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Last modified: 03/09/2017

## 1 Clean the greenhouse after a season

1.1 Completely empty the house.

- Pick up fallen leaves
- Discard plants (including weeds) and soil
- Remove used pots and stakes (Have them sterilized; see 1.6)
- Empty trash bin

Cleaning is the best prevention of pests.

1.2 Spray Clorox (bleach) to sterilize the house.

1.3 Wait for 2-3 days.

1.4 Place work order to fumigate the house. Ask [Lance](#) (link to section 6).

1.5 After fumigation, wait for at least 1 week. Then it is ready for a new season.

- Put cubes of salt on the ground to prevent weeds.

1.6 Prepare stakes

- Bundle stakes together; label with name and greenhouse number; place in metal cart. Place work order to sterilize them. It may take a long time as they only sterilize when the cart is full.



↑ Bundled and tagged stakes

## 2 Start a new season in a clean house

2.1 Sow the seeds.

2.2 Place work order to apply “Marathon” 3 weeks after germination.

“Marathon” is granular pesticide that controls a wide range of insects (except mites).

2.3 Hang thrip bags on the stakes. This will prevent (not cure) thrip damage.



- Do not leave unwanted plants in the house and discard them immediately (including weeds). They may become a home for pests. Note that remnant bean seeds from the previous season may germinate under the bench. Remove them.



- Empty the trash bin with plants in it. The plants harbor insects.



↑ A thrip bag

### 3 If a pest problem occurs

- 3.1 If you see damage or pest on your plants, consult the greenhouse personnel and place work order to apply pesticide. Keep a close eye on your plants for any new damage.
- 3.2 If thrip problem occurs, the only way to control them is to apply pesticide every week or as necessary. It is difficult to completely get rid of them.



- Pick and dispose of weeds before pesticide application so the pests will not hide underneath the leaves of weeds growing under and around the benches.



- Do not go to other greenhouses after going to one where there is a pest problem! You can carry insects around.

### 4 Pests and diseases of beans

#### 4.1 **Thrips**

Thrip bags will help to prevent the problem. If there is an outbreak of thrips, and it is going to be treated, do not use them. They will affect the thrip treatment by the greenhouse staff. Wait at least a month after the treatment until you use thrip bags. It is difficult to eradicate thrips once they emerge. Prevent them by completely cleaning the house following the procedure 1 before planting.

#### 4.2 **Spider mites**

Common when beans are about to mature. They prefer warm and dry conditions. Webs and colonies may be visible near the apical meristems. The only treatment is to apply pesticide.

#### 4.3 **Aphids & fruit flies**

They damage your plants, but also may carry virus around, so they also need to be treated when you have a virus problem.

#### 4.4 **Weevils**

They lay eggs on the pods and the larvae can damage the whole seeds.

#### 4.5 **Root rot**

Ask the greenhouse staff to apply “banrot”, a granular fungicide. To prevent root rot, do not water your plants too much.

## 5 Fertilizer application

Fertilizers and a weighing scale are in front of the office of the greenhouse.

### 5.1 Granular “Osmocote” - slow release

14% Nitrogen (N), 14% Phosphorus (P), 14% Potassium (K)  
Apply a handful to each pot. Plants should be at the trifoliolate stage to avoid salt burning. Once it is used, the soil should not be dry.

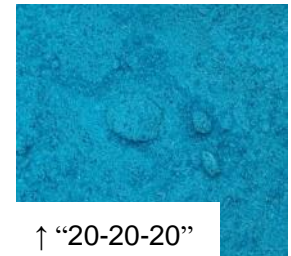


↑ “Osmocote”

### 5.2 Powdery “20-20-20 Water Soluble Fertilizer” - fast release

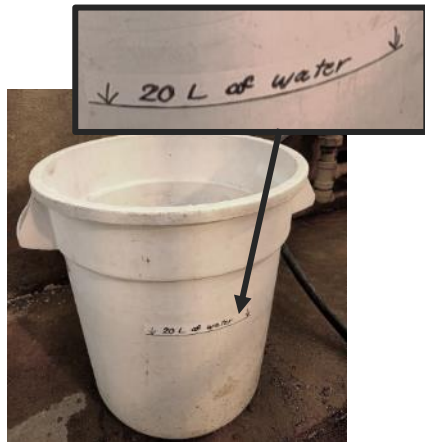
20% N, 20% P, 20% K

Dissolve 320 g (=0.7 lb) of the blue powder with 6 g of S.T.E.M. (Soluble Trace Element Mix) into 20 L of water. Make sure the blue liquid does not touch the leaves to avoid burning. If you do not finish in one time, apply next time in 3-7 days.



↑ “20-20-20”

### How to apply liquid fertilizer



↑ Dissolve fertilizers in a bucket with a 20 L line.



↑ Attach a liquid fertilizer injector between the faucet and the hose. Water normally.



↑ A liquid fertilizer injector

### 5.3 When to apply fertilizer?

- When the trifoliolate are fully developed – Osmocote (because the root system is not developed yet).
- When the second trifoliolate are fully developed – liquid fertilizer.
- When the plants need it (when they are yellow-ish; see pictures below) – liquid fertilizer.
- Right before flowering – liquid fertilizer.
- During the pod filling (physiological maturing) stage – liquid fertilizer.



↑ Hungry plants with light yellow green leaves



↑ Healthy plants with dark green leaves

## 6 Further information

For crossing and other experimental procedures, please go to the Lab Protocols page on MSU Dry Bean Breeding and Genetics website:

<http://bean.css.msu.edu/LabProtocols.cfm>

## 7 Contacts

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