

BMO Soil Analytical Laboratory		Lab Manager: Hongxiu Wang, Ph.D.	Client Type	
Available Services		Instrument / Method	Per Sample Cost (\$)	
			Canadian Academic	Non-Academic
General Services				
Air drying & sieving to 2 mm		---	\$11.00	\$22.00
Coarse grinding		Wiley mill	\$5.00	\$10.00
Fine grinding		Ball mill	\$5.00	\$10.00
Sample weighing & encapsulation (IRMS analyses only)		Sartorius CPA2P balance	\$5.00	\$10.00
Microwave-assisted extraction / digestion		Ethos EX microwave extraction system	\$6.50	\$13.00
Extraction for macronutrient analysis		2M KCl; modified Kelowna, Mehlich 3; Bray 1/2	\$5.50	\$11.00
Water extraction: 1:2, 1:5, 1:10 (w/v) soil:water		---	\$4.00	\$8.00
saturated paste		---	\$6.00	\$12.00
General Soil Analyses				
pH or EC		---	\$4.00	\$8.00
pH & EC		---	\$4.75	\$9.50
Soil moisture content / Soil bulk density		Gravimetric with oven drying	\$2.50	\$5.00
Cation Exchange Capacity (CEC) & Exchangeable Cations				
CEC Prep		---	\$17.00	\$34.00
Total CEC (NH ₄ OAc method)		Seal Analytical AA3 SFA	\$4.50	\$9.00
Effective CEC (sum of cations: Al ³⁺ , Ca ²⁺ , Mg ²⁺ , K ⁺ , Na ⁺)		Agilent 4100 MP-AES	\$35.50	\$71.00
Particle Size Distribution				
Soil texture: Hydrometer method		---	\$12.00	\$24.00
Pipette method		---	\$18.00	\$36.00
Sample Prep				
Removal of carbonates		treat with 1M HCl	\$7.00	\$14.00
Removal of organic matter (SOM ≥ 5%)		treat with 30% H ₂ O ₂	\$8.50	\$17.00

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Analysis of metals, S and P				
Individual elements: Na, K, Ca, Mg, Fe, Cu, Zn		Agilent 200 Series AAS	\$6.00	\$12.00
Na, K, Ca, Mg, Fe, B, Mn, Cu, Zn, S, P		Agilent 4100 MP-AES (high sensitivity)	\$6.00	\$12.00
Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Se, Si, Sr, Ti, Tl, V, Zn		ThermoFisher ICAP-RQ (contact Barry Goetz, Agric 2E83)	\$10.00	\$20.00
Total C and N				
Soild samples ¹				
Total carbon (TC)		Elementar soli TOC cube	\$13.00	\$26.00
Total carbon (TOC + TIC + ROC)			\$15.00	\$30.00
Total organic carbon (TOC)			\$13.00	\$26.00
Total N (TN)		Elementar rapid MAX N exceed	\$9.00	\$18.00
¹ requires fine-grinding of sample				
Liquid samples				
Total Dissolved C (TDC)		Shimadzu TOC-L	\$16.05	\$32.10
Dissolved Inorganic C (DIC)		Shimadzu TOC-L	\$16.05	\$32.10
Dissolved Organic C (DOC = TDC - DIC)		Shimadzu TOC-L	\$24.10	\$48.20
Non-Purgeable Organic C (NPOC)		Shimadzu TOC-L	\$16.05	\$32.10
Total Dissolved N (TDN)		Shimadzu TNM-L	\$16.05	\$32.10
TDC + TDN or NPOC + TDN		(see above)	\$24.10	\$48.20
Light-fraction Soil C			Request quote	
Microbial Biomass C			Request quote	
Nutrient Analysis (segmented flow analysis)				
Single nutrient: NH ₄ ⁺ -N / NO ₃ ⁻ -N / PO ₄ ³⁻ -P / SO ₄ ²⁻ -S / Cl ⁻		Seal Analytical AA3 SFA	\$4.50	\$9.00
2 nutrient combination		Seal Analytical AA3 SFA	\$6.50	\$13.00
3 nutrient combination		Seal Analytical AA500 SFA	\$8.50	\$17.00

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Nitrite N (NO ₂ ⁻ -N)	Seal Analytical AA3 SFA	\$4.50	\$9.00
Total P (TP)	Seal Analytical AA3 SFA	\$5.00	\$10.00
Total Kjeldahl Nitrogen (TKN)		Request quote	

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Stable Isotope Analysis (IRMS-EA)		(contact Kim Janzen, Agric 5E80)		
Solid samples: $\delta^{13}\text{C}$ and/or $\delta^{15}\text{N}$				
$\delta^{13}\text{C}$ & %C	Elementar Isoprime precisION IRMS paired with an Elementar Vario Pyro Cube EA (2 systems)	\$20.00	\$40.00	
$\delta^{15}\text{N}$ & %N		\$20.00	\$40.00	
$\delta^{15}\text{N} + \delta^{13}\text{C}$; %N + %C		\$20.00	\$40.00	
^{15}N diffusion disks		\$20.00	\$40.00	
$\delta^{18}\text{O}$ & %O		\$21.00	\$42.00	
Water samples: $\delta^2\text{H} + \delta^{18}\text{O}$		\$48.00	\$58.00	
Sample Prep ²				
Sample drying & fine grinding (ball mill)	Ball mill	\$5.00	\$10.00	
Sample encapsulation	Sartorius CPA2P balance	\$5.00	\$10.00	
² Contact Kim Janzen if you require this service				
Stable Isotope Analysis (Laser Spectroscopy)		(contact Kim Janzen, Agric 5E80)		
Water samples: $\delta^2\text{H}$, $\delta^{18}\text{O}$ and/or $\delta^{17}\text{O}$				
water: $\delta^2\text{H} + \delta^{18}\text{O}$	(Off-Axis Integrated-Cavity Output Spectroscopy)	\$30.00	\$40.00	
water: $\delta^2\text{H} + \delta^{18}\text{O} + \delta^{17}\text{O}$	Los Gatos Research	\$35.00	\$45.00	
soil vapor: $\delta^2\text{H} + \delta^{18}\text{O}$		\$30.00	\$40.00	
soil vapor: $\delta^2\text{H} + \delta^{18}\text{O} + \delta^{17}\text{O}$		\$35.00	\$45.00	
Water extraction				
Soil (geochemistry & isotopes)	Centrifugation	\$20.00	\$25.00	
Plant material	Centrifugation	\$25.00	\$30.00	
Plant or soil (geochemistry & isotopes)	High-pressure mechanical squeezing	\$30.00	\$35.00	
Plant or soil (isotopes only)	Cryogenic extraction	\$30.00	\$40.00	

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Compound-specific analyses		(contact Bobbi Helgason, Agric 5E22)		Request quote	
Separation, $\delta^{13}\text{C}$ analysis, & quantification ³ of fatty acid methyl esters (methylated neutral and phospholipid fatty acids)		Agilent 8890B GC-FID with 5977B MSD paired to Elementar GC5 interface and precisiON IRMS			
Separation, $\delta^{13}\text{C}$ analysis, & quantification of amino sugars (and monosaccharides)		Agilent 1260 Infinity II bio-inert HPLC-RID paired to Elementar LiquiFace interface and Isoprime precisiON IRMS		Request quote	
³ <i>In development</i>					
Greenhouse Gas Analysis		(contact Rich Farrell, Agric 5E18)			
Gas chromatography:					
N ₂ O & CO ₂		Bruker 450-GC or Scion 456-GC		\$4.00	14.00
N ₂ O, CO ₂ , & CH ₄		(equipped with ECD / TCD / FID detectors)		\$4.50	15.75
high CH ₄ samples				\$7.00	24.50
high CO ₂ samples				\$7.00	24.50
Isotopic GHG Analysis		(contact Rich Farrell, Agric 5E18)			
Cavity Ring-Down Spectroscopy⁴					
¹⁵ N ₂ O ($\delta^{15}\text{N}_{\text{bulk}}$, $\delta^{15}\text{N}_{\alpha}$ & $\delta^{15}\text{N}_{\beta}$)		Picarro G5131- <i>i</i> Isotope & gas concentration		\$16.50	\$33.00
¹³ CO ₂ ($\delta^{13}\text{C}$)		Picarro G2121- <i>i</i> Isotope & gas concentration		\$14.00	\$28.00
¹³ CO ₂ , ¹³ CH ₄ ($\delta^{13}\text{C}$)		Picarro G2201- <i>i</i> Isotopic analyzer		\$16.50	\$33.00
IRMS⁵					
¹⁵ N ₂ O ($\delta^{15}\text{N}_{\text{bulk}}$, $\delta^{15}\text{N}_{\alpha}$ & $\delta^{15}\text{N}_{\beta}$)		Elementar isoFLOW GHG analyzer paired with an Elementar Isoprime precisiON IRMS		\$20.00	\$40.00
¹⁵ N ₂ ($\delta^{15}\text{N}$)				\$20.00	\$40.00
¹³ CO ₂ ($\delta^{13}\text{C}$)					

⁴ includes total gas concentration by GC