



YOU CAN COUNT ON EARTHWORMS!

GRADES 6-12

BACKGROUND INFORMATION

Healthy soil is alive and filled with billions of living things in each shovel full of soil. There are many ways to measure healthy soil. While many of these measures require sophisticated tests and/or lab analysis, there is one way you can measure soil health right in your backyard, school yard or a nearby farm field.

You've probably seen the common nightcrawler, *Lumbricus terrestris*, in your backyard or out on sidewalks after a spring rain. Did you know that the earthworm can help us investigate the health of soil? Healthy soils contain ample amounts of organic material, which feeds bacteria, fungi and earthworms that call soil home. The more organic material that is in soil, the more living things the soil can support, and the more alive and healthy the soil will be.

Nightcrawlers feed on organic material such as plant residue at the soil surface at night or after a rain. These earthworms then pull that material back into their tunnel, leaving a well-defined clumpy mound, or midden, on the soil surface. Since these earthworms typically live in just one single tunnel or burrow, the number of middens (clumpy mounds) on the soil surface of a field provides a good indication of earthworm populations in a field.

Counting middens is a much easier way to estimate earthworm populations than digging for the worms – these creatures can tunnel as deep as six feet beneath the soil surface!

MATERIALS

PVC Pipe (10 ft length needed per frame)
4 PVC 90° Elbows (matched to PVC size)
Hand saw or PVC cutter (some hardware stores will cut the PVC for you in store)
Scissors
Clipboard
Notepad
Pen/Marker

INSTRUCTIONS

Construct the counting frame using four pieces of PVC pipe and 90° elbows. Measure the inner dimensions of your PVC frame(s) – this information will be critical for calculating the numbers of earthworms on a ft² or m² basis. A 2.5ft (30”) by 1.6ft (19.2”) frame is recommended. Because most Iowa crops are spaced in 30” rows, this frame will fit lengthwise between the crop rows.

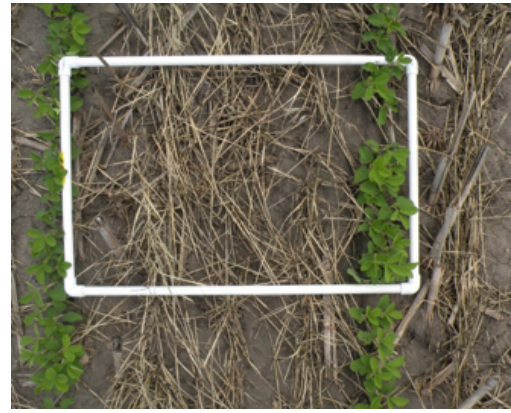
Earthworm midden counts are most effective in the spring. The crops or garden plants are not yet too big at that point to make counting a challenge, and the temperatures are cool and comfortable, meaning the earthworms are generally active and close to the surface this time of year. Earthworm midden counting is also most effective a few days after a rain. The rain washes away old middens, so you can be assured that the middens you see are representative of active earthworms.

Ask the students to discuss and make hypotheses for how the nightcrawler populations will compare under different farming and gardening practices. Consider corn and soybean fields with different soil types, with different amounts of tillage, with/without cover crops, as well as gardens that have grown different vegetables, with different amounts of tillage, and with/without cover crops.

To conduct earthworm midden counts, place the PVC frame in an undisturbed interrow between the crops or vegetables that are growing. Do your best to avoid any wheel tracks.

If there is a lot of plant residue (like the cereal rye cover crop residue shown at the top right), use a pair of scissors to carefully cut back the plant residue to 1-2”. Set the trimmed residue off to the side, outside of the PVC frame. This will allow clearer viewing of the soil surface to search for middens.

Within the plot, look for mounds of soil/plant residue – these are the middens. If you lift up the midden, you should find an earthworm tunnel buried underneath. Some



Overhead view of PVC frame placed in untracked interrow (soybean plot with cereal rye residue)



A signature earthworm midden – soil mounded up, evidence of worms pulling residue down into their tunnel...



BINGO! Midden lifted off – very clear earthworm tunnel underneath.

earthworm holes are quite small; the larger ones can be the size of a pencil eraser (or even bigger).

When all of the middens are counted within the PVC frame, record the results. Move the PVC frame and count at least two more frames in the designated row. The more replicates that are completed, the better statistical confidence you and your students will have in the data!

Compare and contrast the earthworm midden count results under different agricultural and horticultural management practices. How can farmers and gardeners encourage healthy populations of earthworms on their land?