

# Aphid Banker Plant System for Greenhouse IPM, Step by Step

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## What is the Aphid Banker Plant System, and how does it work?



Barley banker plant that produces parasites to manage aphids.

Several species of aphids attack ornamentals, greenhouse grown vegetables and spring bedding plants. Some can be managed effectively with parasitic wasps using an Aphid Banker Plant System. Banker plants are a self-contained sustainable system that supplies a non-pest prey species to support a continual source of natural enemies that disperse into the crop in search of other pests. Essentially they are a mini-rearing system for the natural enemy. The prey may be a plant pest, but not of the crop that is being protected. For the aphid banker plant system, a cereal aphid (bird cherry oat aphid, *Rhopalosiphum padi*), a cereal grass pest that doesn't attack most greenhouse bedding plants, is raised on grain plants (barley, wheat or oats). *Aphidius colemani* is a parasite commonly used to manage green peach aphid (*Myzus persicae*) and cotton or melon aphid (*Aphis gossypii*) and other aphid pest species found in greenhouses. This parasite can be released onto the banker plant when the population of the cereal aphid is high enough to sustain the parasite



*Aphidius colemani* parasitizing an aphid.

population. Over time, the parasite population will increase sufficiently so that it will disperse into your crop in search of pest aphids. The banker plant will continue to produce more parasites as long as there are cereal aphids. To be effective, fresh banker plants must be produced to provide an ongoing source of parasites for your crop over the growing season. Aphid banker plants should be destroyed at the end of the season to avoid the buildup of hyperparasites. Hyperparasites are tiny wasps that lay their egg within the *A. colemani* which has parasitized an aphid.

There are several advantages to this banker plant system: it is an inexpensive way to produce a continual source of aphid parasites without having to purchase new shipments throughout the season; it eliminates the lag time between detecting an aphid infestation and receiving the natural enemy you need from your supplier; it is easy to do and doesn't take a lot of time. To see a video of *A. colemani* laying an egg in an aphid go to <http://www.youtube.com/watch?v=MCfOZtFB3aU&feature=related>

## What crops are appropriate for this system?

Most spring bedding plants and vegetables such as greenhouse-grown tomatoes and cucumbers, particularly those that are dicotyledonous plants. These are not susceptible to infestation by the bird cherry oat aphid.

## What crops are NOT appropriate for this system?

Monocotyledon plants, including Easter lilies, Alstroemria, ornamental grasses, orchids, day lilies, irises, spring bulbs (tulips, daffodils), palms, sweet corn, onions and garlic. Research in Canada has shown that if less than 10% of the crop in a greenhouse is a plant that could be susceptible to the bird cherry oat aphid, it is unlikely that they will infest your crop.



Aphid banker plant in a retail area with a customer awareness sign.

## How many banker plants do you need?

Rates can be variable based on several factors (crop, parasites/predators supported, time of year, etc.). Always check with your supplier to find which rate is the most appropriate for your operation. Biobest recommends starting out with at least 2 banker plants per acre (43,560 ft<sup>2</sup>) of greenhouse. If your greenhouse is less than an acre you still should start with 2 banker plants. Each week after first introducing the banker plants, 1 more banker plant per greenhouse or acre should be added. For this system to work effectively, it is critical to continue to produce new banker plants and add them into your greenhouse throughout the season, until around July 1. After that, you should have enough banker plants to provide management against most of your aphid pests until late August when the system is usually abandoned.

## When should I start to produce banker plants?

Banker plants are used as a preventative IPM tool. Banker plants should be put into greenhouses as soon as they are opened up and plants are added. It takes at least 3-4 weeks before a banker plant is producing adult parasites, so do not wait until you see the first aphid in your crop to start your banker plants. That is TOO LATE.

## Materials needed:

- Hairnet/Bouffant: white polypropylene, size: (xlarge, 24 in) (available from Grainger Supply [www.grainger.com], item #3EZC6) (cost [US\$]: around \$10.50 for 100) **OR** a dedicated aphid banker cage. Several options for cages are available commercially: Pristine Plants, LLC [pristineplants@gmail.com] (cost [US\$]: around \$300); Bioquip Products: (www.bioquip.com/) **OR** you can make your own containment cage. Some growers have modified soda coolers for this purpose to keep parasitic wasps away from the host aphids.
- Plastic plant pots or hanging baskets: 12 inch diameter.
- Potting soil: Metro mix or other similar potting mix; use whatever you commonly use for your crop plants (cost [US\$]: around 2 cents )
- Grain seed: Winter barley, oats or winter wheat. Winter wheat is ideal because the grass blade is particularly wide, which supports a larger population of aphids. Oats also work well. You can purchase these from many seed companies (cost [US\$]: around \$7 for one pound from Park Seed Co.) or local livestock feed companies (cost [US\$]: around \$20 for 50 pound bag of organic or untreated feed).
- Starter population of bird cherry oat aphid (*Rhopalosiphum padi*) (available from IPM Laboratories Inc.- <http://www.ipmlabs.com>).
- *Aphidius colemani* (the parasite to release on the banker plant). Order the parasites at the time indicated below.



Aphid Banker Cage (Pristine Plants, LLC)



Aphid banker plants grown in a modified soda cooler.

## Step-by-Step Procedure

Start aphid banker plants **6 weeks before** you plan to start plants in a greenhouse in the spring. It takes that long to get the system up and running and ready to use in a clean greenhouse. Banker plants should be put into the greenhouse on the same day you warm up the house and start to fill it with crop plants.

## Before you start:

1. Order the grain seed you need and store in a cool, **dry** place in a closed waterproof container. Make sure they are protected from mice and other rodents.
2. Order 1-2 packages of hairnets (depending on how many banker plants you intend to produce over the season) **or** order/construct your aphid banker plant cages.
3. Order the cereal aphid starter population (generally called aphid banker plant starter). You should order one starter pack for each banker plant pot you are going to start.

## Week 1:

1. When the aphid starter populations arrive, fill 4 plant pots with potting soil and make the soil moist (enough for up to 2 banker plants per greenhouse).
2. Plant one cube of the aphid starter population per pot directly into the moist potting soil.
3. Scatter half a cup of grain seed per pot directly on the moist potting soil around the starter.
4. **Immediately** cover each pot with a hairnet **or** place in containment cage. If you don't, stray parasites can get in and destroy the cereal aphid population before it is able to build up on the grass.
5. Continue to water pots as needed by carefully lifting up the edge of the hairnet, making sure you reseal the pot afterward. Don't over water. The greenhouse temperature should be 70-75 deg. F.
6. Place an order to receive 500 *A. colemani* each week for 3-4 weeks, with the first shipment to arrive the following week (**Week 2**). They are shipped in a tube of parasitized aphid mummies in vermiculite.



Production of aphid banker plants. Seeds spread on soil surface (left), barley 1 week after planting (right). These starter plants must be covered with a hairnet or kept in a screened cage at all times to keep parasites out.

## Week 2:

1. Fill 4 plant pots with potting soil and make the soil moist.
2. Scatter half a cup of grain seed per pot directly on the moist potting soil.
3. **Immediately** cover each pot with a hairnet **or** place in containment cage.
4. Using scissors, trim off 3-5 sprigs of grass blades containing a few cereal aphids from pots started **Week 1**. Lift up the edge of the hairnet on the newly seeded pots and place these grass sprigs on the moist potting soil and grain seed. When the seeds germinate, the cereal aphids will move to the new plants. Don't lift the hairnet until you are ready to add the infested grass so parasites don't get into your banker plants.
5. Release 100 *A. colemani* wasp mummies evenly into each of the pots you started on **Week 1** by lifting up the edge of the hairnet. If there are very few aphids on the banker plant, you may want to wait a week before introducing the parasites. Continue to water all of the pots as needed. Do not over water. Hanging baskets can be put on a drip irrigation system.
6. **IMPORTANT NOTE:** Make sure you release the parasites **after** infesting **Week 2** pots with cereal aphids (Step 4) so you don't accidentally let parasites in those pots.



Production system for aphid banker plants. Plants from Wk 3 and 4 are covered with hairnets, Wk 1 and 2 and are uncovered to allow parasites to disperse into the crop.



Close-up of banker plant in pot covered with hairnet.

## Week 3:

1. Fill 4 plant pots with potting soil and make the soil moist.
2. Scatter one half cup of grain seed on the moist potting soil.
3. **Immediately** cover each pot with a hairnet **or** place in containment cage.
4. Follow step 4 above, taking sprigs of infested grass from **Week 2** pots.
5. Release 100 *A. colemani* wasp mummies into each of the pots you started on **Week 2**, as described in step 5 above. You should be able to see a few aphid mummies on the grass.
6. Continue to water all of the pots as needed.



Aphid mummy. A parasite is maturing inside, which killed the aphid.

#### Week 4:

1. Fill 4 plant pots with potting soil and make the soil moist.
2. Scatter one half cup of grain seed on the moist potting soil.
3. **Immediately** cover each pot with a hairnet **or** place in containment cage.
4. Follow step 4 above, taking sprigs of infested grass from **Week 3** pots and then infesting **Week 3** pots with the parasites.
5. Remove hairnet from **Week 1** pots then place the pots around the greenhouse. You should be able to see parasites flying around the plants and aphid mummies with exit holes. Some growers put them in hanging baskets to save space. They can be watered with drip irrigation systems if necessary.
6. Continue to water all of the pots as needed.



Parasite exit hole (above) of aphid mummy. Note that the hole is a perfect circle. The exit hole of a hyperparasite is jagged and has uneven edges (below).

#### Week 5:

1. Fill 4 plant pots with potting soil and make the soil moist.
2. Scatter one half cup of grain seed on the moist potting soil.
3. **Immediately** cover each pot with a hairnet **or** place in containment cage.
4. Follow step 4 above, taking sprigs of infested grass from **Week 4** pots.
5. By now parasites should be established and additional releases should not be needed.
6. Remove the hairnet from **Week 2** pots and place them near the **Week 1** pots in the greenhouses.
7. Continue to water all pots as needed.



Hyperparasite of *A. colemani*.

#### Week 6:

1. Fill 4 plant pots with potting soil and make the soil moist.
2. Scatter one half cup of grain seeds directly on the moist potting soil.
3. **Immediately** cover each pot with a hairnet.
4. Follow step 4 above, taking sprigs of infested grass from **Week 5** pots to put in **Week 6** pots.
5. Remove the hairnet from plants started in **Week 3** and place them around the greenhouse.
6. Move Week 1 pots to other greenhouses you are starting to fill with crop plants.
7. Continue to water all pots as needed.

#### Future weeks:

Continue to start new banker plants weekly until July, following the same steps described above. Before discarding old banker plants, place under a bench for 7-10 days to let remaining parasites emerge. Keep an eye out for an infestation of hyperparasites. Hyperparasites are tiny wasps that lay an egg in the *A. colemani* which has parasitized an aphid. You know you have hyperparasites in your banker plants if the edge of the parasite exit hole in the aphid mummy is jagged and uneven. Hyperparasites can wipe out your *A. colemani* population if allowed to reproduce. Destroy any remaining aphid banker plants at the end of the season to avoid the buildup of hyperparasites. This banker plant system can be used outside in ornamental crops such as potted mums, but be sure you don't place them near other field crop plants that could be susceptible to the bird cherry oat aphid.

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