BioComplete™ Compost

Lecture 6 – BioComplete™ Vermicompost

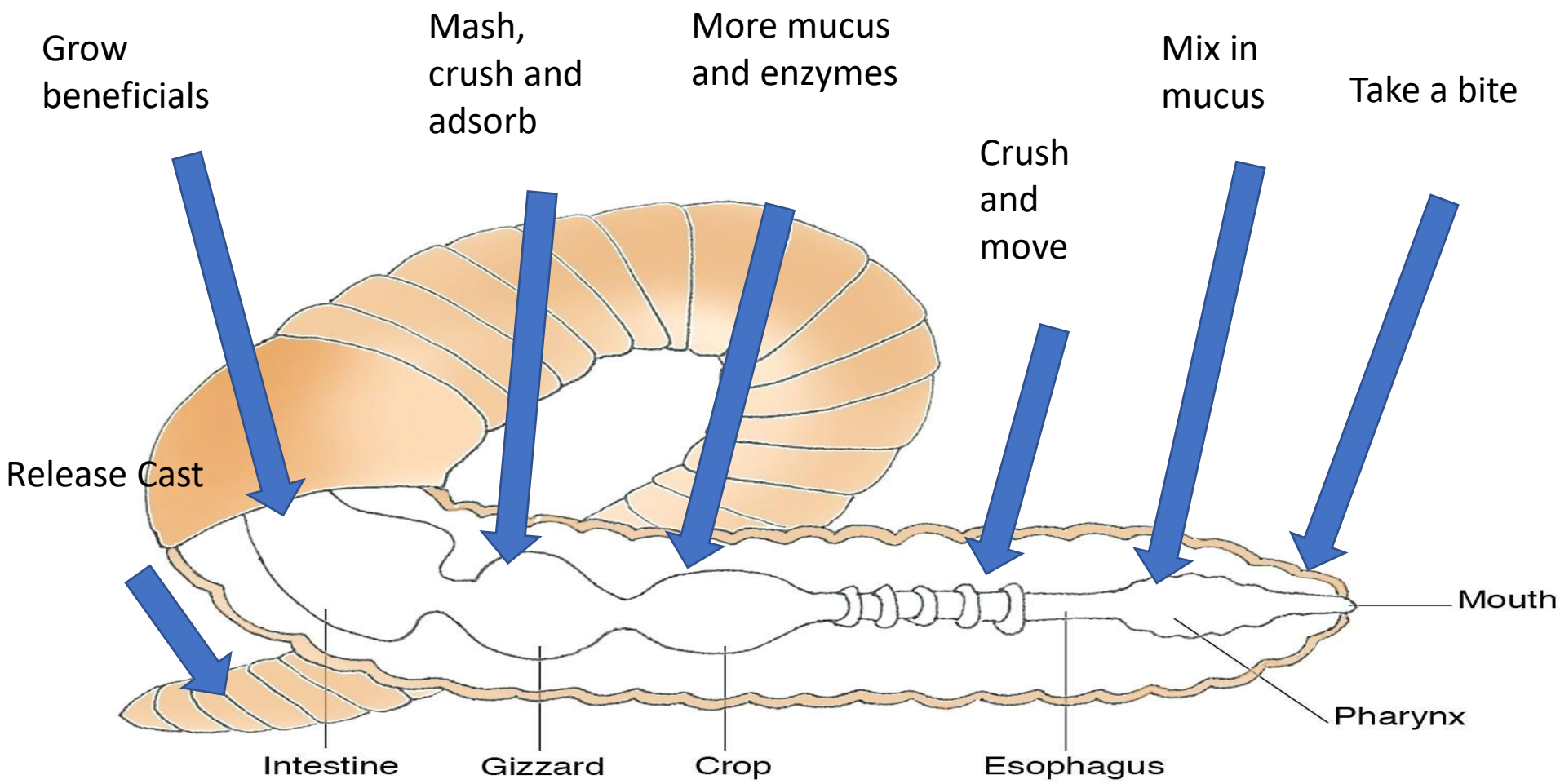
How to Make BioComplete™ Compost

- **Hot or Thermal Composting**
  - Commercial, back-yard, household
- **Worm or Vermicomposting (cold composting)**
  - Batch or flow-through
- **Static Composting**
  - Anaerobic middle, aerobic surface, leave alone for 1 – 2 years, hope for worms

BioComplete™ Vermicomposting

- **Cold composting method.**
- **Periodically (every 3 days) layer additional organic matter on the top of the worm bed. Maintain 60 to 70% moisture on bed surface. Lower in the pile, the moisture will tend to accumulate, and compaction layers will need to be opened up to prevent anaerobic conditions.**
- **Temperatures above 90 F, or anaerobic conditions, or growth of particular microbes will cause the worms to try to leave the worm bed.**
- **Worms consume bacteria, fungi, protozoa, and nematodes growing on foods added to the bin, make castings, and move upwards into new food.**

Earthworm Diagram



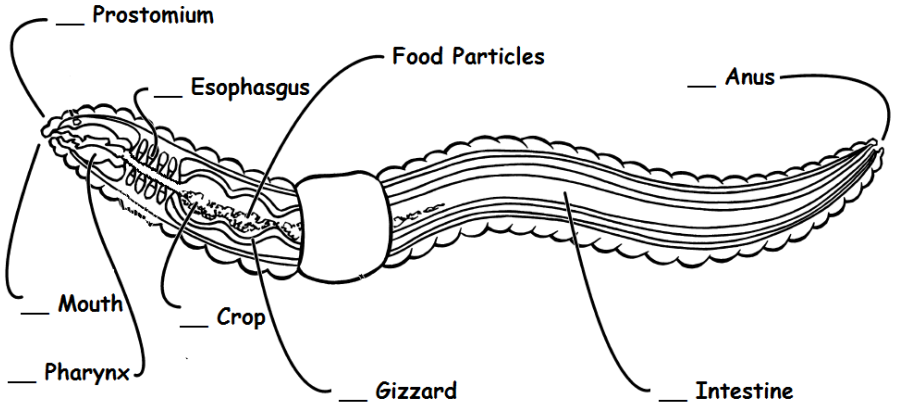
Earthworm picture from Online.mastermind.club

Worm Biology: What Happens Where?

- **Mouth** - Worms bite into the material in front of them. Through muscle contractions, the material gets "chewed" into smaller chunks.

- **Pharynx** – More mucus and enzymes are added, contractions keep occurring to chew the material into mush to ease movement through the worm.

- **Esophagus** – Contractions keep occurring, which pop bacteria, fungi, protozoa, nematodes and any other creature small enough to fit into the mouth open, and the worm begins to enjoy "microbe juice" for its meals.

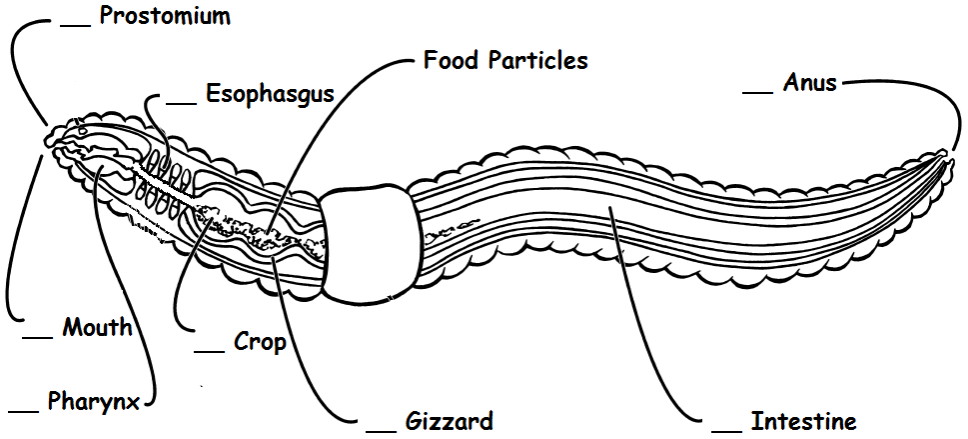


Worm Biology: The Tail End

- **Gizzard** - Muscle contractions continue to chew the material into smaller chunks, more microbes are crushed and their juices released.

- **Intestine** – Contractions keep moving the material along but now the focus is on growing beneficial organisms. Some of the best bacteria, fungi, protozoa, and nematodes maintain stable populations inside the earthworm intestines.

- **Release Cast** – Round balls which can vary in size from 1 - 2 mm to 5 - 10 mm are released from the worm's anus. Worm mucus covers these casts, and the cast itself is fully inoculated with extremely beneficial organisms.



Worm Biology is Strictly Aerobic

- **Earthworms are strict aerobes. Worms die in anaerobic conditions.**

  Example: When it rains and the worm's burrow fills with water, the worm uses up the oxygen in the water and is forced to leave the burrow. That's why you see them on the sidewalk when it is raining hard.

- **Take-home message: Don't let compaction occur. Those air passageways are critical for worms to maintain oxygen uptake.**

Worm Biology and Pathogens

- **Worms mix and turn the soil, but this disturbance is very localized. The casts left behind usually more than make up for any damage their burrowing does.**

- **Manure is often part of worm compost. All manure will most likely contain disease-causing and pest organisms. But these bad guys can't deal with all the conditions that select against their survival in the worm's digestive system. None of them make it out alive.**

Worm Biology and Oxygen

- **Worms can’t ingest seeds - they are just too big. Thus heat treatment needs to be done before going to the worms in order to deal with seeds.**

- **Food scraps are usually placed on the top of the organic matter pile, so the worms move to the microbes growing on the scraps. The worms burrow through the organic matter, aerating as they go.**

- **Worms need to fully mix the organic matter within a 3 day period of time (summer temps).**

BioComplete™ Vermicomposting and Temperature

- **Worms slow down as it gets colder, to the point they really don’t do much when the temperatures are close to freezing.**
- **Worms leave eggs behind when things go badly for the worms. So the populations will recover.**
- **As temperatures increase above 85 to 90 F, worms get too hot and slow down again. They need water, but water with oxygen bubbled into it in these conditions.**
- **Less food in either temperature extreme.**

How Much to Feed the Worms

- **Worms reproduce, so in a few weeks of starting your bin, the worms should have at least doubled --- if conditions were good for them. How do you tell?**
- **By how fast they eat the food you left for them.**
- **They should completely use up their food within 3 days. If it takes them longer to eat the food you left, give them less food next time. If they eat all the food before 3 days, then you need to leave more food next time.**

Batch Worm-Bins

- **Mix a base for the bottom of the bin of shredded paper and good compost with good sets of organisms in it.**
- **Buy worms, taking care to get Red Wrigglers, Eisenia foetida. Beware of Jumping Worms.**
- **Mix the bedding material the worms came in with the base material, add water to bring to about 60% moisture (squeeze and several drops should be expressed).**
- **Place food on top of the mixed bedding material to about a quarter inch depth. Observe. When the food is gone, add more.**

Flowerfield Enterprises
Kalamazoo, MI

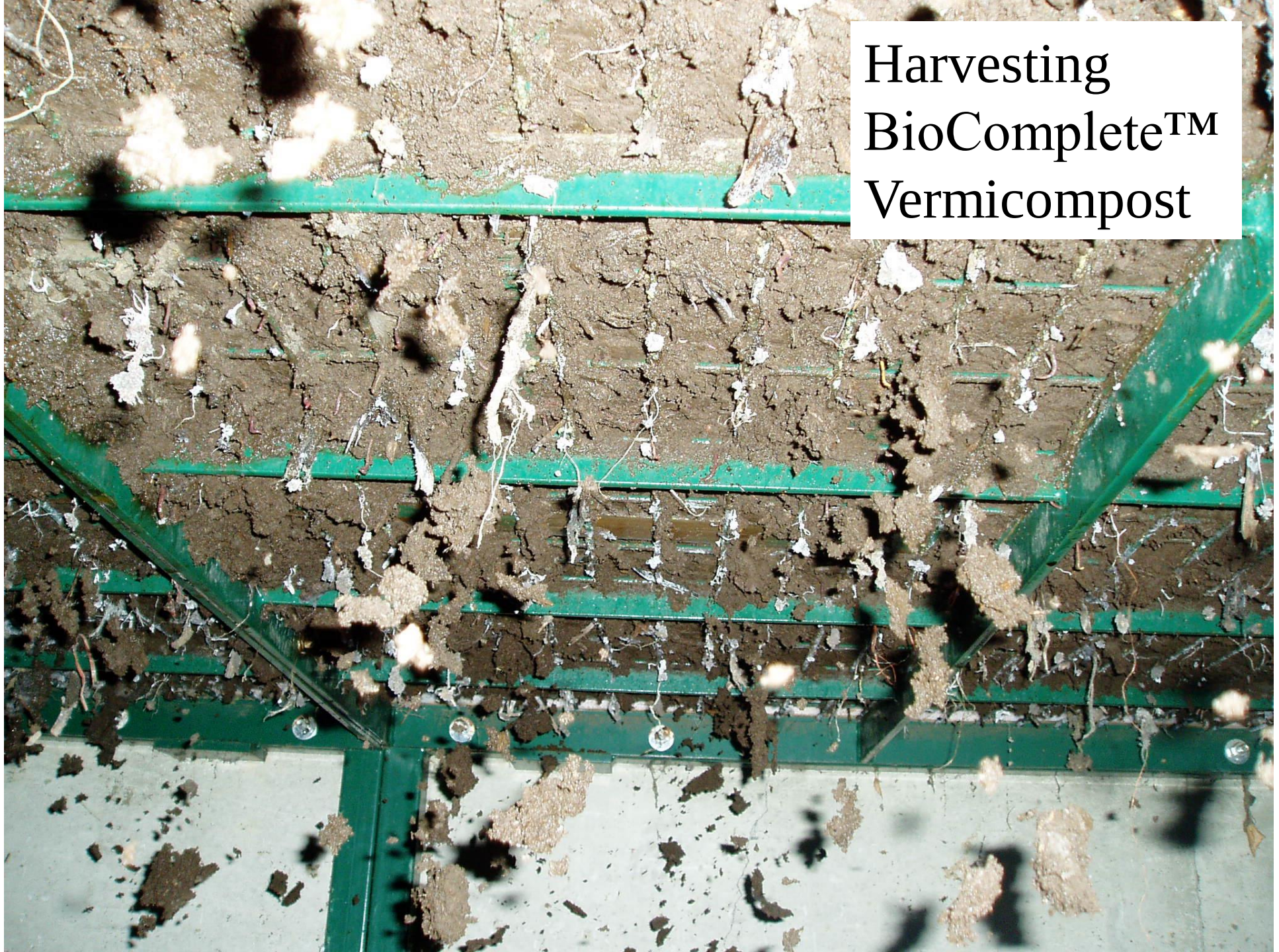
Flow-Through Worm-Bins

- The bottom of the container is made of heavy gauge wire. The bin is up off the floor, on study legs.
- A slot along the side of the bin allows a knife to cut the bottom ½ to ¾ inch of the bottom of the compost off.
- The compost falls through the open wire bottom and is collected in containers set below the bin.
- When starting the worm bin, 5 to 10 layers of newspaper are laid over the wire on the bottom of the bin to prevent the worms and organic matter from falling through. Add the worms in their bedding material with compost or organic matter.

Joe Richards EPM Worm Bin

Flow-Through Worm-Bins

- Maintain moisture at 60 – 70%; be careful to maintain good aggregation through the pile.
- Punching chimneys to aerate lower levels of the bed may be necessary.
- Food is placed on the top surface of the bed. The worms consume the microbes and comminute the organic matter.
- When the compost is within an inch of the top of the bin, remove the first cut of bottom compost.



Harvesting BioComplete™ Vermicompost


Harvesting
BioComplete™
Vermicompost

Industrial Flow-Through Bins

- Same idea, but automate the process. Mix the starting materials in a large container, add water to make a slurry.
- Spin the excess water out of the materials – be careful to not concentrate too many salts.
- Use dairy feeders to spread a half inch to 2 or 3 inches, depending in temperature, over the surface of the beds.
- Check for compaction, mix the beds lightly of compaction occurs.
- When the compost is within an inch of the top of the bin, remove a ¼ to ¾ inch from the bottom of the bin.
- Sieve the removed worm compost through a smaller-than-a-worm size opening sieve. Pick out the worms and return to the worm bin.
- Continue feeding as before.

Sunburst Worm Farm,
South Australia