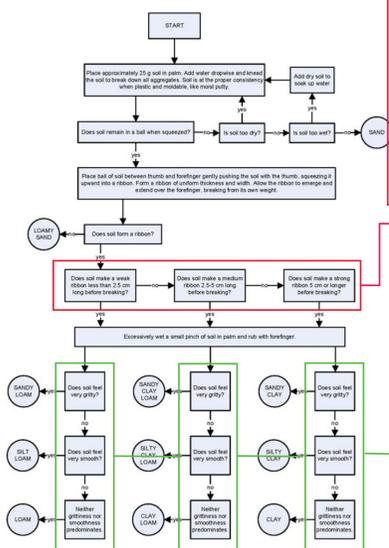


## Texture-by-feel is an essential skill for soil scientists that is widely used for a variety of applications

- Soil mapping: Criteria for soil classification at a range of levels in USDA and FAO systems
- Site evaluation for septic systems: Estimation of hydraulic conductivity
- Hydric soil delineation: Selection of appropriate hydric soil indicators
- Ecological site description: Selection of appropriate ecological site concepts and accompanying state-and-transition models
- Fertilizer and lime recommendations: Adjustment for interactions with soil matrix

## Current guides for texture-by-feel are confusing to students

USDA Guide to Texture by Feel



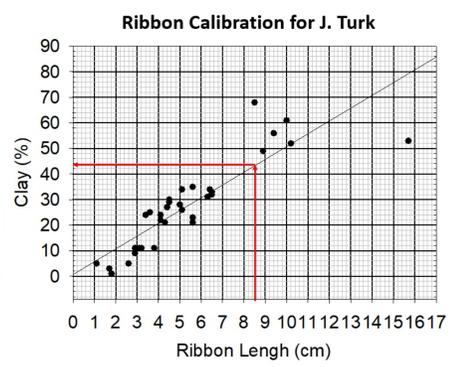
Student ribbon lengths often disagree with cutoffs used to separate loam, clay loam, and clay classes

- Does soil make a weak ribbon less than 2.5 cm long before breaking?
- Does soil make a medium ribbon 2.5-5 cm long before breaking?
- Does soil make a strong ribbon 5 cm or longer before breaking?

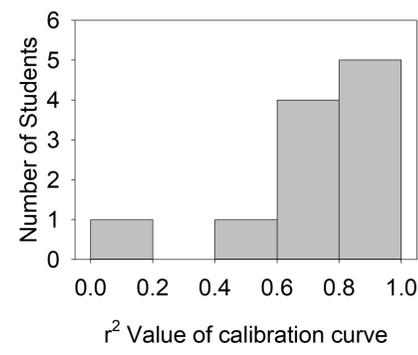
Criteria of "very gritty" and "very smooth" are subject to individual interpretation

## Direct estimation of percent clay by ribbon calibration

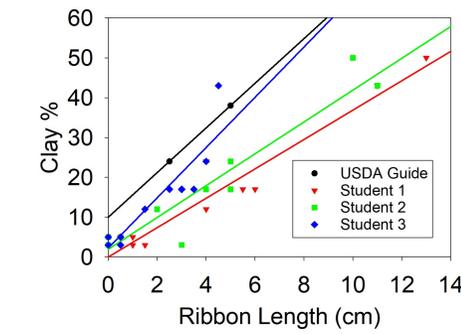
The method: measure ribbon length and calculate clay percentage using personalized calibration curve developed using lab-analyzed samples



Calibration curves for UNL Soil Judging Team:  
 $R^2$  values were  $>0.6$  for most students

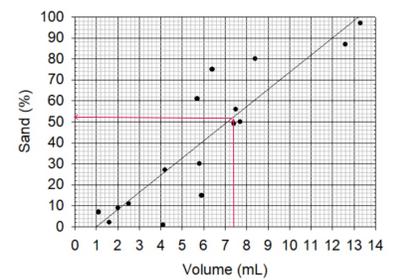


Calibration curves differ amongst students and show poor agreement with clay percentage cutoffs used on the USDA Guide to Texture by Feel.



## Direct estimation of sand percent by washing and volume measurement

The method: Wash silt and clay from a tablespoon of soil, measure the volume remaining, and determine percent sand using a calibration curve developed using lab-analyzed samples



Preliminary Results:

- $R^2 = 0.90$  for samples dominated by fine sand and  $0.62$  for samples dominated by very fine sands
- Not yet calibrated for medium and coarse sands
- Requires 4-7.5 minutes per sample

## Determining percent silt and textural class

Once clay and sand percentages are estimated, silt can be determined by difference from 100% and textural class can be found using the USDA texture triangle.

## Conclusions and future work

- Individual calibration of ribbon length to clay percentage is recommended over use of uniform cutoffs separating textural classes
- Sand estimation using a visual guide did not offer any improvement in estimation of sand percentage and is not recommended for future use
- Volume of washed sands can be correlated to lab-measured sand, but has not yet been compared to estimations based on how gritty or smooth the sample feels
- Larger student trials comparing clay and sand estimation methods are needed.

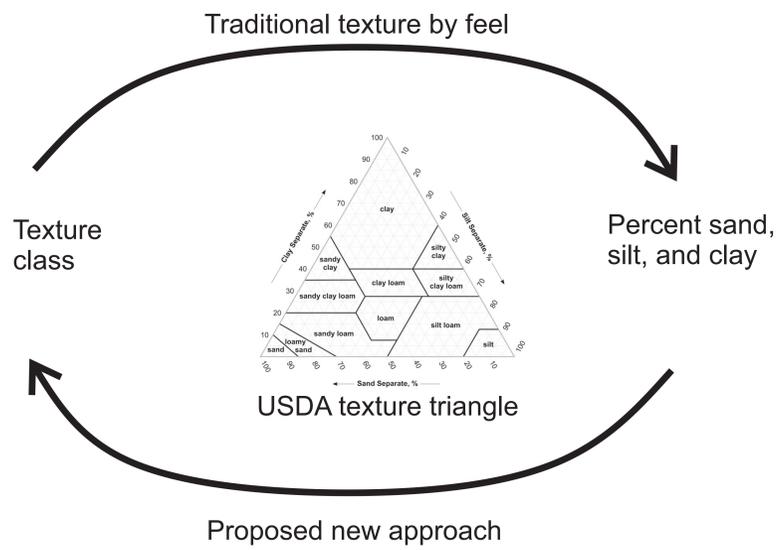
## Acknowledgements

Thank you to Mike Pearson for providing texture samples from the National Soil Survey Center Archives and the members of the UNL soil judging team for their help in evaluating the methods.



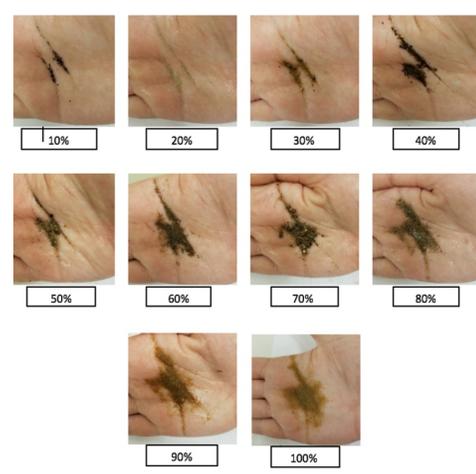
## This study aims to develop and evaluate a new approach that makes it easier for students to accurately determine texture by feel

The proposed approach focuses on direct estimation of the particle size fractions



## Direct estimation of percent sand by washing and visual guide

The method: Wash silt and clay from a pea-sized sample and estimate sand percent by comparison to visual reference chart



Evaluation by UNL Soil Judging Team:

No improvement in accuracy was observed with the use of the visual guide.

