composition in each granule, consisting of the same amount of N, P and K for precise nutrient distribution and availability to plants.

Verdanta EcoVita 7-5-10 Rates:

- Field Spinach.....870–2,180 lb/acre
- Greenhouse/High Tunnel Spinach.....435–1,745 lb/acre

Verdanta N-Vita 9-4-3 Rates:

- Spinach - Base fertilization.....435–1,350 lb/acre
- Top dressing.....435–870 lb/acre

Refer to product labels for complete application details. Additional technical information is available on our website (www.bioworksinc.com) or from your BioWorks technical sales representative. Always read and follow label instructions.