

Marigold Guardian Plant Production Guidelines

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Guardian Plants help protect plants by supporting biological control agents that kill pests. Marigold guardian plants (Fig. 1) are used to manage western flower thrips by combining predatory mites, a granular form of an insect-killing fungus and marigolds in a self-sustaining IPM system. Adult thrips are lured from the crop to the marigolds. A predatory mite that feeds on thrips larvae (*Neoseiulus* or *Amblyseius cucumeris*) is placed on the plant in a slow-release sachet. The fungus is applied together with a granular supplement to the potting soil and mixed into the top 2 inches. The fungus colonizes and is sustained on a granular material, eliminating the need for repeat applications. The mites feed on thrips in the foliage and flowers and on pollen when prey are scarce. Thrips that escape predation drop to the soil to pupate, where they come in contact with spores of the fungus, *Beauveria bassiana*, and become infected. This is a sustainable, low-cost, ecological way to combat thrips. A commercial granular formulation of *B. bassiana* is not currently available. These are do-it-yourself guidelines for production of a marigold guardian plant system using millet as a soil supplement to encourage the sustained growth of *B. bassiana* from the product BotaniGard® and predatory mite sachets. Our research has shown that guardian plants contributes to keeping western flower thrips populations below damaging levels for at least 12 weeks. They should be started early and placed in the greenhouse or high tunnel before the crop begins to bloom. For Northeast bedding plants, marigolds are started in January for use in late-February-March. It usually takes at least **6 weeks** for the marigolds to begin flowering, after which the fungus, grain supplement and predatory mites are added.



Fig. 1. Marigold guardian plant.

Marigold Production

Essential Materials

- Organic millet
- BotaniGard® Wettable Powder
- Predatory mites (*N. cucumeris*)
- Marigold seeds (yellow French variety)

Seeding & Transplanting: Start yellow French marigolds, *Tagetes patula* L, in 606 flat inserts. We prefer Hero Yellow varieties. Fill flats with potting soil (e.g., Metro-Mix® 360, Sungro Horticulture), water well. Place 2 seeds per cell on the surface and lightly press in with a finger, and then broadcast a thin layer of potting soil over the top and lightly water again. Thin to one plant per cell after seedlings are 1-inch tall. After 20 days, transplant seedling with the soil into 7-in azalea pots. To transplant, fill pots

with soil to the inner lip line and water in. Make a hole in the soil with 2 fingers and insert one plant from the liner cell. After all plants are potted, water in well. Greenhouse temperature should be maintained at around 25°C (77°F).

Fertilizer: Marigolds should be fertilized regularly using your standard mix. We feed them daily 2 weeks after emergence at a rate of 150 ppm (EC 1.02) of the following mixes: Jacks LX All Purpose (21-5-20) (Rate: 100 ppm = 1,814 grams (64 oz.) in 10 gal. water, EC =0.65) and Jacks 15-0-14 Dark Weather plus Magnesium (rate: 50 ppm = 1,276 grams (45 oz.) in 10 gal. water, EC=0.37). **Do not fertilize marigolds after treatment with the fungal material (see below).**

Supplemental Lighting: If supplemental lighting is not used, allow 2 additional weeks before preparing them as guardian plants. Marigolds are usually grown under two 1,000-W high pressure sodium (HPS) lights and they receive indirect light from a metal halide. Lights are generally placed ~5 ft from the bench. A photoperiod of 16 hrs light and 8 hrs dark is generally used.

Millet Preparation

Cooking: One cup of dry raw millet yields about 3 ½ cups of cooked millet. To cook 1 cup of millet, bring 2 cups of tap water to a boil, add the millet and then reduce the heat and cover the pot. Slowly boil the millet for 20 minutes, or until all the water has been absorbed.



Fig. 2. Millet drying in the oven (top) and packaging (bottom right).

Drying & Packaging: Once cooked, spread the millet on a baking tray covered with aluminum foil. Make sure the millet is evenly distributed on the tray and there are no clumps. Place the tray in an oven at 300°F. Take the tray out every hour and mix the millet so it doesn't form clumps or stick to the aluminum foil. Bake it for about 3 hours, or until it is completely dry (Fig. 2). When dry, let the millet cool at room temperature for ~20 minutes and place it in a clean plastic Ziploc bags and store in a cool dry place.

Soil Fungal Inoculation

Use either BotaniGard® 22WP or Mycotrol® WPO (certified organic product)(BioWorks, Inc.) We describe two methods depending on what works best for you. **The instructions below provide enough to treat 10 marigold pots (7-inch).** When preparing and applying the fungal inoculum, follow the safety instructions on the product label for handling BotaniGard®. You should wear a long-sleeved shirt and long pants, protective eyewear, chemical-resistant gloves and shoes and socks, and a dust/mist filtering respirator (NIOSH R-95 or P-95).

Dry Powder Method: In a clean plastic bag, mix 5 teaspoons of corn oil with 1¼ cup (20 tablespoons) of dry millet that has been cooked and dried as described above and mix until the millet grains are fully coated with oil. To each pot, apply 2 tablespoons of the millet/oil mixture at the base of the plant and distribute it evenly over the soil surface. In each pot add ½ teaspoon of BotaniGard® (WP or WPO) over the millet, and then mix the millet and fungus into the top 2 inches of the potting soil until it is fully incorporated (Fig. 3).



Fig. 3. Applying BotaniGard® and millet.

~OR~

Drench Method: Prepare the dry millet and corn oil mixture as described above and spread 2 tablespoons evenly over the soil surface and mix it into the top 2 inches of the soil. Prepare 2.5 quarts of the BotaniGard® product (5 teaspoons BotaniGard® in 10 cups of tap water) and mix thoroughly. Apply 1 cup of the suspension evenly over the surface of the soil in the vicinity of the millet mixture.

Predatory Mites

Purchase slow-release sachets containing the predatory mite, *N. cucumeris*, from your biocontrol supplier (Fig. 4). This should be done 1-2 weeks before the marigolds are blooming and you are ready to set up the guardian plants. Hang the sachets on a wire hook or a branch of the marigold, making sure to keep it from touching the moist soil. The sachets provide a continual supply of predatory mites for 4-6 weeks, after which they should be replaced.



Fig. 4. Predatory mite sachet.

Other Details

- Place guardian plants throughout the crop at a rate of 2 plants/1,000 sq. ft. Elevate them above the crop plants by placing them on an inverted pot.
- Water guardian plants regularly, but don't overwater. Don't fertilize after fungal treatment has been applied.
- Guardian plants should be monitored weekly for thrips or other pests, such as aphids or spider mites. Tap plants gently over a white piece of paper, taking care not to allow millet grains to fall out. If pest populations are high and predatory mites are absent, put the plant in a bag, throw it away and start another.

If you have questions about this system, contact: Margaret Skinner at (802) 656-5440 or miskinner@uvm.edu



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