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# ALP Program Report

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**Special points of interest:**

- An assessment homogeneity of all ALP proficiency materials indicate were highly uniform for Cycle 59.
- Sixty-six laboratories provided soil pH (1:1) $H_2O$ results, medians ranged from 4.75 - 7.64.
- Soil P Olsen for Cycle 59 ranged from 6.2 to 30.3 mg $kg^{-1}$ with intra-lab stdev values ranging 2.7 - 7.6 mg $kg^{-1}$ across the five soils.
- Soil M3-K values ranged from 72 - 490 mg $kg^{-1}$ for the five ALP soils of PT Cycle 59.
- Botanical N by combustion was reported by 44 labs, with two samples showing intra-lab variability < 2.1% for Cycle 59.
- Botanical B results show very high lab consistency across all four samples.
- Results for water EC show very high consistency across 23 labs over all three PT samples.

**Inside this issue:**



## ALP Overview

The Agriculture Laboratory Proficiency (ALP) Program spring 2026 Round Cycle 59 was completed April 29, 2026, with results from one-hundred twenty labs enrolled from the US, Canada, Columbia, Guatemala, Italy, Poland, Serbia, Slovakia, Ireland, United Kingdom, South Africa, Pakistan and Philippines. Proficiency samples consisted of five soils, four botanical and three water samples. Analytical methods are base on those published by AOAC, regional soil work groups, the Soil Plant Analysis Council and Forestry Canada.

Data was compiled for each method (test code) and proficiency material. Data analysis of each material include: the number results; grand median value; median absolute deviation (MAD), 95% Confidence Interval; method intra-lab standard deviation (*s*); lab mean, and standard deviation. Additional information on methods and statistical protocols can be found at the program web site.

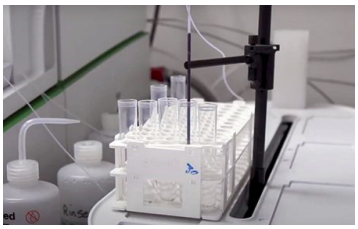
## Proficiency Materials

Standard Reference Soils (SRS) materials utilized for Cycle 59 were: SRS-2601 Snyderville cobbly loam, collected Morgan Cty, UT; SRS-2602 Osco silt loam collected Lee Cty, IL; SRS-2603 Ulto fine sandy loam collected Rusk Cty, TX; SRS-2604 a glaciolacustrine soil collected near Summerland, BC Canada; and SRS-2605 Alton gravelly sandy loam collected Cayuga, NY. Chemical properties of the SRS materials ranges: pH (1:1) $H_2O$ 5.47 - 8.15; Sikora Buffer 6.65 - 7.51 mg $kg^{-1}$; Bray P1 (1:10) 2.0 - 46.7 mg $kg^{-1}$; $SO_4$-S 2.3 - 7.2 mg $kg^{-1}$; M3-K 72.1 - 490.0 mg $kg^{-1}$; M3-Ca 539 - 15,570 mg $kg^{-1}$; DTPA-Zn 0.19 - 13.1 mg $kg^{-1}$; SOM-LOI 0.90 – 2.83%; CEC 4.5 - 17.7 cmol $kg^{-1}$; sand 24.8 - 70.5% and $NO_3$-N 8.0 - 111 mg $kg^{-1}$.

Standard Reference Botanical (SRB) materials for Cycle 59 were: SRB-2601 field pea composite from CO; SRB-2602 a soybean leaf composite from NE; SRB-2603 a olive leaf composite from CA; and SRB-2604 a corn ear leaf composite GS-R1 from CO. SRB median analytes concentrations: $NO_3$-N 260 - 2780 mg $kg^{-1}$; combustion N 0.43 - 3.98 %; wet digestion total P 0.041 - 0.406 %; total K 1.62 - 2.50 %; total Ca 0.455 - 2.66 %; total S 0.123 – 1..14 %, total B 8.9 - 68.6 mg $kg^{-1}$; and Zn 4.8 - 29.4 mg $kg^{-1}$.

Standard Reference Water (SRW) samples represent an agriculture water samples collected: SRW-2601 an irrigation reservoir canal collected near Wood River, NE; SRW-2602 from an irrigation canal near Blythe, CA and SRW-2603 from a well near Underhill, VT. SRW median concentrations: pH 7.72 - 8.10; EC 0.22 - 3.87 $dSm^{-1}$; SAR 0.95 - 55.8; Ca 1.0 - 6.8 molc $L^{-1}$; Na 0.76 - 30.7 mmolc $L^{-1}$; $HCO_3$ 1.15 - 5.4 mmolc $L^{-1}$ ; and $NO_3$ 0.022 - 1.28 mmolc $L^{-1}$.

## Homogeneity Evaluations



SRS material homogeneity was evaluated based on soil test codes pH (1:1) $H_2O$, buffer pH Adams Evans, EC (1:1), P Olsen, K Olsen, $NO_3$-N, and SOM-WB on analysis of six jars of each PT soil, each in analyzed in triplicate by an independent laboratory. Homogeneity results were all within acceptable limits for all soils, with the lowest noted for pH 1:1, EC 1:1 $H_2O$, and NO3-N, Table 1. Proficiency soil antecedent moisture contents ranged from 1.1 to 4.6 across the five samples.

*"..soil pH, Buf pH A&E, Olsen P and SOM-WB analysis Stdev values for Cycle 59 met homogeneity standards."*

Homogeneity was also evaluated on SRB and SRW matrix samples. Botanical results indicate all samples were well homogenized for N, P, Zn and C, with RSD values less than 0.5% of N and C on three of botanical samples, Table 2. Water results for EC, Ca, $NO_3$ and $NH_4$ were well homogenized with RSD values for EC less than 2% for all three of the PT samples, Table 3.

**Table 1. ALP soils homogeneity evaluation Cycle 59, 2026.**

| Sample | pH (1:1) $H_2O$ | | EC 1:1 (dS $m^{-1}$) | | P Olsen (mg $kg^{-1}$) | | $NO_3$-N (mg $kg^{-1}$) | |
|---|---|---|---|---|---|---|---|---|
| | Mean [1] | *Std* | Mean | *Std* | Mean | *Std* | Mean | *Std* |
| SRS-2601 | 8.00 | *0.02* | 0.45 | *0.01* | 2.9 | *0.2* | 43.6 | *0.4* |
| SRS-2602 | 6.25 | *0.01* | 0.14 | *0.01* | 8.2 | *0.5* | 8.1 | *0.1* |
| SRS-2603 | 5.95 | *0.01* | 0.12 | *0.01* | 2.9 | *0.1* | 8.7 | *0.1* |
| SRS-2604 | 6.87 | *0.01* | 1.02 | *0.01* | 27.2 | *2.0* | 124.0 | *2.2* |
| SRS-2605 | 5.38 | *0.02* | 0.23 | *0.01* | 9.0 | *0.5* | 14.9 | *0.4* |

[1] Statistics based on five randomly selected soil replicates, each analyzed in triplicate.

**Table 2. ALP botanical homogeneity evaluation Cycle 59, 2026.**

| Sample | N (%) | | Mg (%) | | Zn (mg $kg^{-1}$) | | C (%) | |
|---|---|---|---|---|---|---|---|---|
| | Mean [1] | *Std* | Mean | *Std* | Mean | *Std* | Mean | *Std* |
| SRB-2601 | 1.52 | *0.042* | 0.45 | *0.02* | 20.5 | *0.92* | 42.6 | *0.20* |
| SRB-2602 | 0.462 | *0.025* | 0.15 | *0.02* | 5.21 | *0.85* | 44.7 | *0.40* |
| SRB-2603 | 3.84 | *0.060* | 0.19 | *0.03* | 21.2 | *0.75* | 42.1 | *0.33* |
| SRB-2604 | 2.80 | *0.045* | 0.31 | *0.03* | 30.2 | *1.4* | 37.2 | *0.14* |

[1] Statistics based on three randomly selected botanical replicates analyzed.

**Table 3. ALP water homogeneity evaluation Cycle 59, 2026.**

| Sample | EC (dS $m^{-1}$) | | Ca (meq $L^{-1}$) | | $NO_3$ (meq $L^{-1}$) | | Na (mg $L^{-1}$) | |
|---|---|---|---|---|---|---|---|---|
| | Mean [1] | *Std* | Mean | *Std* | Mean | *Std* | Mean | *Std* |
| SRW-2601 | 3.82 | *0.16* | 6.92 | *0.28* | 1.45 | *0.12* | 31.2 | *0.41* |
| SRW-2602 | 0.61 | *0.03* | 0.05 | *0.02* | 0.080 | *0.011* | 6.80 | *0.51* |
| SRW-2603 | 0.25 | *0.03* | 1.05 | *0.09* | 0.025 | *0.008* | 0.79 | *0.16* |

[1] Statistics based on three randomly selected soil replicates, each analyzed in triplicate.

## SRS - pH (1:1)$_{H2O}$

Sixty-six laboratories provided ALP results for soil pH (1:1) $H_2O$ (test code 116). Soils ranged from acid to alkaline, median range 5.47 - 8.15. Lab results were ranked low to high based on sample SRS-2605 (see Figure 1) with median pH designated by horizontal lines for each soil. Generally across labs all soils showed good consistency across labs. Lab #1 showed low bias across thre of five soils. Labs #9, #27, and #66 were inconsistent. Source of bias is likely associated with ISE performance and/or method compliance. Inconsistency could be result of extract carry-over.

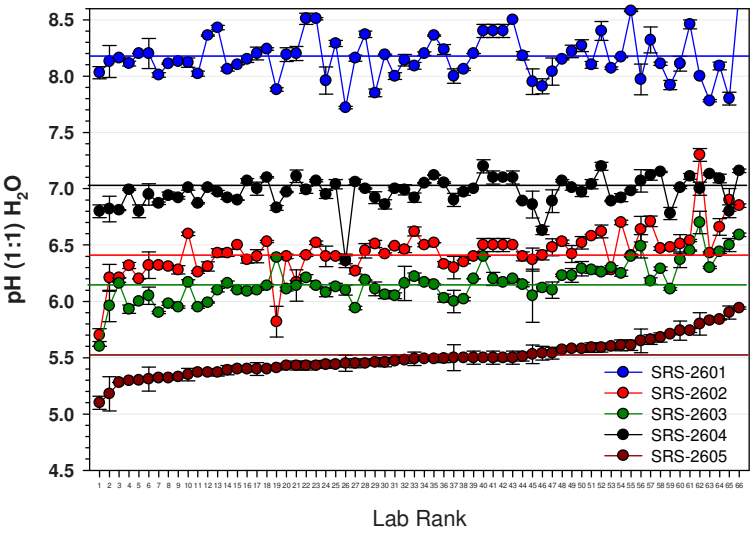



Figure 1. pH (1:1) $H_2O$ distribution plots for SRS materials, ALP 2026 Cycle 59.

pH precision across the five ALP soils indicates very high precision, with median intra-lab standard deviation (*s*) values ranging from 0.020 to 0.031 pH units, the lowest noted for SRS-2603, and were one of lowest noted in ALP program over the past 10 years. Twelve labs had poor precision, with standard deviations exceeding intra-lab stdev. Specifically *s* for labs #2, #6, #24, #47, and #57 exceeded 0.10 pH units for SRS-2601.

## SRS - Phosphorus: Bray P1, Olsen P and Mehlich 3

Bray P1 results were reported by twenty-nine labs. Olsen-P was reported by fifty labs and M3-P ICP was reported by 48 labs. Median soil Bray P1 values ranged from 2.0 - 46.7 mg $kg^{-1}$ $PO_4$-P; Olsen P 3.4 to 24.4 mg $kg^{-1}$ P; Bray P2 ranged from 9.0 to 180.1 mg $kg^{-1}$ P; and M1-P from 4.3 to 182 mg $kg^{-1}$ P, across the five soils. Ranking lab results based on sample SRS-2603, median Olsen P concentrations are shown in indicated in Figure 2. Soil SRS-2605, highest in concentration was variable between labs. Soils SRS-2601 and SRS-2603 had similar concentrations. Several lab had in consistent results across all five soils. Labs #49 and #50 had low bias for all five soils.

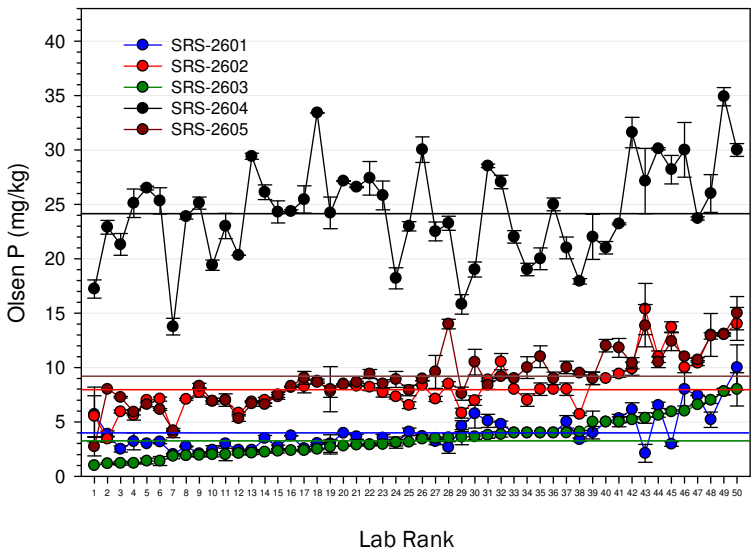



Figure 2. Olsen P distribution plots for SRS materials, ALP 2026 Cycle 59.

Six labs reported saturated paste $PO_4$ with median concentrations of 0.18 - 2.87 $mmol_c$ $l^{-1}$. Six labs reported M3-P Spec median concentrations ranging 5.9 - 49.0 mg $kg^{-1}$ P. Sixteen laboratories reported Bray P 1:7 with medians ranging from 0.8 - 41.4 mg $kg^{-1}$ $PO_4$-P. Four results for Modified Morgan P, with medians ranging from 0.9 - 20.7 mg $kg^{-1}$ $PO_4$-P. Modified Kelowna was reported by two laboratories ranging from 3.9 - 48.2 mg $kg^{-1}$ P and total P (US-EPA 513) ranged 147 - 871 mg $kg^{-1}$ P with the highest concentration noted for SRS-2604.

## SRS - Potassium

Forty-seven laboratories provided ALP results for soil M-3 K (test code 159) results. Results were ranked low to high based on sample SRS-2605 (see Figure 3). Soil SRS-2601 was the most inconsistent across labs. The source of the variability is likely associated with higher coarse sand and low SOM-LOI. Lab #47 had high bias on all soils. Across all soils labs #1, #3, and #46 were inconsistent across soils. Source of inconsistency is likely related to extraction, analysis instrument and/or method compliance.

M3-K intra-lab *s* values were lowest for soil SRS-2603, with a median intra-lab value of 1.3 mg $kg^{-1}$ K and highest for SRS-2604 with a value of 8.9 mg $kg^{-1}$. M3-K within-lab precision across the ALP soil materials indicates very good precision, generally, for soils with less than 100 mg $kg^{-1}$ K. Precision was poor (based on intra-lab *s*) for three labs which exceeded 5 mg $kg^{-1}$ K on SRS-2605. Across the five soils for Cycle 59 eight labs were flagged for poor intra-lab precision. Poor precision is attributed to extraction and/or analysis instrument operation.

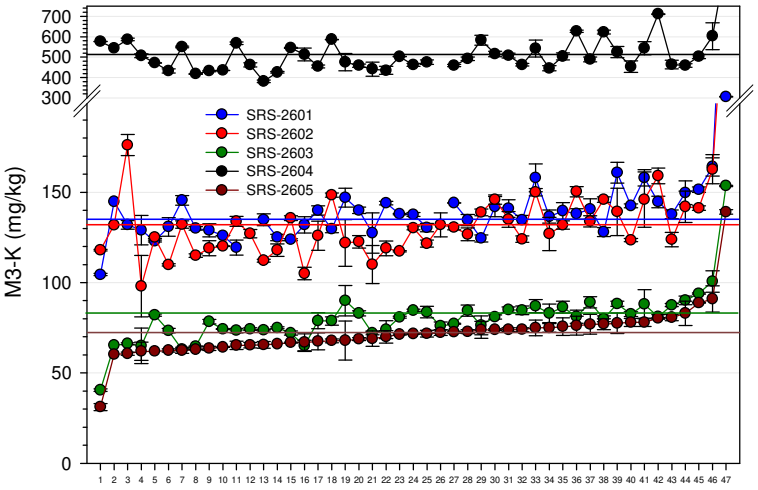



Figure 3. Extractable M3-K distribution plots for SRS materials, ALP 2026 Cycle 59.

## SRS - SOM-LOI

Forty-eight laboratories provided ALP results for soil SOM-LOI (test code 183). Soil Median SOM-LOI values ranged from 0.90 to 3.25%. Results were ranked based on sample SRS-2601 (see Figure 4) and had high consistency. Labs #1 and #2 had consistent low bias across all three. Labs #4, #34, #44 and #47 were. Source of bias is likely related to muffle furnace operation and/or method compliance.

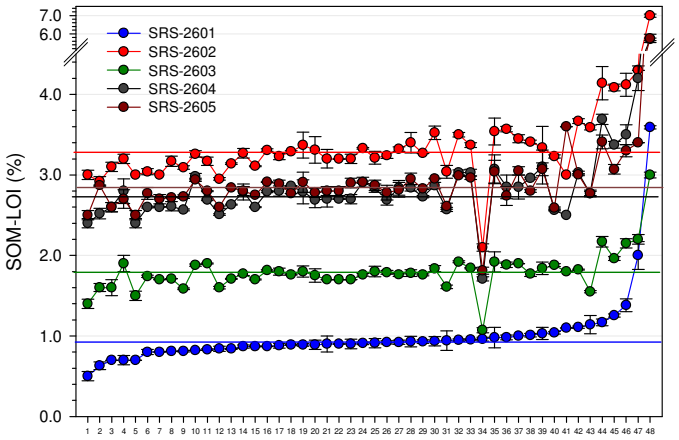



Figure 4. SOM-LOI distribution plots for SRS materials, ALP 2026 Cycle 59.

SOM-LOI precision across the five soils indicates high median intra-lab precision *s* values ranging from 0.020 to 0.045% SOM-LOI, highest for SRS-2605. Across labs, *s* values for SRS-2602 ranged from 0.005 - 0..260%. Across soils low precision was noted for several laboratories. Specifically *s* for labs #31, #35, #43, and #47 exceeded 0.10% SOM-LOI for SRS-2601. Lab #21 had poor precision on all Cycle 59 samples. Poor precision may be associated with the muffle furnace and heating time.

## ALP - Sand content

Forty-four laboratories provided ALP results for soil sand content (test code 189) results. Results were ranked low to high based on sample SRS-2602 (see Figure 5). Soil SRS-2605 was the most inconsistent across laboratories. Lab #1 showed low bias on four of five soils and lab #44 high bias on all five soils. Laboratories #6, #19, #29 and #41 were inconsistent across soils. Source of inconsistency is likely related to extraction, analysis instrument and/or method compliance.

Soil sand content median intra-lab s values were lowest for soil SRS-2601, with a median intra-lab value of 0.03 % and highest for SRS-2605 with a value of 0.57 %. Generally sand content intra-lab precision across the ALP soil materials indicates very good precision. Precision was poor (based on intra-lab *s*) across all soils for Lab #1, #6 and #7 exceeding 1.8% on soils SRS-2601 and SRS-2602. Across the five soils for cycle 59 seven PT sand content values were flagged for poor precision.

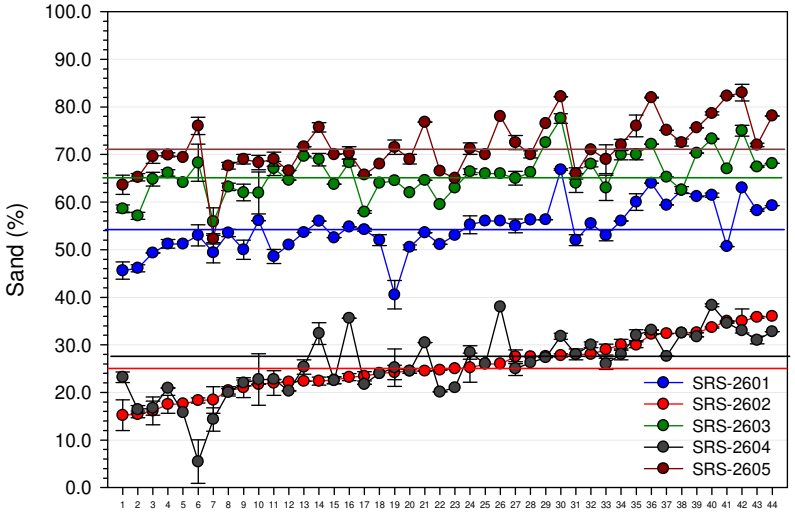



Figure 5. Sand content distribution plots for SRB materials, ALP 2026, Cycle 59.

## SRB - Chloride

Twenty laboratories provided ALP results for botanical extractable Cl (test codes 208). Median values are designated by horizontal lines for each of the four botanical materials labs based on sample SRB-2602 (see Figure 6). Lab #1 had low bias results for three materials and Lab #16 had high bias on three of four botanical materials. The data plot shows labs #10, #12, #16 and #19 were inconsistent on three of four samples.

Botanical Cl (test code 208) results for Cycle 59 indicate very high precision, with intra-lab median standard deviation (*s*) values ranging from 0.011 to 0.039 % Cl across the four samples. Cl intra-lab *s* values for SRB-2601 ranged from 0.001 – 0.18 %; SRB-2602 ranged from 0.005 - 0.015 %, SRB-2504 ranged from 0.005 – 0.049 % and SRB-2604 ranged from 0.007 – 0.12 %. Lab and #7 had consistently high standard deviations for samples SRB-2603 and SRB-2604 highest Cl content. Five of 20 labs were flagged for poor precision across the four botanical samples for cycle 59.

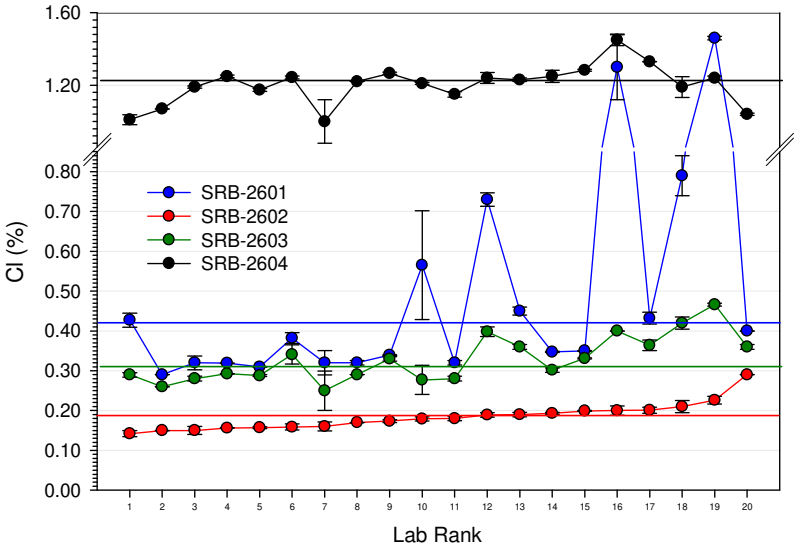



Figure 6. Chloride distribution plots for SRB materials, ALP 2026, Cycle 59.

## SRB - Combustion Nitrogen and TKN

Forty-four laboratories provided ALP results for botanical combustion (Dumas) nitrogen (test code 210) and seven labs for TKN (Test code 209) for Cycle 59. Median values are designated by horizontal lines for each material and labs results ranked low to high based on sample SRB-2602 (see Figure 7). Lab #39 had high bias on three of four PT materials. Unique for this cycle were four botanical materials with very distinct median nitrogen values: 1.48%, 0.43%, 3.98 and 2.84%, respectively. SRB-2601 showed the most inconsistent combustion N across labs. Similar results were found for TKN.

Combustion N results indicate very high intra-lab precision across all labs for all samples. Intra-lab median N lab *s* values were 0.012% N for SRB-2601; 0.011% N for SRB-2602; 0.015% for SRB-2603; and 0.014% for SRB-2604. Lab #4 had consistent high standard deviations on all four botanical PT samples.

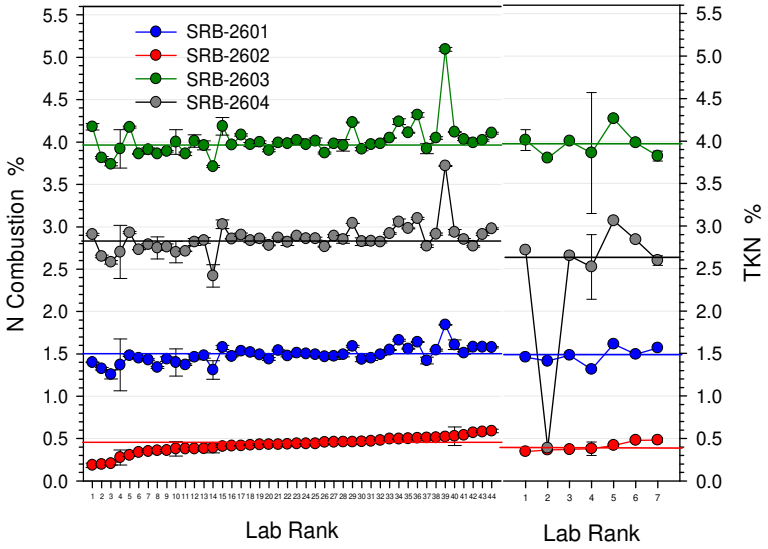



Figure 7. N distribution lab plots for SRB materials, ALP 2026 Cycle

## SRB - Phosphorus

Forty-six laboratories provided ALP results for Cycle 59 phosphorus (P) (test code 212). Botanical results median values are designated by horizontal lines for each botanical material and labs results are ranked low to high based on sample SRB-2602 (see Figure 8). Labs #1, #38, #39, #45 and #48 showed inconsistency. Source of inconsistency is likely related to sample digestion, analysis instrument and/or test code method compliance.

Botanical P results indicate very high precision, with median intra-lab standard deviation (*s*) values ranged 0.007 to 0.005 % P for test code 212 across the four botanical samples. Individual lab intra-lab *s* values for SRB-2601; ranged from 0.002 - 0.046% P; SRB-2602 ranged from 0.001 – 0.030 % P and SRB-2603 0.006 - 0.071 % P; and SRB-2604 0.005 - 0.073 % P. Seven labs were flagged for poor precision for botanical P for cycle 59.

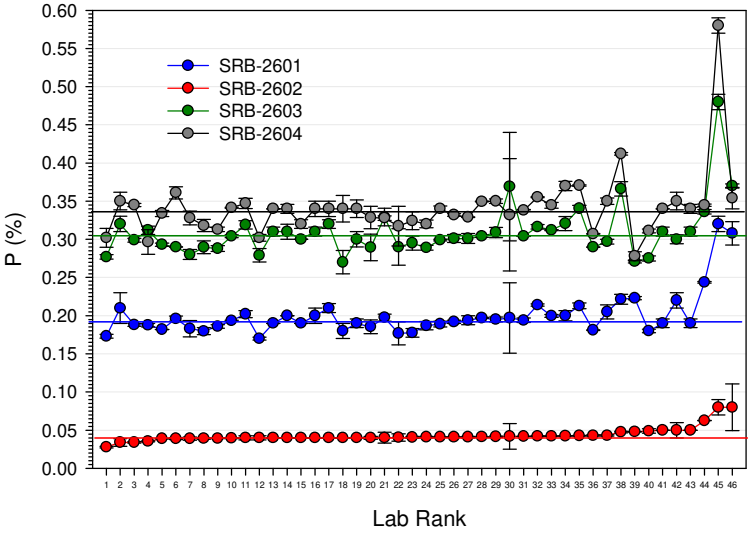



Figure 8. Phosphorus distribution lab plot for SRB materials, ALP 2026 Cycle 59.

## SRB - Potassium

Forty-seven laboratories provided ALP results for potassium (K) (test code 213). Median values are designated by horizontal lines for each botanical material and labs ranked low to high based on sample SRB-2602 (see Figure 9). Labs #1, #7, #8, #17, #45 #46 and #47 were inconsistent. Source of bias is related sample digestion, analysis instrument and/or method compliance.

Botanical K results indicate very high precision, with intra-lab median standard deviation (*s*) values ranging from 0.031 to 0.036 % K for test code 213 across the four samples. Individual lab intra-lab *s* values were: SRB-2601, ranged from 0.002 - 0.214 % K; SRB-2602, 0.001 - 0.275 % K; SRB-2603, 0.002 - 0.374 % K; and SRS-2604, 0.001 - 0.356 % K. Lab #45 had high standard deviations exceeding 0.20 % K on all four samples. Across samples ten labs were flagged for poor K precision for Cycle 59.

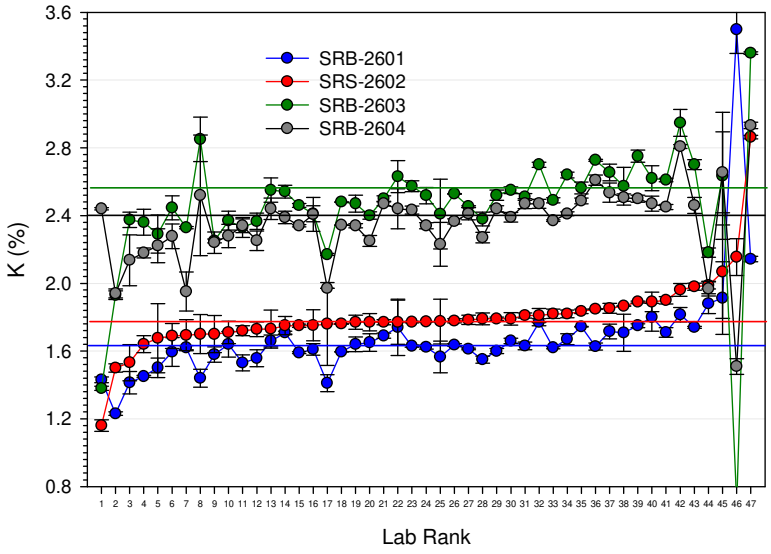



Figure 9. Potassium lab plot for SRB materials, ALP 2026 Cycle 59.

## SRB - Boron

Forty-three laboratories provided ALP results for boron (B) (test code 219). Result median values are designated by horizontal lines for each botanical material and individual labs results are ranked low to high based on sample SRB-2603 (see Figure 10). Across samples lab #1 had low bias on all samples. Labs #5, #6 and #21 were inconsistent. Source of bias is likely related sample digestion, analysis instrument and/or method compliance.

Botanical B results indicate very high precision, with median intra-lab standard deviation (*s*) values ranged from 0.21 to 0.95 mg $kg^{-1}$ B for across the four botanical proficiency samples. Individual lab intra-lab *s* values for SRB-2601; ranged from 0.21 - 9.13 mg $kg^{-1}$ B; SRB-2602 ranged from 0.09 – 5.8 mg $kg^{-1}$ B; SRB-2603 0.12 - 6.1 mg $kg^{-1}$ B; and SRB-2604 0.09 - 5.2 % B. Labs #38 through #41 had consistently high lab standard deviations.

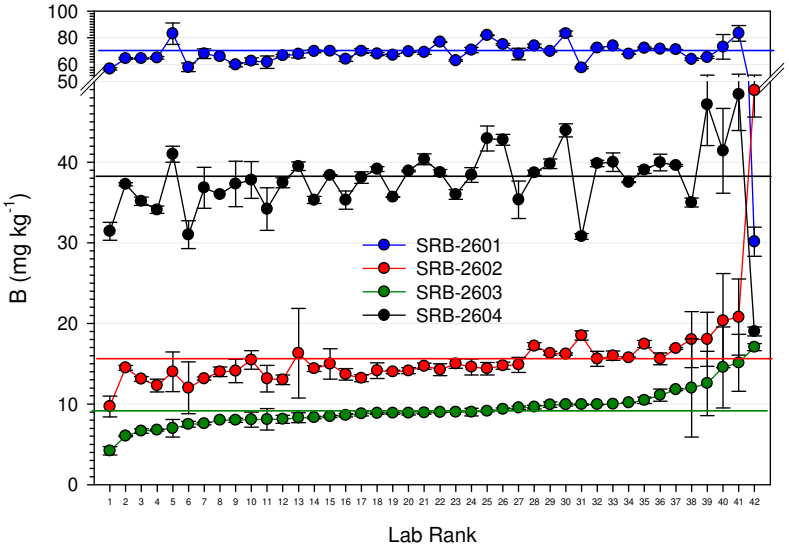
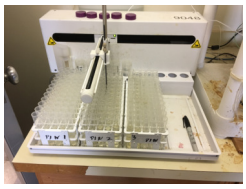



Figure 10. Boron (code 219) lab plots for SRB materials, ALP 2026 Cycle 59.

## SRW - Water EC



Twenty-three laboratories provided ALP results for water pH (test code 302) and EC. Lab results were ranked low to high based on sample SRW-2603 (see Figure 11). Lab #1 indicated high bias on Son two of three samples, and lab #10 was inconsistent sone of three sampels. Source of bias is likely associated with EC probe performance and/or calibration.

EC intra-lab precision across the three water materials indicates very high precision, with median intra-lab *s* values of 0.021, 0.003 and 0.0003 $dSm^{-1}$, for the three water samples, respectively. Precision for sample SRW-2603 was the most consistent across the twenty-three participating laboratories. Intra-lab *s* values for lab #10 exceeded 0.20 $dSm^{-1}$ on SRW-2601. Highest EC precision was noted for lab #22 with intra-lab *s* values of < than 0.05 $dSm^{-1}$ for all three water samples.

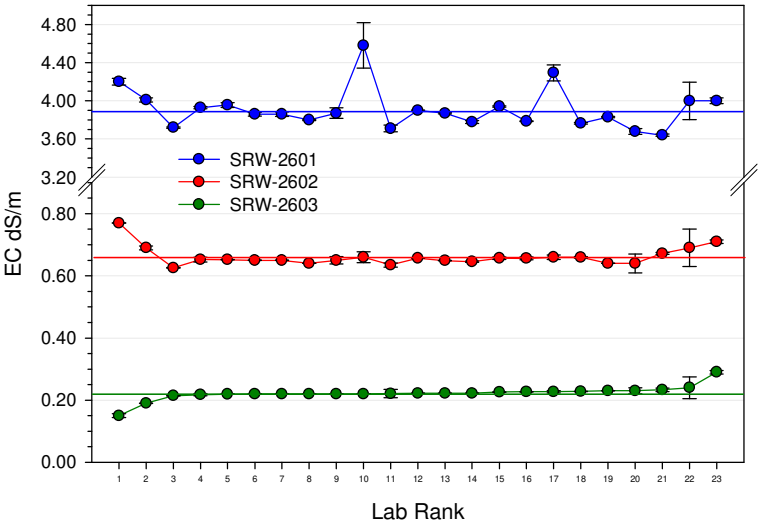



Figure 11. Water EC distribution plots for SRW materials, ALP 2026 Cycle 59.

## SRW - Na

Twenty laboratories provided ALP results for water Na (test code 305). Lab results were ranked low to high based on sample SRW-2603 (see Figure 12). Median values are designated by horizontal lines. Lab #1 showed low bias on all three samples and labs #11 and #1 were inconsistent. Bias is likely a result of a calibration error.

Sodium precision across the three water solution matrices indicates excellent precision, with median intra-lab *s* values of 0.503, 0.112, and 0.012 mmolc $L^{-1}$ for SRW-2601, SRW-2602, and for SRW-2603, respectively. Water Na precision was excellent with only six labs flagged for poor precision on Na across the three water samples for ALP Cycle 59.

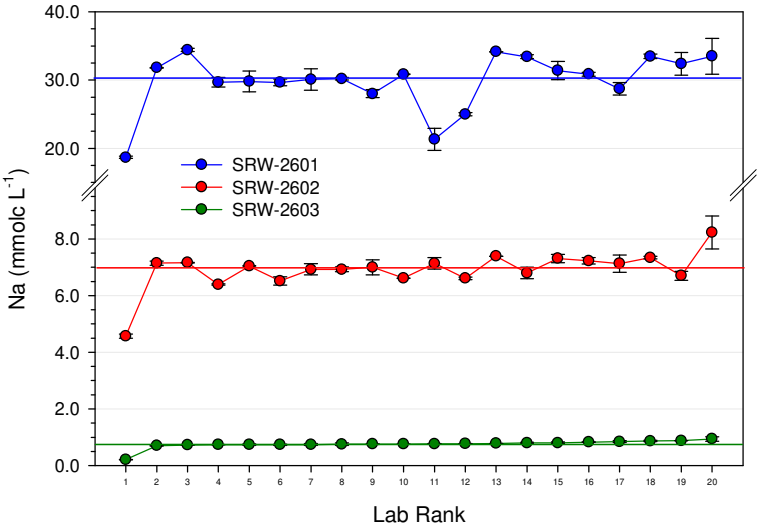



Figure 12. Water Na distribution plots for SRW materials, ALP 2026 Cycle 59.

## Announcements

- ALTA will host the summer workshop in Downers Grove, IL August 18-19th and is sponsored by Perkin-Elmer at their Chicago headquarters. The workshop program will focus on ICP-OES instrumentation and of soil analysis extracts.

- The 19th International Symposium on Soil and Plant Analyses (ISSPA) will be held September 27-30, 2027 in Cape Town, South Africa. Registration opens October 1, 2026, www.isspa2027.org.

- The Technical Director of the ALP program in the fall of 2025 with the director of the WEPAL-QUASIMEME an international PT provider proficiency program in Wageningen, The Netherlands. WEPAL will provide two botanical PT materials to the ALP program in 2026.

- In May ALP secured a new proficiency soil material from Nebraska, two water samples from California and Wyoming and three botanical materials for use in the 2026 and 2027 proficiency testing cycles.

- ALP has standard reference soils and botanical tissue materials available for purchase. For more information on these contact the ALP Technical Director, Robert.Miller@cts-interlab.com.

## Summary

ALP has provided twenty years of service with the completion of Cycle 59. Since 2005 ALP has completed the analysis of 295 soils, 208 plant samples and 189 water samples providing comprehensive proficiency data on inter and intra laboratory performance across a range of analytical methods.

We thank all laboratories who participated in Cycle 59. As the coordinators of the program we appreciate your consideration and participation in the proficiency program. We continually seek feedback from laboratory participants to improve the service and function of the program. Please forward all comments to info@cts-interlab.com.

**Cycle 60 Ship**

**June 22, 2026**

**"Geology differs from physics, chemistry, and biology in that the possibilities for experiment are limited. "**

***- Reinout Willem van Bemmelen, 1961***

ALP
Agricultural Laboratory Proficiency Program