

P and K Trials to Validate CSTV

PROTOCOL FOR ON-FARM PARTICIPANTS

OVERVIEW— Critical soil test values (CSTV) are used to interpret phosphorus (P) and potassium tests in order to make sound P and K fertilization decision. Specifically, the CSTV lets us answer the question: Should I apply? To answer, we need to answer a larger question: **What soil test value for P and K should be considered “sufficient” (CSTV) depending on soil type?** In collaboration with KSI Laboratories and funded by ISA, the University of Illinois Urbana-Champaign is organizing on-farm trials to recalibrate the CSTV of P and K in the Illinois Agronomy Handbook, which have not been updated in over 70 years. Our updates will improve upon existing CSTV in the Illinois Agronomy Handbook by...

-  Accounting for soil type to increase regional specificity of CSTV
-  Utilizing contemporary soil tests to modernize CSTV
-  Considering subsoil nutrient supply by testing 0-7" and 7-14" depths
-  Accounting for modern tillage methods and crop hybrids

Locations: 75 production farms per year

Geographic scope: Statewide (Illinois), with an emphasis on including as many counties and soil types as possible

Duration: Five years currently funded (2023–2027)

Crops: Soybeans

OBJECTIVES

- ★ Establish updated and evidence-based P and K critical values for Illinois soybean
- ★ Provide recommendations specific to (i) soil type, (ii) nutrient stratification by tillage management (chisel, strip, no-till) and (iii) soil sampling depth to fine-tune CSTV interpretations
- ★ Account for changes in soil tests measurements in commercial labs since the last Illinois Agronomy Handbook update

TREATMENT— Comparison of yields between fertilized (**2x maintenance rate**) and unfertilized (**0x maintenance rate**) strips. CSTV are calculated from the relative yield between this pair of unfertilized and well-fertilized plots.

FIELD PREREQUISITES— To be considered for trials, fields must:

- Have not been spread with P or K fertilizers for at least one year (12 months)
- Have not received manure amendments in at least 2 years.
- Be at least 9 acres.
- Have soil test results available from the last 5 years.
- Have soybeans planted in the trial year.

Typical field management (tillage, pesticides, etc.) is **encouraged** for the duration of trials as long as it is **consistent across trial areas**.

PLOT LAYOUT— Flexible depending on equipment specs and field dimensions.

- Each trial is 4 reps. Each rep contains 2 paired plots.
- Target dimensions of each plot: **120' wide x 160' length**
 - Plot width varies by spreader: larger of 120' or two spreader swaths.
 - In spreader files, reps are buffered out 50' in each direction lengthwise to account for boom lag, and 40' widthwise.
- All plots are minimally 100' (typically >150') from field edges.
- Full trial area depends on spreader widths, but is typically **~9 acres** worth of research plots.
- Four soil samples are collected every 40' lengthwise through the center of each plot. Each soil sample is split into two depths: 0-7" and 7-14".



EQUIPMENT AND PRODUCTS NEEDED

Fertilizer application: Dry granular broadcast, spray, or banding, with VRT capability

- P and K fertilizers can be spread in fall or spring—farmer's choice
- The following fertilizers are required:
 1. **Trial Nutrient**— Applied at 2x maintenance rate in half of the plots, and 0x maintenance rate (omitted) from the other half.
 - For P trials → DAP, MAP, TSP, MES, etc.
 - For K trials → red or white potash, or a blend (must be <20% N).
 2. **Non-Trial Nutrient**— Applied at 1.5-2x maintenance rate on all plots to ensure yield differences are attributable to the trial nutrient, rather than a deficiency in the non-trial nutrient.
 - For P trials → red or white potash, or a blend (can be high N for non-trial nutrient)
 - For K trials → DAP, MAP, TSP, MES, etc.
 - Load of the non-trial nutrient in the trial area is, on average, 1 ton.
 3. **Nitrogen**— Nitrogen is not required for P or K trials ahead of soybeans.

Yield monitor: Calibration is encouraged but not required, as only relative yields are used for CSTV calibration.

PARTICIPANT COMPENSATION— All data collected by the research team will be shared with participants free of charge. Additionally, participants will receive a stipend of \$1,000 per field with one trial and \$1,500 per field with two trials per year. The estimated retail value of the data collected and shared with participants is \$1,344 per trial, itemized as follows:

- Four sampling points per plot × 8 plots × 2 depths (0-7" and 7-14") = 64 samples
- Soil fertility testing (including micronutrient panel) at \$21/sample = \$1,344

Additionally, retailers who identify and recruit a field for a completed season will be compensated \$500/field.

TRIAL TIMELINE AND LOGISTICS— Farmer responsibilities are shown in blue. Responsibilities of the research team are shown in orange.

Phase I: Interest and Enrollment

1. Farmer sends the research team the following files for fields they'd like to enroll:

- Field boundary (shapefile/ArcView format)
 - Most recent soil test results, within the past 5 years (shapefile/ArcView format if available)
2. Research team evaluates the fields and provides enrollment forms for fields which fit the trial criteria (max 3 fields per farm per year).
 - Enrollment forms include questions about equipment and fertilizers, as well as 3-5 years of crop history and agronomic management (tillage, cover crops).
 3. Farmer completes enrollment form(s) and sends to the research team.

Phase II: Trial Setup

4. Research team creates plots and sends plot maps and load sheets to the farmer for approval.
5. Farmer approves plot placement or requests modifications.
6. Research team submits the field for soil sampling with KSI Lab.
7. KSI Lab completes baseline soil fertility sampling & analysis. University of Illinois Soils Lab begins soil health assays.
8. Research team sends farmer VRT files for P and K fertilizers.

Phase III: Trial Execution

9. Farmer uses the VRT files to spread P and K fertilizers (must be completed extb after soil sampling).
10. Farmer uses the VRT files to spread P and K fertilizers (must be completed extb after soil sampling).
11. Farmer sends as-applied maps to research team.
12. Farmer carries out remainder of the crop year as usual.
13. Farmer harvests the field using a yield monitor.
 - Farmer sends yield maps to research team.
14. Research team processes trial payment, compiles results, and sends farmer a data report.

Multi-Year Participation: Farms can participate every year with trials moved to new areas of the field (if space allows), or to new fields. Trials can not be repeated in the same areas of a field in consecutive years.

Trial Cancellation Disclaimer: The following actions render trial data unusable and will result in trial cancellation:

- Modification of VRT files without approval from the research team.
- Spreading fertilizer before soil samples are pulled.
- Spreading fertilizer on omission plots.

Farmers or other parties responsible for trial cancellation for the above reasons are liable for the costs of any sampling and analyses completed up to the point of cancellation and will not receive trial compensation.

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