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Counting Earthworms Made Easy

Why Does it matter?

Scientists need methods to measure the number of earthworms in soil because earthworms are key indicators of soil quality. Earthworms play an important role in decomposing plant residues and organic matter by ingesting and passing large quantities of soil through their digestive system. Nutrients are absorbed from the plant residues and soil organic matter as it is acted on by enzymes in the earthworm's gut. The excreted waste form casts have increased nutrient concentrations and greater aggregate stability compared to surrounding soil. Processing of the soil enhances availability of organic and inorganic nutrients to plants and microorganisms. In addition to the impact on nutrient cycling, worms create holes that increase porosity and infiltration and can act as root channels. Through the above actions earthworms significantly increase the water holding capacity of soils. Measurement of earthworm populations has, however, been difficult because methods are labor intensive or use chemicals that can negatively affect soil processes.

What was done?

A previously developed method for measuring earthworm populations was improved and tested by Agricultural Research Service scientists from Morris, MN, Watkinsville, GA, and scientists from the University of Georgia. The instrument used an octet arrangement of metal probes to induce an electrical current in the soil. To escape the mildly shocking environment, earthworms migrate to the soil surface where they can easily be counted. Improvements to the design included the addition of an external control via data logger or PC and the ability to modify the electrical field to suit specific environmental conditions.

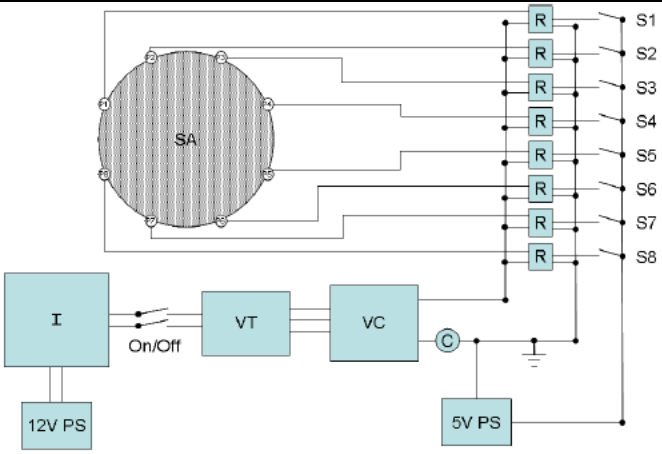

Figure 2. Schematic diagram for a hand built electrical extraction device for sampling earthworms without soil disturbance. I - Inverter, converts 12V DC into 120V AC; VT - Voltage transformer, 120V to 480V AC; VC - Single phase variable voltage controller, Payne Engineering Model 18D; C - Current meter, to measure voltage and amperage; R - optically isolated solid state relays; S1-8 - toggle switches to turn on/off electricity going out to soil probes; SA - Sample area defined by electrical field produced by soil probes; P1-8 - soil probes constructed of 60-cm long, 0.5-cm thick stainless steel rods. PS - Power supply, 12 V DC batteries connect to I, 5V DC power supply connection for R.

What was found?

This electroshocking methodology produced similar results as the more time consuming hand sorting and chemical extraction methods used in most other studies. The efficiency of the device to sample earthworm populations was

tested in a forested area and found to be 75%-100% effective, depending on soil conditions, earthworm species present and their stage of growth. The device was used successfully in a conservation system experiment, and established that earthworm populations in no-tillage operations with application of poultry manure were greater than in conventional systems of tillage and commercial fertilizer use. The greater earthworm population indicates a positive impact of conservation management on soil quality.

What is the impact?

The use of the instrument is more desirable than hand sorting because it reduces the amount of labor involved and is more environmentally friendly than chemical extraction. Efficient use of the device requires good soil moisture conditions, which will restrict its use during certain times of year. The design allows potential users to construct their own portable apparatus for sampling earthworm populations in agricultural fields and remote areas. A major benefit of the electroshocker is that it enables sampling in areas where soil disturbance or contamination must be avoided.

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Publication:

Weyers, S.L., Schomberg, H.H., Hendrix, P.F., Spokas, K.A., Endale, D.M. 2008. *Construction of an electrical device for sampling earthworm populations in the field*. Applied Engineering in Agriculture. 24(3):391-397.