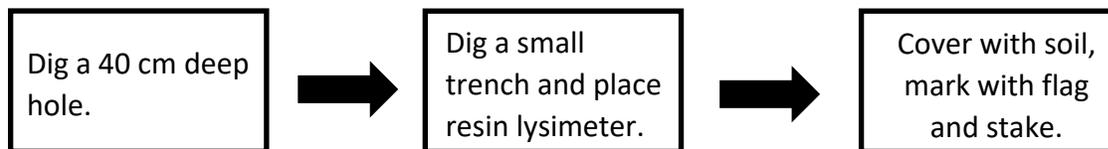


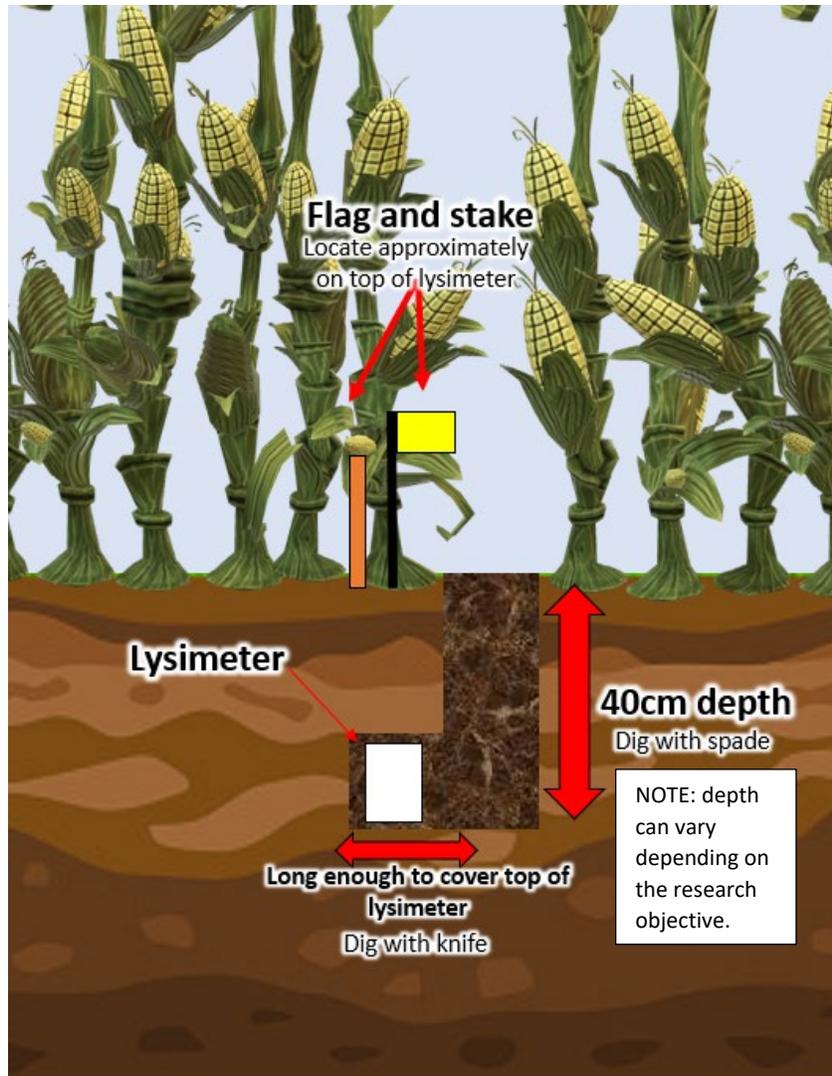
SOP: Resin Lysimeter Installation and Harvest

Overview:

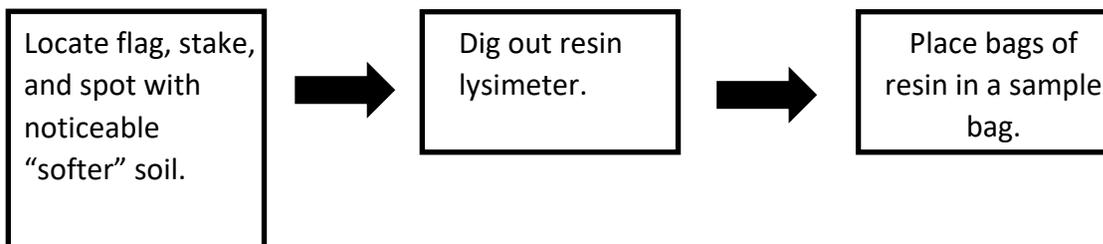
This standard operating procedure (SOP) describes a protocol for resin lysimeter installation and harvest used to trap nutrients (nitrate-N, ammonium-N, phosphate-P) from leachate in the soil profile. This method was originally reported by Susfalk and Johnson (2002) and modified by UIUC Soils Lab in 2020. These resin lysimeters were originally developed to study nutrients in snowmelt (Susfalk & Johnson, 2002). In the limited studies that have adapted this approach to agricultural systems, the lysimeters are buried for 12 months (G. McIsaac, M. David, and C. Mitchell, 2010; K. Greer and C. Pittelkow, 2018; G. Behnke, M. David, and T. Voigt, 2012), whereas this protocol distinguishes between in-season and out-of-season, approximately 6 months each. Key instruments include resin lysimeters, spade, flags, and stakes. For details on how to make the resin lysimeters, refer to lab protocol on resin lysimeter construction.

Installation:





Harvest:



Safety:

All standard safety protocols and online safety training via UIUC [Division of Research Safety \(DRS\)](#) are required.

Installation:

Instrumentation & Consumables:

- Digging tools: Spade/Shovel/Mattock (only if other tools cannot be used, as this tool causes a slight compaction of the sides of the hole, making it difficult to dig the lateral hole with the knife) / Knife
- Resin Lysimeters (For details on how to make the resin lysimeters, refer to lab protocol on resin lysimeter construction.)
- Flags (metal, taller ones of about 2 ft are better to get further into the ground)
- Wooden stakes (~1 ft tall)

Detailed Procedure:

I. Digging hole

1. Choose a location that is in the middle of the plot and between two rows of crop.
2. With digging tool, dig a hole that is 40 cm deep and wide enough for someone to dig a small trench into (~1 ft). When digging, please keep in mind that ALL OF THE SOIL must be returned to the hole after the installation.



This hole was dug with a mattock.

II. Digging trench

1. Once main hole is dug, choose a side of the hole. Using the knife, dig a cavity into the undisturbed soil perpendicular to the main hole at the bottom of the hole (40 cm deep).
2. Dig the cavity large enough to fit the resin lysimeter, but not bigger than needed (~3 in x 3 in).



Digging of the cavity

III. Placement of resin lysimeter

1. Remove the cheesecloth from one side of the resin lysimeter – this will be the top.
2. Place the resin lysimeter into the cavity and ensure that the entirety of the top is within the cavity (none is visible from a bird's eye view).
3. Remove cheese cloth and put a single layer of hand-crumbled soil from the soil that was dug from the cavity on top of the sand layer of the resin lysimeter. The purpose of the hand-crumbled soil layer is to fill the space between the lysimeter and the soil from the cavity for water flow.



Resin lysimeter with layer of soil on the top in cavity.

IV. **Covering resin lysimeter**

1. Place the flag directly over the resin lysimeter to enable location identification for harvesting.
2. Take soil that was dug out of trench and place around resin lysimeter in trench to ensure that it will not move during the season.
3. Place **ALL OF THE SOIL** that was dug out of the main hole back into the hole.
4. Place a stake next to the flag.

Harvest:

Instrumentation & Consumables:

- Spade/Shovel
- Sample Bags
- Buckets

Detailed Procedure:

V. **Locating the resin lysimeter**

1. The first marker will be the flag and stake. These can sometimes shift during field season so they give an indicator of where the resin lysimeter is, but may not be completely accurate.
2. Look for a soft spot in the soil where the hole that was dug – this is where the resin lysimeter is.



A picture of the soft spot in the soil before digging.

VI. Excavating the resin lysimeter

1. Begin to dig in the location for the resin lysimeter. The soil should feel very soft compared to soil where a hole has not been dug. The goal is to keep the excavation hole *as small as possible* (1 ft diameter is ideal, 1.5 ft max).
2. Keep digging until you find the resin lysimeter or max diameter is reached.



BEST!



Not great, at max diameter



Unacceptable – what *not* to do

VII. Collection of resin

1. Once you have located the resin lysimeter, remove the two resin bags and place into a sample bag for storage and transport back to the lab. Store harvested resin bags at 4 °C until analysis (maximum storage time not known; for our lab, within 6 months).
2. The sand can be dumped into the hole. Collect the rubber band and cheesecloth and dispose in trash. Use the bucket to collect PVC pipes for reuse and all extra material.

VIII. Filling the excavation hole

1. After excavation, place **all of the soil** back into the hole.

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