

SOIL ROLLERS - LESS DISRUPTIVE PREP FOR SOIL HEALTH ANALYSIS

ALTERING SOIL HANDLING TO PROTECT SOIL HEALTH TESTS

Solvita was first introduced in the 1990's to measure microbial respiration in fresh, unprocessed soils. More recently it has been adapted to commercial labs with some success. However, labs process soil by drying, grinding and sieving and this is raising new interest in how soil processing may be affecting apparent biology.

A key concern is soil behavior when re-wetted to initiate respiration. The response is influenced by the quality of soil structure which in turn is impacted by grinding and sieving. Woods End was the first to report¹⁻² this as a cause of variability.

A considerable body of early work exists on soil C-min and N-min testing, specifically reporting artifacts caused by lab processing of soil³⁻⁴. Over-intense handling disaggregates soils, exposes protected organic matter and compromises microbial CO₂-rate and N-min. Soil grinding has also been found to alter PLFA signatures⁵. What this means is that labs offering soil biology tests may need specific and appropriate protocols for soil handling prior to performing reliable biological tests.

Soil Rolling is a traditional processing method dating to the 1960's which has been largely replaced by more efficient, high-throughput grinding methods. Extracting soil rapidly to measure soluble minerals is certainly aided by intense mechanical homogenization, but this is nearly opposite to the analytical requirement of allowing microbes to express themselves in an intrinsic soil environment.



Fig 3. Modern Soil Roller gang in UK soil lab

Returning to use of rollers may be a viable means forward. Some labs have already taken steps with semi-automated rolling (Fig 3) and Fritsch (Germany) is making high-throughput brush-rollers to "avoid artifacts in soil analysis"⁶. Hand soil rollers are still in use for non-destructive soil preparation at the National Soil Survey Center in Lincoln, Nebraska.

Using this model, Woods End Labs has developed a 2-kg hand hardwood roller (Fig. 4) which enables relatively easy and very effective crushing of most soil types without loss of aggregate structure. This low-tech approach can enable researchers to evaluate soil effects and is practical for small labs wishing to integrate the "triangle" of biology tests associated with soil health in a single soil preparation step. Research has shown that respiration is less variable and water stable aggregates preserved by less intensive techniques⁷. Standards do not yet exist for how soil labs process soil but with continued growth of soil health testing this may be necessary and very desirable.



Fig 1 Natural structure (L) vs Machine-Ground (R). The loss of aggregated structure during soil processing may negatively impact biology tests.



Fig 2. Early Soil Roller still in use (Univ. Maine Soil Lab)



Fig 4. Woods End Soil Roller with 2 kg mass. The rollers are available by contacting solvita.com/store

¹ Brinton, W (2015) [Variables Influencing Solvita CO₂ Respiration Results](#) – Woods End Research Newsletter/ ASA-SSSA Mtgs

² Brinton, W (2016) [Soil Grinding Effects on Solvita® CO₂ Respiration](#)

³ Waring & Bremner (1964) Effect of soil mesh size on mineralizable nitrogen in soils. Nature, Lond. 202, 1141.

⁴ Craswell & Waring (1972) Effect of grinding on the decomposition of soil organic matter. Soil Biol. Biochem. Vol. 4, pp. 435--442

⁵ For a list of additional published papers on soil disturbance please contact solvita@woodsends.com

⁶ Fritsch GmbH (2016) Boden-Deglomerator: Schonende Deglomeration getrockneter Bodenproben. Idar-Oberstein

⁷ Brinton, W (2017) Effects of variously sized soil on soil biology results. Report to NAPT (contact solvita@woodsends.com).