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ALP Program Report

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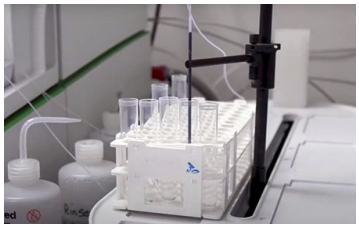
Special points of interest:

- An assessment homogeneity of all ALP proficiency materials indicate were highly uniform for Cycle 58.
- Sixty-nine laboratories provided soil pH (1:1) H_2O results, medians ranged from 4.75 - 7.64.
- Soil P Olsen for Cycle 58 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 41 - 335 mg kg^{-1} for the five ALP soils of PT Cycle 58.
- Botanical N by combustion was reported by 41 labs, with Three samples showing intra-lab variability < 2.5% for Cycle 58.
- Botanical K results show very high lab consistency across three of four cycle 58 for concentrations < 2.5% K.
- Results for water EC show very inconsistency across 24 labs over all three PT samples.

Inside this issue:

ALP Overview

The Agriculture Laboratory Proficiency (ALP) Program spring 2025 Round Cycle 58 was completed November 19, 2025, 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.

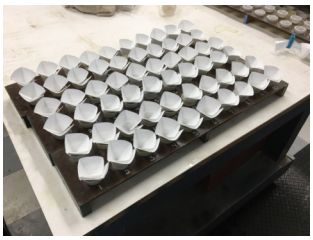
Proficiency Materials

Standard Reference Soils (SRS) materials utilized for Cycle 58 were: SRS-2511 Hosmer silt loam, collected Gibson Cty, IN; SRS-2512 Tifton loamy sand collected Tifton Cty, GA; SRS-2513 an Doughty-Sipple loam collected Fergus Cty, MT; SRS-2514 a loam texture collected Verdin, Manitoba, Canada; and SRS-2515 a Busti silt loam collected Chatauqua, NY. Chemical properties of the SRS materials ranges: pH (1:1) H_2O 4.75 - 7.64; Sikora Buffer 6.46 - 7.53 mg kg^{-1}; Bray P1 (1:10) 10.4 - 54.4 mg kg^{-1}; SO_4-S 4.6 - 69.6 mg kg^{-1}; M3-K 41.3 - 335 mg kg^{-1}; M3-Ca 324 - 8367 mg kg^{-1}; DTPA-Zn 0.35 - 5.24 mg kg^{-1}; SOM-LOI 0.28 – 4.80%; CEC 0.83 - 23.0 cmol kg^{-1}; clay 2.5 - 30.0% and NO_3-N 8.5 - 279 mg kg^{-1}.

Standard Reference Botanical (SRB) materials for Cycle 58 were: SRB-2509 field pea composite from CO; SRB-2510 a soybean leaf composite from NE; SRB-2507 a olive leaf composite from CA; and SRB-2508 a corn ear leaf composite GS-R1 from CO. SRB median analytes concentrations: NO_3-N 25.1 - 1228 mg kg^{-1}; combustion N 1.34 - 5.23 %; wet digestion total P 0.101 - 0.406 %; total K 0.675 - 3.36 %; total Ca 0.771 - 1.96 %; total S 0.143– 0.336 %, total B 18.7 - 51.6 mg kg^{-1}; and Zn 15.6 - 38.8 mg kg^{-1}.

Standard Reference Water (SRW) samples represent an agriculture water samples collected: SRW-2507 a river near Frisco, CO; SRW-2508 an irrigation canal collected near Severance, CO, and SRW-2509 from an irrigation canal Coolidge, KS. SRW median concentrations: pH 7.57 - 7.95; EC 0.392 - 1.61 dSm^{-1}; SAR 0.31 - 2.25; Ca 2.25 - 7.67 molc L^{-1}; Na 0.603 - 6.02 mmolc L^{-1}; HCO_3 0.94 - 2.67 mmolc L^{-1} ; and NO_3 0.020 - 0.035 mmolc L^{-1}.

Homogeneity Evaluations



"..soil pH, Buf pH A&E, Olsen P and SOM-WB analysis Stdev values for Cycle 58 met homogeneity standards."

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, SOM-WB and DTPA-Zn on analysis of five jars of each PT soil, each in analyzed in triplicate by an independent laboratory. Homogeneity results were within acceptable limits for all soils, with the lowest noted for EC 1:1 H_2O, Table 1. Proficiency soil antecedent moisture contents were: 2.2 ± 0.1, 1.1 ± 0.4, 2.2 ± 0.3, 3.8 ± 0.05 and 4.1 ± 0.1 %, respectively.

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 1% for all three of the PT samples, Table 3.

Table 1. ALP soils homogeneity evaluation Cycle 58, 2025.

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-2511	7.67	*0.02*	0.29	*0.014*	7.0	*0.48*	16.0	*0.2*
SRS-2512	6.95	*0.02*	0.26	*0.008*	6.2	*0.33*	7.9	*0.4*
SRS-2513	5.85	*0.02*	0.38	*0.024*	28.4	*2.0*	27.5	*0.3*
SRS-2514	7.62	*0.02*	2.35	*0.025*	15.1	*0.45*	277	*4.2*
SRS-2515	4.73	*0.02*	2.11	*0.036*	33.2	*1.7*	284	*6.6*

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

Table 2. ALP botanical homogeneity evaluation Cycle 58, 2025.

Sample	N (%)		Mg (%)		Zn (mg kg^{-1})		C (%)	
	Mean [1]	*Std*	Mean	*Std*	Mean	*Std*	Mean	*Std*
SRB-2509	3.75	*0.047*	0.342	*0.011*	33.9	*0.80*	43.6	*0.10*
SRB-2510	5.20	*0.065*	0.369	*0.011*	30.6	*0.95*	45.2	*0.12*
SRB-2511	1.32	*0.040*	0.235	*0.007*	15.4	*0.85*	48.6	*0.43*
SRB-2512	2.37	*0.045*	0.185	*0.004*	38.6	*1.4*	42.7	*0.17*

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

Table 3. ALP water homogeneity evaluation Cycle 58, 2025.

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-2507	0.78	*0.08*	6.06	*0.13*	0.020	*0.005*	0.60	*0.019*
SRW-2508	0.38	*0.02*	2.20	*0.06*	0.021	*0.002*	0.64	*0.021*
SRW-2509	1.90	*0.02*	7.55	*0.10*	0.035	*0.003*	6.0154	*0.011*

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

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

Sixty-nine laboratories provided ALP results for soil pH (1:1) H_2O (test code 116). Soils ranged from acid to alkaline, median range 4.75 - 7.64. Lab results were ranked low to high based on sample SRS-2515 (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 all soils. Labs #3, #15, #39, #40 and #69 were inconsistent. Source of bias is likely associated with ISE performance and/or method compliance. Inconsistency could be result of extract carry-over.

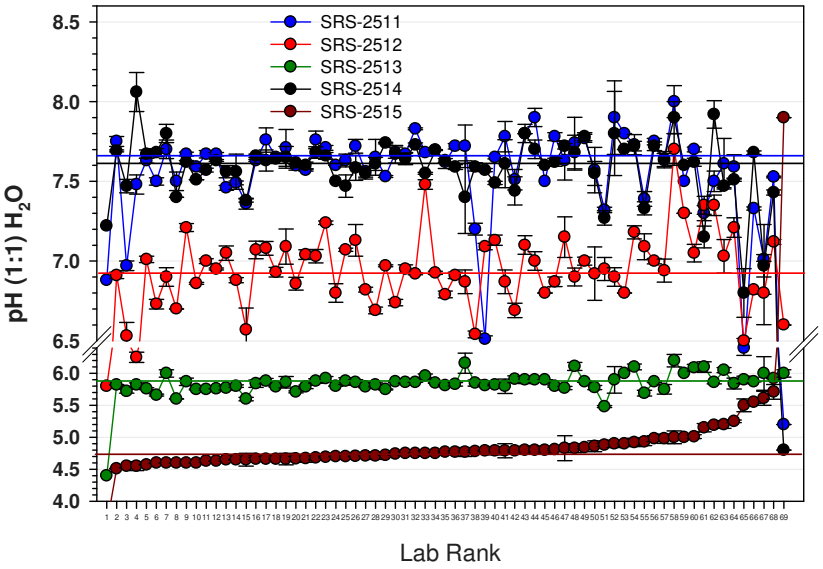


Figure 1. pH (1:1) H_2O distribution plots for SRS materials, ALP 2025 Cycle 58.

pH precision across the five ALP soils indicates very high precision, with median intra-lab standard deviation (*s*) values ranging from 0.052 to 0.067 pH units, the lowest noted for SRS-2515. Twelve labs had poor precision, with standard deviations exceeding intra-lab stdev. Specifically *s* for labs #19, #28, #37, and #50 exceeded 0.10 pH units for SRS-2511

SRS - Phosphorus: Bray P1 and Olsen P

Bray P1 results were reported by thirty labs. Olsen-P was reported by fifty-four labs and M3-P ICP was reported by 45 labs. Median soil Bray P1 values ranged from 10.4 - 54.4 mg kg^{-1} PO_4-P; Olsen P 6.5 to 30.3 mg kg^{-1} P; Bray P2 ranged from 36.6 to 83.3 mg kg^{-1} P; and M1-P from 4.5 to 31.8 mg kg^{-1} P, across the five soils. Ranking lab results based on sample SRS-2511, median Olsen P concentrations are shown in indicated in Figure 2. Soil SRS-2515, highest in concentration was variable between labs. Soils SRS-2511 and SRS-2512 had similar concentrations. Several lab had in consistent results across all five soils. Labs #53 and #54 had low bias for all five soils.

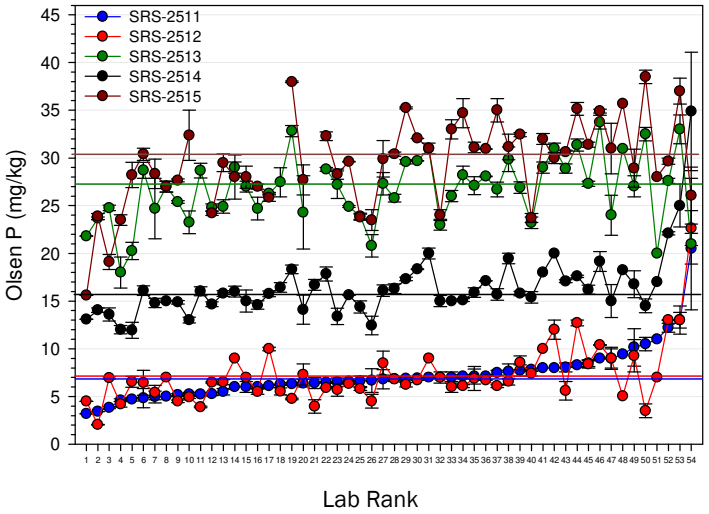


Figure 2. Olsen P distribution plots for SRS materials, ALP 2025 Cycle 58.

Three labs reported saturated paste PO_4 with median concentrations of 0.36 - 1.03 $mmol_c$ l^{-1}. Nine labs reported M3-P Spec median concentrations ranging 17 - 52.3 mg kg^{-1} P. Sixteen laboratories reported Bray P 1:7 with medians ranging from 6.9 - 50.1 mg kg^{-1} PO_4-P. Three results for Modified Morgan P, with medians ranging from 5.8 - 19.3 mg kg^{-1} PO_4-P. Modified Kelowna was reported by two laboratories ranging from 7.0 - 44.5 mg kg^{-1} P and total P (US-EPA 513) ranged 45.6 - 860 mg kg^{-1} P with the highest concentration noted for SRS-2515.

SRS - Potassium

Forty-three laboratories provided ALP results for soil M-3 K (test code 159) results. Results were ranked low to high based on sample SRS-2512 (see Figure 3). Soil SRS-2515 was the most inconsistent across labs. The source of the variability for SRS-2515 is likely associated with higher coarse sand. Lab #43 had high bias on all soils. Across all soils labs #2, #4, #36 and #42 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-2512, with a median intra-lab value of 1.6 mg kg^{-1} K and highest for SRS-2514 with a value of 8.0 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 nine labs which exceeded 8 mg kg^{-1} K on SRS-2512. Across the five soils for Cycle 58 seven labs were flagged for poor intra-lab precision. Poor precision is attributed to extraction and/or analysis instrument operation.

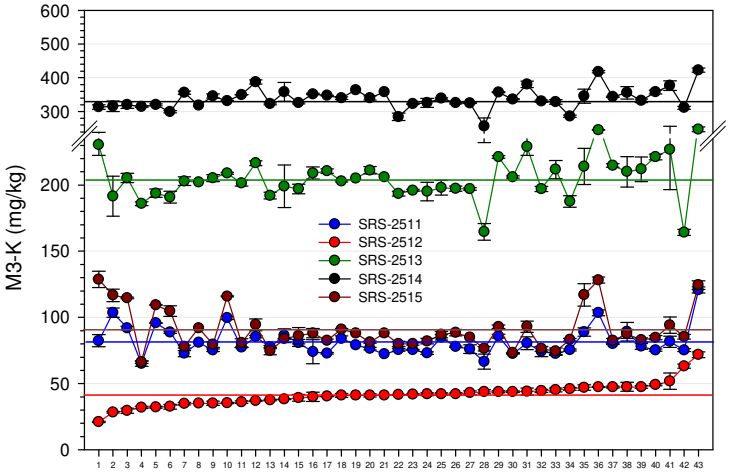


Figure 3. Extractable M3-K distribution plots for SRS materials, ALP 2025 Cycle 58.

SRS - SOM-LOI

Forty-four laboratories provided ALP results for soil SOM-LOI (test code 183). Soil Median SOM-LOI values ranged from 0.23 to 4.80%. Results were ranked based on sample SRS-2512 (see Figure 4) and had high consistency. Labs #1 and #2 had consistent low bias across all soils. Labs #12 #43 and #44 were. Source of bias is likely related to muffle furnace operation and/or method compliance.

SOM-LOI precision across the five soils indicates high median intra-lab precision *s* values ranging from 0.031 to 0.24% SOM-LOI, highest for SRS-2513. Across labs, *s* values for SRS-2511 ranged from 0.003 - 0.521%. Across soils low precision was noted for several laboratories. Specifically *s* for labs #2, #3, #21, and #28 exceeded 0.15% SOM-LOI for SRS-2511. Lab #21 had poor precision on all Cycle 58 samples. Poor precision may be associated with the muffle furnace and heating time.

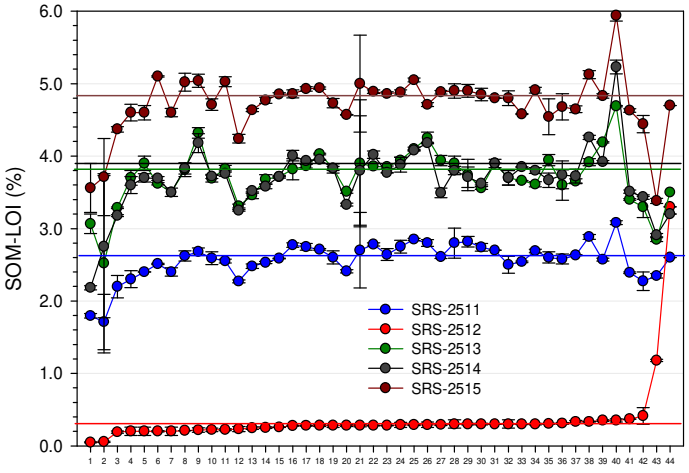


Figure 4. SOM-LOI distribution plots for SRS materials, ALP 2025 Cycle 58.

SRS - Soil CEC Displacement

Sixteen laboratories provided ALP results for soil CEC by displacement (test code 186) results. Results were ranked low to high based on sample SRS-2504 (see Figure 5). Soil SRS-2510 was the most inconsistent across laboratories. Lab #1 and #2 showed low bias on four of five soils. Laboratories #13 and #15 were inconsistent across soils. Source of inconsistency is likely related to extraction, analysis instrument and/or method compliance.

Soil CEC median intra-lab *s* values were lowest for soil SRS-2512, with a median intra-lab value of 0.10 cmol kg^{-1} and highest for SRS-2513 with a value of 0.87 cmol kg^{-1}. Generally CEC within-lab precision across the ALP soil materials indicates very good precision. Precision was poor (based on intra-lab *s*) across all soils for Lab #3 and #16, exceeding 2.0 cmol kg^{-1} on soils SRS-2513 and SRS-2514. Across the four soils for cycle 58 seven PT measurements were flagged for poor precision.

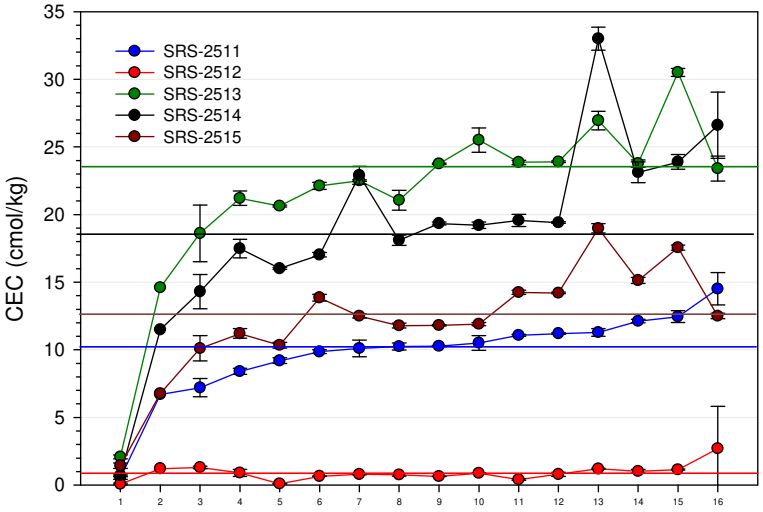


Figure 5. Soil total carbon distribution plots for SRS materials, ALP 2025 Cycle 58.

SRB - Chloride

Sixteen 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-2510 (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 #12, #13, and #15 were inconsistent on three of four samples.

Botanical Cl (test code 208) results for Cycle 58 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-2501 ranged from 0.001 – 0.038 %; SRB-2502 ranged from 0.002 - 0.093 %, SRB-2503 ranged from 0.001 – 0.122 % and SRB-2504 ranged from 0.001 – 0.026 %. Lab and #18 had consistently high standard deviations for samples SRB-2503 and SRB-2502 highest Cl content. Five of 18 labs were flagged for poor precision across the four botanical samples for cycle 58.

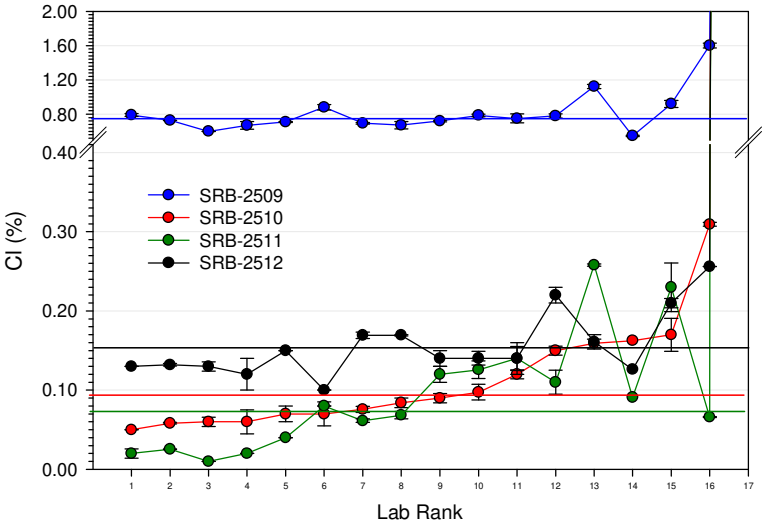


Figure 6. Chloride distribution plots for SRB materials, ALP 2025, Cycle 58.

SRB - Combustion Nitrogen and TKN

Forty-one laboratories provided ALP results for botanical combustion (Dumas) nitrogen (test code 210) and eight labs for TKN (Test code 209) for Cycle 58. Median values are designated by horizontal lines for each material and labs results ranked low to high based on sample SRB-2511 (see Figure 7). Lab #41 had low bias on three of four pT materials. Unique for this cycle were four botanical materials with very distinct median nitrogen values: 3.74%, 5.22% 1.34 and 2.37%, respectively. SRB-2510 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 0.020% N for SRB-2509; 0.032% N for SRB-2510; 0.024% for SRB-2511; and 0.022% for SRB-2512. Lab #40 had consistent high standard deviations on all four botanical PT samples.

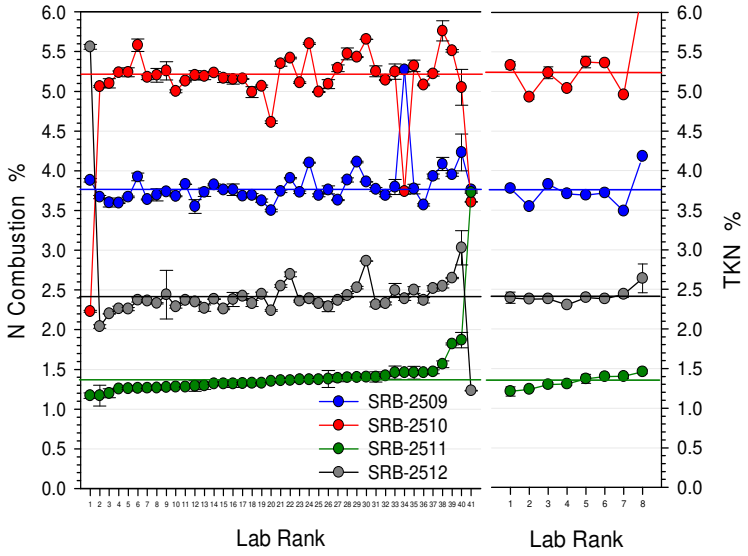


Figure 7. N distribution lab plots for SRB materials, ALP 2025 Cycle

SRB - Phosphorus

Forty-eight laboratories provided ALP results for Cycle 58 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-2511 (see Figure 8). Labs #1, #20, #28 and #38 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 0.005 to 0.013 % P for test code 212 across the four botanical samples. Individual lab intra-lab *s* values for SRB-2509; ranged from 0.002 - 0.044% P; SRB-2510 ranged from 0.001 – 0.044 % P and SRB-2511 0.001 - 0.020 % P; and SRB-2512 0.002 - 0.037 % P. Six labs were flagged for poor precision for botanical P for Cycle 58.

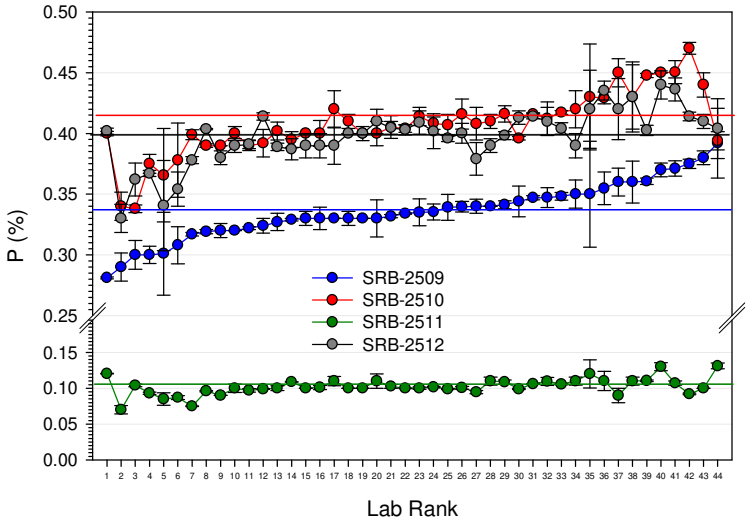


Figure 8. Phosphorus distribution lab plot for SRB materials, ALP 2025 Cycle 58.

SRB - Potassium

Forty-four laboratories provided ALP results for potassium (K) (test code 213). Median values are designated by horizontal lines for each botanical material and labs results are ranked low to high based on sample SRB-2511 (see Figure 9). Labs #1, #5, and #48 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 0.013 to 0.110 % K for test code 213 across the four samples. Individual lab intra-lab *s* values were: SRB-2509, ranged from 0.002 - 0.247 % K; SRB-2510, 0.001 - 0.137 % K; SRB-2511, 0.002 - 0.057 % K; and SRS-2512, 0.006 - 0.225 % K. Lab #46 had high standard deviations exceeding 0.20 % K on two of four samples. Across samples six labs were flagged for poor K precision for Cycle 58.

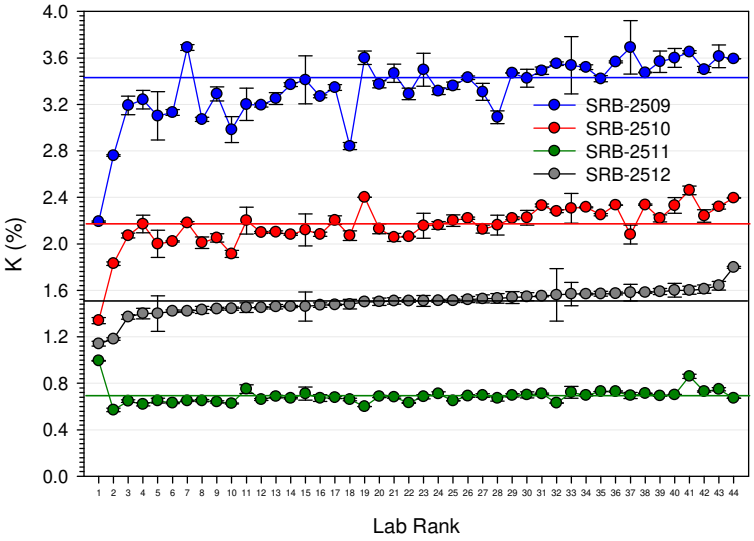


Figure 9. Potassium lab plot for SRB materials, ALP 2025 Cycle 58.

SRB - Copper

Forty-six laboratories provided ALP results for copper (Cu) (test code 223). 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-2510 (see Figure 10). Across samples lab #1 had low bias on all samples. Labs #7 and #36 were inconsistent. Source of bias is likely related sample digestion, analysis instrument and/or method compliance.

Botanical Cu results indicate very high precision, with median intra-lab standard deviation (*s*) values ranged from 0.005 to 0.22 mg kg^{-1} Cu for across the four botanical proficiency samples. Individual lab intra-lab *s* values for SRB-2509; ranged from 0.01 - 1.6 mg kg^{-1} Cu; SRB-2510 ranged from 0.02 – 2.3 mg kg^{-1} Cu; SRB-2511 0.05 - 3.3 mg kg^{-1} Cu; and SRB-2512 0.02 - 2.1 % Cu. Lab #40 had consistently high standard deviations.

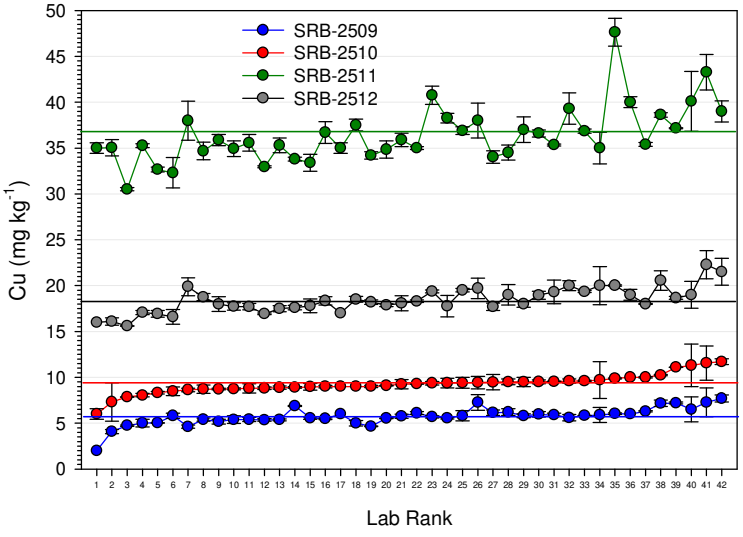
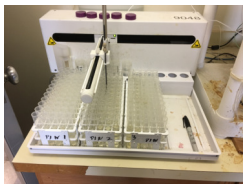


Figure 10. Copper (code 223) lab plots for SRB materials, ALP 2025 Cycle 58.

SRW - Water EC



Twenty-four laboratories provided ALP results for water pH (test code 302) and EC. Lab results were ranked low to high based on sample SRW-2507 (see Figure 11). Labs #1 indicated low bias on SRW-2507 and lab #24 high bias on all three samples. No labs indicated inconsistency. 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 0.045, 0.007 and 0.023 dSm^{-1}, for the three water samples, respectively. Precision for sample SRW-2507 was the most consistent across the twenty-four participating laboratories. Intra-lab *s* values for lab #24 exceeded 0.052 dSm^{-1} on SRW-2507. Highest EC precision was noted for labs #2, #7 and #17 with intra-lab *s* values of < than 0.002 dSm^{-1} for all three samples.

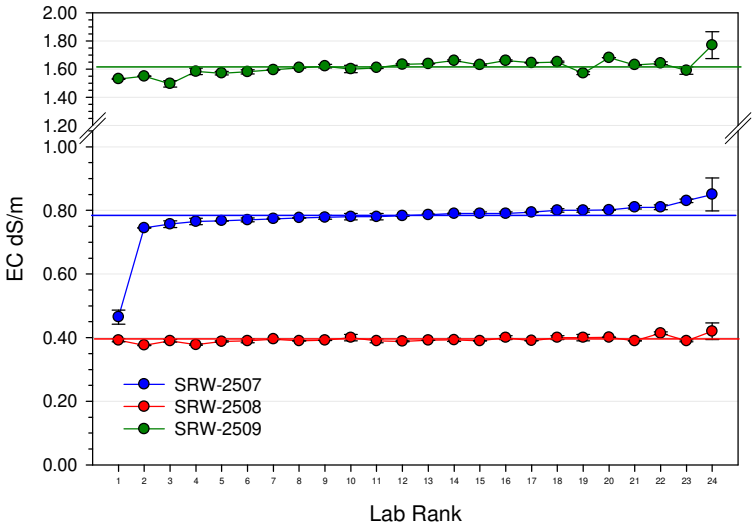


Figure 11. Water EC distribution plots for SRW materials, ALP 2025 Cycle 58.

SRW - Mg

Twenty-three laboratories provided ALP results for water Mg (test code 304). Lab results were ranked low to high based on sample SRW-2507 (see Figure 12). Median values are designated by horizontal lines. Lab #1 showed low bias on all three samples and lab #23 was inconsistent. Bias is likely a result of a calibration error.

Magnesium precision across the three water solution matrices indicates excellent precision, with median intra-lab *s* values of 0.041, 0.043, and 0.152 mmolc L^{-1} for SRW-2507, SRW-2508, and for SRW-2509, respectively. Water Mg precision was excellent with only labs #15 and #21 exceeding 0.10 mmolc L^{-1} Mg on sample SRW-2508. Four labs was flagged for poor precision on Mg for ALP Cycle 58.

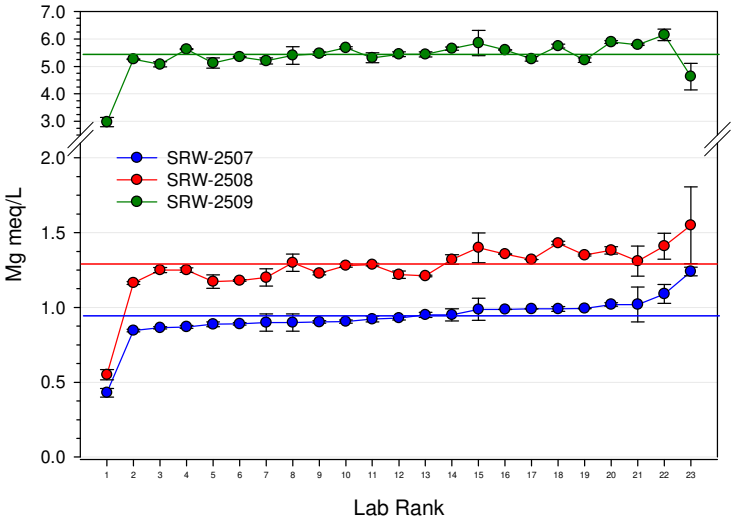


Figure 12. Water Mg distribution plots for SRW materials, ALP 2025 Cycle 58.

Announcements

- In August ALP launched the soil carbon proficiency program. Test parameters include, total Soil Carbon (SC), soil organic carbon (SOC), soil inorganic carbon (SIC), total soil carbon, pH and soil moisture content. The program consists three cycles per year each with four soils.

- The 19th International Symposium on Soil and Plant Analyses (ISSPA) has been schedule to be held in September 2027 in Cape Town South Africa. Information on the Symposium will are to be announced in early 2026.

- The Technical Director of the ALP program in October met 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.

- ALP has secured 18 new proficiency soil materials from Arkansas, Florida, Georgia, Illinois, New York, New Hampshire, Oklahoma, and Texas 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 58. Since 2005 ALP has completed the analysis of 290 soils, 204 plant samples and 186 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 58. 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 59 Ship

March 17, 2026

"Talent hits a target no one else can hit.
Genius hits a target no one else can see "

– Arthur Schopenhauer, 1844

ALP
Agricultural Laboratory Proficiency Program