



2024 North American Proficiency Testing Program
Quarter 1 Report - 4/29/2024

Laboratory ID
General

PAP certification requirements: All 20 soil and/or 12 plant samples have to have data submitted with an average score >60% for each method to be certified, as well as an overall of all methods >80%.

Overall PAP Score for this Year

Soil	Soil 2024-101			Soil 2024-102			Soil 2024-103			Soil 2024-104			Soil 2024-105			Current		
Analysis - Modus Code	Units	n	Median	MAD	Lab Result	Median	MAD	Lab Result	Median	MAD	Lab Result	Median	MAD	Lab Result	Median	MAD	Lab Result	PAP Score
Saturated Paste																		
Moisture - sp	%	21	44.3	3.83		51.7	3.45		47.5	3.94		26.0	2.02		33.9	3.30		
pH - sp	Unit	22	6.83	0.14		6.92	0.14		6.28	0.13		6.48	0.13		7.48	0.15		
ECe - sp	dS/m	26	0.84	0.082		0.85	0.10		1.02	0.12		0.31	0.043		0.61	0.069		
HCO3 - sp	mmolc/L	13	3.90	0.55		2.49	0.49		2.08	0.44		1.74	0.26		4.70	1.69		
Ca - sp	mmolc/L	23	5.50	0.64		5.15	0.55		5.14	0.69		1.42	0.24		3.35	0.52		
Mg - sp	mmolc/L	22	1.70	0.20		1.88	0.17		1.82	0.21		1.03	0.053		2.40	0.40		
Na - sp	mmolc/L	20	0.48	0.020		0.42	0.031		0.26	0.041		0.13	0.039		0.12	0.032		
SAR - sp	value	19	0.24	0.025		0.22	0.020		0.14	0.020		0.12	0.050		0.080	0.030		
Cl - sp	mmolc/L	16	0.28	0.046		0.58	0.070		1.52	0.23		0.32	0.075		0.33	0.040		
SO4 - sp	mmolc/L	16	0.94	0.12		1.10	0.11		1.19	0.16		0.40	0.050		0.98	0.085		
NO3 - sp	mmolc/L	11	2.73	1.09		3.80	1.11		3.76	0.92		0.50	0.42		0.72	0.49		
B - sp	mg/L	14	0.16	0.020		0.078	0.020		0.13	0.020		0.080	0.027		0.45	0.035		
pH & EC (1:1 or 1:2)																		
EC (1:1)	(dS/m)	34	0.42	0.031		0.38	0.038		0.43	0.035		0.10	0.020		0.19	0.025		
EC (1:2)	(dS/m)	38	0.24	0.034		0.26	0.034		0.30	0.030		0.070	0.020		0.15	0.020		
pH (1:1) Water	Unit	77	7.00	0.14		7.00	0.14		6.37	0.13		6.57	0.13		7.64	0.15		
pH (1:2) Water	Unit	22	7.05	0.14		7.08	0.14		6.50	0.13		6.65	0.16		7.65	0.15		
pH (1:1) 0.01M CaCl2	Unit	23	6.58	0.13		6.60	0.13		5.98	0.12		5.90	0.12		7.12	0.14		
pH (1:2) 0.01M CaCl2	Unit	11	6.60	0.13		6.60	0.13		6.02	0.12		5.96	0.12		7.12	0.14		
Lime Req.																		
SMP Buffer pH	Unit	23	7.15	0.14		7.11	0.14		6.91	0.14		7.01	0.14		7.34	0.15		
Adams-Evans Buf pH	Unit	8	7.65	0.15		7.72	0.15		7.65	0.15		7.71	0.15		7.86	0.16		
Woodruff Buf. pH	Unit	17	6.97	0.14		6.93	0.14		6.78	0.14		6.82	0.14		7.06	0.14		
Mehlich Buffer pH	Unit	7	6.48	0.13		6.54	0.13		6.36	0.13		6.38	0.13		6.72	0.14		
Sikora Buffer pH	Unit	35	7.22	0.14		7.21	0.14		7.02	0.14		7.13	0.14		7.47	0.15		
Titrateable Acidity	cmol/kg																	
Inorganic Nitrogen (NO3-N & NH4-N)																		
NO3-N Cd. Rd.	mg/kg	60	23.9	1.09		31.3	2.18		32.0	1.72		3.50	0.40		5.04	0.61		
NO3-N ISE	mg/kg	5	28.7	N/A		37.3	N/A		38.0	N/A		4.00	N/A		8.00	N/A		
NO3-N CTA	mg/kg	2	23.0	N/A		31.8	N/A		31.8	N/A		3.92	N/A		6.76	N/A		
NO3-N Ion Chr.	mg/kg																	
NO3-N Other	mg/kg	11	23.1	1.34		31.7	1.83		32.0	3.70		3.27	0.73		5.00	0.46		
NH4 - N (KCl Extr.)	mg/kg	48	26.9	1.51		73.3	5.10		113.0	8.64		7.29	0.80		28.2	1.38		
Phosphorus and Sulfur																		
PO4-P Bray P (1:10)	mg/kg	38	70.4	3.70		18.8	2.31		28.9	3.85		114.0	5.00		123.0	7.37		
PO4-P Bray P1 (1:7)	mg/kg	8	65.1	1.40		13.1	3.08		20.4	4.80		98.8	10.1		87.8	10.7		
PO4-P Olsen/Bicarb	mg/kg	50	37.4	2.39		23.4	2.06		25.5	2.50		27.6	2.87		53.6	6.38		
PO4-P AB-DTPA	mg/kg	2	18.6	N/A		16.6	N/A		18.4	N/A		17.1	N/A		47.9	N/A		
PO4-P Modified Morgan	mg/kg	4	19.8	N/A		7.05	N/A		6.45	N/A		7.15	N/A		22.6	N/A		
PO4-P True Morgan	mg/kg	4	25.0	N/A		6.00	N/A		6.00	N/A		7.35	N/A		28.4	N/A		
PO4-P Mod. Kelowna	mg/kg																	
PO4-P Stong Bray (1:10)	mg/kg	9	311.0	14.8		70.0	3.73		87.0	4.69		150.0	9.20		183.0	18.6		
PO4-P Water Soluble	mg/kg	1	5.69	N/A		0.78	N/A		5.05	N/A		20.6	N/A		2.92	N/A		
SO4 - S (PO4 Extr.)	mg/kg	28	6.73	0.67		8.53	1.65		10.2	2.13		2.95	0.92		6.20	0.81		
Bases																		

K NH4OAc	mg/kg	67	693.0	30.0	137.0	8.00	213.0	11.0	107.0	9.12	170.0	12.8
Ca NH4OAc	mg/kg	63	2530.0	127.0	2160.0	121.0	1380.0	73.0	500.0	48.4	1540.0	94.0
Mg NH4OAc	mg/kg	65	340.0	12.5	281.0	21.9	184.0	12.0	111.0	9.00	305.0	21.0
Na NH4OAc	mg/kg	53	19.0	1.72	16.9	2.10	10.8	1.32	7.80	1.86	7.89	1.31
Bray Extractable K	mg/kg	5	522.0	N/A	106.0	N/A	172.0	N/A	107.0	N/A	165.0	N/A
K- Bicarb.	mg/kg	4	521.0	N/A	121.0	N/A	208.0	N/A	99.6	N/A	156.0	N/A
K - Modified Morgan	mg/kg	3	606.0	N/A	140.0	N/A	207.0	N/A	86.8	N/A	156.0	N/A
K - True Morgan	mg/kg	4	388.0	N/A	96.0	N/A	170.0	N/A	87.0	N/A	128.0	N/A
Ca Modified Morgan	mg/kg	3	2240.0	N/A	2330.0	N/A	1370.0	N/A	391.0	N/A	1450.0	N/A
Aluminum KCL Extr.	mg/kg	5	0.20	N/A	0.22	N/A	0.39	N/A	0.11	N/A	0.30	N/A

Mehlich-1 Multi Element

Scoop Soil Mass

P	mg/kg	9	255.0	17.6	9.01	0.38	11.8	0.95	56.5	3.78	59.7	4.19
K	mg/kg	9	418.0	31.9	83.5	2.54	148.0	6.10	88.4	11.1	142.0	4.43
Ca	mg/kg	10	2500.0	122.0	2140.0	102.0	1340.0	65.4	506.0	56.8	2150.0	151.0
Mg	mg/kg	9	306.0	14.0	253.0	11.0	164.0	10.2	116.0	7.52	464.0	41.2
Mn	mg/kg	8	111.0	13.3	444.0	28.1	654.0	41.7	97.3	3.75	36.9	1.96
Zn	mg/kg	7	2.43	0.15	4.52	0.11	3.49	0.13	1.15	0.023	7.63	0.59

Mehlich-3 Multi-Element

Scoop Soil Mass

Assumed Density

Volume of Scoop

Extractant Volume mL

P Colorimetric	mg/kg	14	88.9	3.66	31.4	1.65	37.7	2.62	116.0	6.75	137.0	7.50
P ICP-AES	mg/kg	57	98.9	5.65	33.0	3.48	41.1	4.00	127.0	4.86	148.0	9.36
K	mg/kg	57	726.0	31.0	136.0	6.85	216.0	11.5	112.0	6.20	190.0	11.4
Ca	mg/kg	56	2700.0	128.0	2410.0	112.0	1520.0	70.6	578.0	28.1	1990.0	121.0
Mg	mg/kg	54	386.0	10.8	300.0	12.6	198.0	8.86	131.0	6.50	370.0	15.9
Na	mg/kg	46	20.4	2.41	18.0	1.85	12.2	1.98	9.22	1.77	9.78	1.51
S	mg/kg	46	12.8	0.83	14.3	0.96	17.0	1.22	8.57	0.76	14.8	1.26
Al	mg/kg	37	628.0	28.6	494.0	32.5	530.0	29.6	1060.0	85.6	476.0	34.0
Zn	mg/kg	53	3.56	0.18	3.72	0.25	3.20	0.17	1.70	0.14	5.50	0.31
Mn	mg/kg	49	240.0	17.7	355.0	22.8	490.0	30.0	239.0	21.9	34.0	2.05
Fe	mg/kg	51	151.0	11.5	534.0	52.8	585.0	50.3	169.0	14.6	499.0	69.1
Cu	mg/kg	48	3.20	0.15	1.02	0.24	0.90	0.19	0.68	0.070	0.49	0.18
B	mg/kg	36	1.20	0.10	0.97	0.11	0.79	0.14	0.43	0.097	1.85	0.085

Micronutrients

Zn - DTPA	mg/kg	58	1.60	0.090	2.12	0.12	2.04	0.098	0.60	0.073	3.58	0.30
Mn - DTPA	mg/kg	50	85.6	4.75	184.0	16.5	283.0	22.5	51.3	5.14	20.2	1.44
Fe - DTPA	mg/kg	48	32.1	2.43	179.0	17.2	192.0	10.7	19.0	3.70	179.0	16.8
Cu - DTPA	mg/kg	51	1.80	0.085	2.29	0.18	2.30	0.13	0.29	0.050	0.80	0.065
Zn - HCl	mg/kg	2	3.94	N/A	5.00	N/A	4.16	N/A	1.59	N/A	7.65	N/A
Mn-H3PO4	mg/kg	10	86.8	3.73	304.0	12.6	414.0	24.1	79.0	2.50	28.2	2.00
Cl - Ca(NO3)2 Extr.	mg/kg	10	4.70	1.40	9.40	1.65	23.9	1.90	3.00	0.73	4.90	1.35
B - Hot Wat.	mg/kg	20	0.76	0.20	0.49	0.13	0.46	0.098	0.28	0.080	0.95	0.23
B - DTPA/Sorbitol	mg/kg	20	0.67	0.035	0.47	0.078	0.46	0.080	0.19	0.041	0.99	0.10

N & C

Total N - Kjeldahl	%	9	0.14	0.020	0.18	0.020	0.16	0.020	0.067	0.020	0.17	0.020
Total N - combustion	%	38	0.15	0.020	0.18	0.020	0.16	0.020	0.067	0.020	0.18	0.020
TOC - combustion	%	23	1.35	0.040	1.72	0.040	1.54	0.040	0.77	0.034	1.90	0.090
Total C - combustion	%	37	1.36	0.050	1.74	0.050	1.58	0.040	0.82	0.030	2.12	0.10
OM - Walkley-Black	%	24	2.46	0.14	2.86	0.19	2.68	0.080	1.30	0.10	3.30	0.17
OM - LOI (% Wt loss)	%	65	2.73	0.10	3.50	0.10	3.09	0.090	1.61	0.095	3.18	0.12

Miscellaneous

CaCO3 Content	%	10	0.48	0.40	0.76	0.30	0.55	0.18	0.22	0.069	1.50	0.40
CEC - Cation Displacement	cmol/kg	10	18.7	1.68	17.6	1.50	13.6	1.42	5.28	0.96	10.2	1.93
CEC - Estimation	cmol/kg	13	19.6	1.60	15.8	1.40	10.9	0.90	5.30	1.20	11.2	1.72
Soil Density (Scoop)	g/cc											
Particle Size Analysis - Hydrometer												
Sand 2000 - 50 um	%	29	23.9	4.60	15.0	3.94	13.0	4.80	60.0	2.00	83.8	1.67
Silt 50 - 2 um	%	29	55.8	4.28	64.5	3.00	68.0	4.20	26.0	2.70	8.20	1.50
Clay 2 - 0 um	%	28	20.0	2.45	20.0	3.00	18.7	1.65	14.0	2.60	7.00	1.70
Particle Size Analysis - Pipette												
Sand 2000 - 50 um	%	4	25.5	N/A	11.5	N/A	8.50	N/A	60.5	N/A	85.6	N/A
Silt 50 - 2 um	%	4	55.5	N/A	69.0	N/A	73.0	N/A	27.5	N/A	9.38	N/A
Clay 2 - 0 um	%	4	17.1	N/A	16.9	N/A	15.0	N/A	11.6	N/A	5.00	N/A
Soil Health												
Autoclave-Citrate Extractable (ACE) protein	mg/g	3	3.20	N/A	4.65	N/A	6.71	N/A	3.05	N/A	4.82	N/A
Microbial CO2 respiration (1 day incubation-ST)	mg/g	6	0.062	0.021	0.080	N/A	0.10	0.032	0.045	0.020	0.094	0.045
Microbial CO2 respiration (4 day incubation-ST)	mg/g	1	0.045	N/A	0.061	N/A	0.055	N/A	0.025	N/A	0.053	N/A
Microbial enzyme activity - As	mg PNP/kg soil h											
Microbial enzyme activity - Beta Glucosidase (E)	mg PNP/kg soil h											
Microbial enzyme activity - NAG	mg PNP/kg soil h											
Microbial enzyme activity - Pase	mg PNP/kg soil h											
PMN 7 day anaerobic	mg/kg	2	28.4	N/A	40.3	N/A	29.2	N/A	21.4	N/A	46.8	N/A
Reactive carbon - permanganate oxidizable (PC)	mg/kg	7	478.0	79.0	573.0	51.9	543.0	63.2	175.0	34.0	775.0	15.5

Water	Water 2024-301			Water 2024-302			Water 2024-303				
Analysis - Modus Code	Units	n	Median	MAD	Lab Result	Median	MAD	Lab Result	Median	MAD	Lab Result
pH & EC											
pH		24	7.75	0.16		7.96	0.16		7.47	0.15	
EC	dS/m	22	1.58	0.055		0.44	0.020		0.16	0.020	
Cations											
Ca	mmol/L	26	11.8	0.52		1.91	0.079		1.01	0.14	
Mg	mmol/L	27	5.20	0.13		0.98	0.040		0.64	0.42	
Na	mmol/L	23	1.65	0.088		1.26	0.058		0.62	0.029	
K	mmol/L	26	0.16	0.020		0.090	0.020		0.21	0.12	
NH4-N	mmol/L	11	0.007	0.020		0.006	0.020		0.030	0.022	
Sum Cations	mmol/L	11	18.4	0.76		4.46	0.26		2.93	0.56	
SAR	---	12	0.57	0.020		1.04	0.021		0.60	0.043	
Adj-SAR	---	4	1.50	N/A		1.74	N/A		0.73	N/A	
Anions											
HCO3	mmol/L	16	5.29	0.27		2.45	0.11		0.91	0.095	
CO3	mmol/L	3	0.000	N/A		0.12	N/A		0.00	N/A	
Cl	mmol/L	21	2.44	0.049		1.44	0.057		0.37	0.18	
NO3	mmol/L	19	0.17	0.020		0.010	0.020		0.11	0.020	
SO4	mmol/L	16	10.6	0.53		0.31	0.025		0.27	0.029	
Sum Anions	mmol/L	11	18.2	0.84		4.23	0.40		1.91	0.35	
Cation-Anion Difference	---	6	0.58	N/A		0.30	N/A		1.20	0.55	
Miscellaneous											
Boron	mg/L	11	0.11	0.020		0.050	0.020		0.030	0.020	
PO4-P Phosphorus - Spec	mg/L	6	0.020	N/A		0.019	N/A		0.13	0.052	
Phosphorus - ICP (Total)	mg/L	11	0.018	N/A		0.020	0.020		0.52	0.18	
TKN	mg/L	5	0.30	N/A		0.20	N/A		2.20	N/A	
Nitrogen Combustion (Total)	mg/L	2	6.70	N/A		2.01	N/A		3.78	N/A	
Total Organic Carbon	mg/L	3	1.73	N/A		2.84	N/A		14.0	N/A	

Environmental	Soil 2024-101			Soil 2024-102			Soil 2024-103			Soil 2024-104			Soil 2024-105				
Soil Analyses - Modus Code	Units	n	Median	MAD	Lab Result	Median	MAD	Lab Result	Median	MAD	Lab Result	Median	MAD	Lab Result	Median	MAD	Lab Result
Metals																	
Ag	mg/kg																
Al	mg/kg	7	15100.0	1870.0		10200.0	1410.0		7750.0	981.0		8310.0	1330.0		3440.0	597.0	
As	mg/kg	5	3.65	N/A		8.45	N/A		6.27	N/A		2.44	N/A		2.29	N/A	
Ba	mg/kg	2	130.0	N/A		195.0	N/A		194.0	N/A		68.6	N/A		26.6	N/A	
Be	mg/kg																
Bi	mg/kg																
B	mg/kg	4	7.32	N/A		3.60	N/A		3.32	N/A		1.80	N/A		3.10	N/A	
Ca	mg/kg	6	4840.0	194.0		3600.0	130.0		2110.0	N/A		784.0	66.7		5860.0	287.0	
Cd	mg/kg	6	0.61	0.084		0.31	0.053		0.45	N/A		0.14	0.020		0.20	N/A	
Co	mg/kg	6	6.78	0.24		10.1	0.58		9.53	0.44		4.16	0.20		0.67	0.28	
Cr	mg/kg	8	19.5	1.39		15.0	0.72		12.8	1.12		13.3	1.84		5.52	0.30	
Cu	mg/kg	6	13.9	0.98		10.5	1.11		11.2	0.75		4.46	0.44		3.14	0.43	
Fe	mg/kg	6	16100.0	1160.0		15500.0	1930.0		14700.0	833.0		9690.0	531.0		3490.0	274.0	
K	mg/kg	7	4210.0	449.0		1000.0	178.0		1230.0	139.0		406.0	51.9		383.0	39.0	
Li	mg/kg																
Mg	mg/kg	7	4330.0	313.0		1590.0	114.0		1490.0	119.0		476.0	68.0		2400.0	110.0	
Mn	mg/kg	7	548.0	22.6		1480.0	133.0		1700.0	34.0		788.0	30.3		61.1	4.26	
Mo	mg/kg	4	0.37	N/A		0.61	N/A		0.55	N/A		0.37	N/A		0.23	N/A	
Na	mg/kg	7	143.0	34.0		74.9	11.8		50.9	14.3		36.7	20.3		44.6	20.6	
Ni	mg/kg	6	14.9	0.40		11.3	0.81		14.9	0.45		5.36	0.49		1.97	0.17	
P	mg/kg	6	855.0	17.1		549.0	20.9		486.0	N/A		554.0	11.1		488.0	13.9	
Pb	mg/kg	7	12.4	2.26		19.9	2.34		16.6	1.55		12.3	0.78		6.35	0.67	
S	mg/kg	7	195.0	6.50		226.0	4.67		190.0	7.05		91.9	7.76		242.0	14.9	
Sb	mg/kg																
Se	mg/kg	3	0.55	N/A		1.29	N/A		1.02	N/A		0.64	N/A		0.24	N/A	
Sn	mg/kg																
Sr	mg/kg	1	28.7	N/A		16.1	N/A		11.1	N/A		4.44	N/A		6.53	N/A	
V	mg/kg	1	19.6	N/A		26.3	N/A		22.5	N/A		14.9	N/A		7.64	N/A	
Zn	mg/kg	7	65.0	1.94		43.6	1.65		42.3	2.49		18.9	2.45		27.2	0.98	
Hg (US-EPA 7470 or 7471)	mg/kg	1	0.010	N/A		0.010	N/A		0.001	N/A		0.012	N/A		0.003	N/A	

n = Number of labs submitting results

MAD = Median Average Deviation

N/A = Not applicable as there are too few labs submitting data for this test to run statistics

H = High - Outside 2.5* +/- MAC VH = Very High - Outside 4* +/- MAD

L = Low - Outside 2.5* +/- MAD VL = Very Low - Outside 4* +/- MAD

✓ = Passing