

A Proposed Minimum Dataset for Plant PFAS Uptake Studies in Agriculture

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INTRODUCTION

The discovery of per- and polyfluoroalkyl substances (PFAS) contamination of farmland has prompted in situ studies of PFAS uptake by agricultural crops.

For research results to be:

- Comparable across studies and regions, and
- Useful for meta-analyses and simulation modeling, datasets and published research must include a core set of details and parameters.

We propose a minimum dataset of descriptive and measured information to serve as a standard for plant PFAS uptake studies in agricultural systems.

OBJECTIVE & METHODS

Outline a minimum dataset for plant PFAS uptake studies in agriculture.

The information and parameters included should:

- Help elucidate observed phenomena and effects,
- Meet the criteria for peer-reviewed publication,
- Satisfy criteria for simulations modeling, meta-analysis, and collaborative research; and
- Be easy enough to adopt¹.

Site information and parameters were identified from other minimum datasets for field studies² and from research literature on the influence of specific soil and plant characteristics on plant PFAS uptake³⁻²¹.

SITE INFORMATION

Sample collection date	
Location	Latitude and longitude
Weather ^{3,4}	Note atypical weather for the season. Provide link to nearest weather station.
Size of area of interest	
Sludge/septage application history	
Crop history	Include crop and field management.

References

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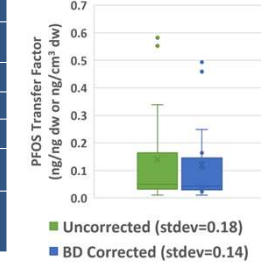
SOIL PARAMETERS

Soil series/complex	
Depth of soil sample	Preferably the 0-15-cm standard depth, and multiple depths
Texture (% sand, silt, clay) 4,5,6,7,8	
Bulk density ⁹	
pH ⁷	
Total organic carbon ^{4,5,6,7,8,10}	Organic matter if TOC not possible Optional – soil protein ¹¹
Cations (Ca ²⁺ , Na ⁺ , Mg ²⁺ , K ⁺) ⁴	
Cation exchange capacity ^{4,7}	Use effective CEC
Phosphorus ¹²	Preferably Mehlich III, as standard
Iron and Aluminum ^{7,8,13}	Preferably Fe- and Al- oxides and hydroxides
Sample collection, processing, and storage	

Example – Bulk Density (BD)

Should we correct soil PFAS concentrations for soil density?

Doing so reduced the variability of soil-to-plant PFOS transfer factors estimated for 18 perennial forage field across central Maine using co-located sampling.

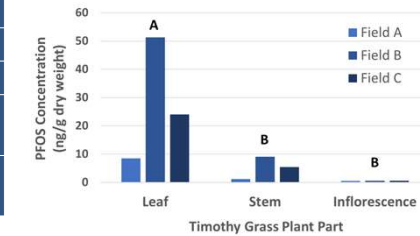


PLANT PARAMETERS

Species composition ^{14,15,16}	For mixes, % grass, legume, forb
Crop variety if known ¹⁷	
Growth stage at sampling ^{18,19}	For forages, include cutting #, e.g., "1st aftermath harvest, boot stage"
Plant part sampled ^{14,18,20}	Leaves, stems, fruits, grains, ... And for forage, cutting height
Rooting depth at sampling	
Dry matter	
Sample collection, processing, and storage	
Optional – Plant quality ^{5,15,16,21}	Protein, lipids, starch, fiber fractions. Plant NIR compositional analysis can provide much of this.

Example – Plant parts and growth stage

PFAS levels vary among plant parts, and plant composition varies as plants move through different growth stages.



PFAS INFORMATION

Analytes	
Analysis method	Include reporting limits
Sample collection, processing, and storage	Include holding time

WHAT ELSE SHOULD BE INCLUDED?



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