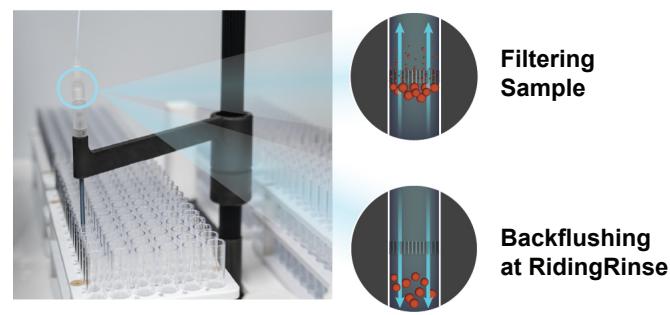




## Instrumentation

### FilterProbe with Syringe-driven Backflush

The FilterProbe's inline CTFE filter prevents particulates, fibers and debris from entering the sample flowpath, significantly reducing valve and nebulizer maintenance. The free-flowing filter enables unrestricted sample transport without slowing analytical runs, while syringe-driven backflushing automatically clears the sample flowpath before the next sample is analyzed.



**Figure 2.** FilterProbe catches particulates and backflushes them to waste.

### RidingRinse: Mobile Rinse Station

RidingRinse moves with the autosampler carriage, providing the fastest access to a rinse station and further expediting sample-to-sample time. With a simple rotary movement, FASTFluidic FilterProbe Soil can perform backflushing and rinsing in place, preventing wasted autosampler movements required for a conventional fixed rinse location.



**Figure 3.** RidingRinse integrated to 4DXW autosampler.

### Multiposition Magnetic SnapValves

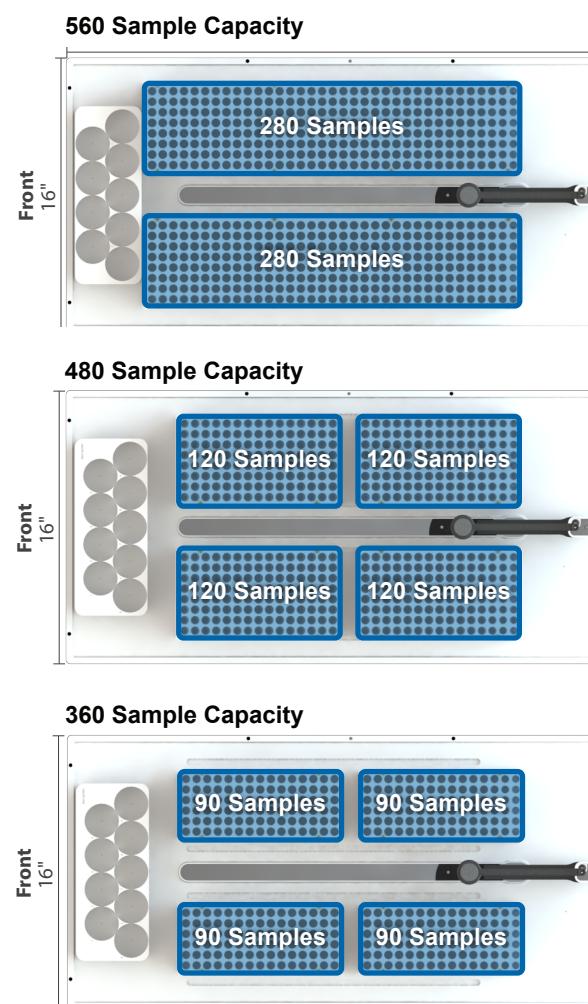
FASTFluidic FilterProbe Soil features patented Magnetic SnapValves with magnetic coupling technology, enabling valves to snap on and off by hand for tool-free installation and maintenance. Clearly labeled ports simplify line attachment, and cleaning takes just seconds, enhancing both usability and efficiency.

### SampleSense 3

SampleSense 3 Optical Sensors are integrated into the sample flowpath, providing intelligent, real-time sample detection that automatically triggers ICP or ICPMS analysis. This eliminates fixed timing parameters, improving throughput and reducing sample consumption. It adapts dynamically to variable sample viscosities and detects missed or incomplete samples, delivering real-time error notifications.

### 4DXW Autosampler

The innovative 4DXW autosampler increases sample capacity by 55% in a footprint narrower than a conventional 4-rack autosampler.



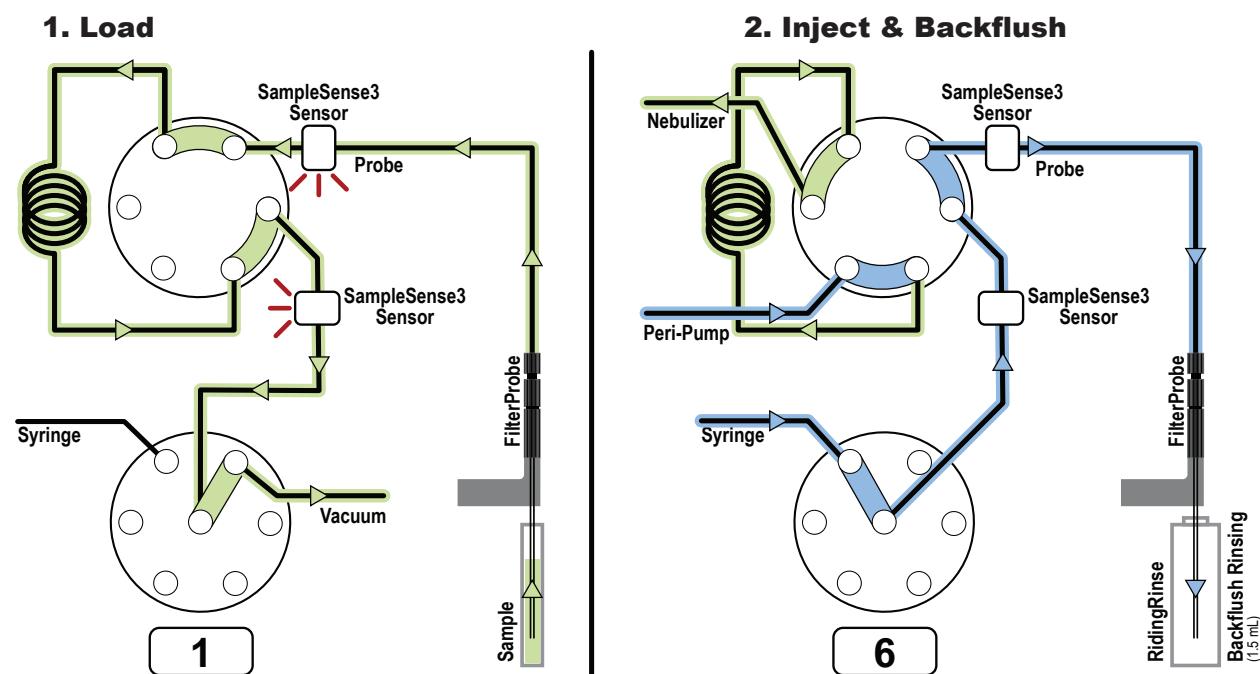
**Figure 4.** 4DXW autosampler example rack layouts. Capacities up to 560 samples taking up only 16" of linear lab bench space.

## Experimental

In this experiment, ICPOES was used in tandem with the FASTFluidic FilterProbe Soil to determine bioavailable concentrations of 11 extractable micronutrient elements in soil samples. Because soil analyses must be completed within a narrow seasonal time window, laboratories require ultra-high sample throughput with high analytical reliability. Conventional soil methods often have extended rinse out times following sample measurement to prevent carryover, limiting productivity. FASTFluidic FilterProbe Soil overcomes these limitations by achieving effective rinse out without sacrificing high-throughput, enabling

**Table 1.** Instrument Conditions

Instrument	Avio 550 Max
Peri-Pump Rate	1.5 mL/min
Matrix	2% HNO <sub>3</sub>
Radial Acquisition View	15 mm
Plasma Gas Flow	12 L/min
Auxiliary Gas Flow	0.5 L/min
Nebulizer Gas Flow	0.55 L/min
RF Power	1500 Watts
Read Time	3 Seconds



**Figure 5.** Sample loading with filtering diagram.

consistent measurements across the full calibration range. Mehlich-3-ICP is widely used to determine fertilizer application rates in agricultural soils; in this study it served as a representative high-throughput method, while the described sample introduction approach is broadly applicable to other common soil extraction methods.

The ICP operating conditions and sample introduction parameters used in this study are summarized below.

**Table 2.** Sample Introduction Parameters

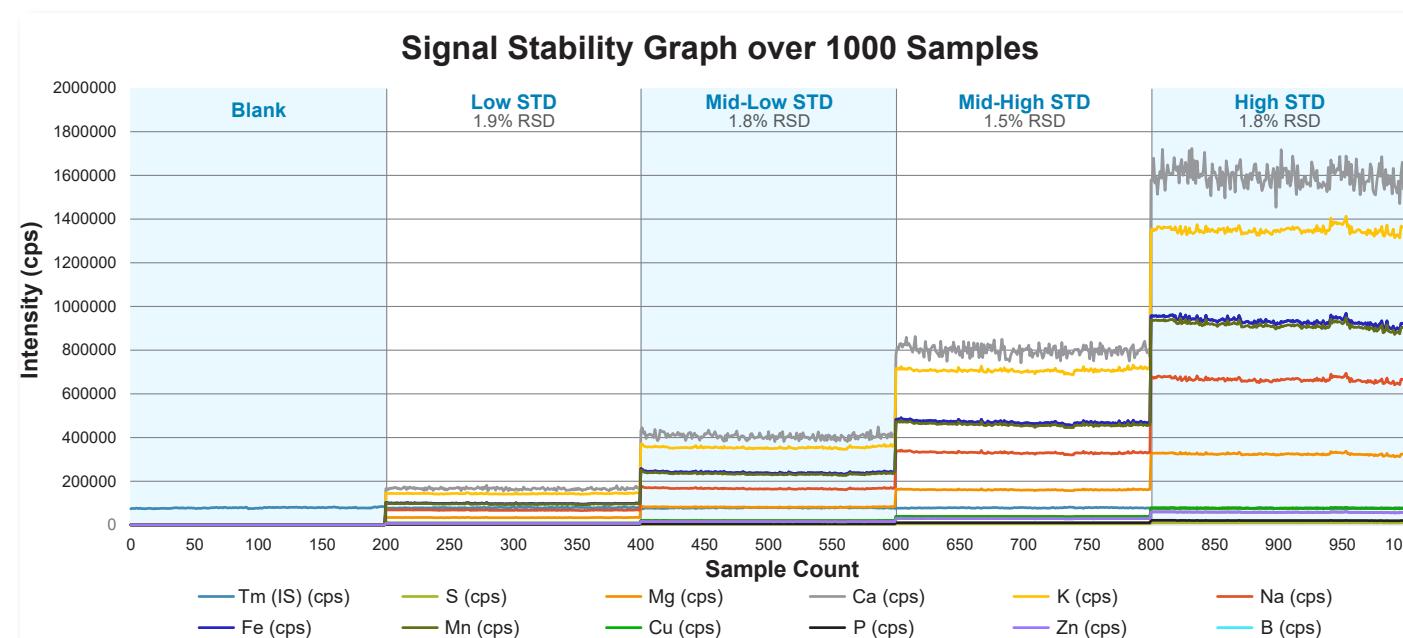
FAST System	FASTFluidic FilterProbe Soil
Filter	FilterProbe CTFE Filter
Autosampler	ESI 4DXW with RidingRinse
Nebulizer	PFA ST3 Nebulizer
Spray Chamber	G3 Cyclonic
Injector/Torch	2.0 mm Quartz ZipTorch
Sample Tubing	Black-Black
ISTD Tubing	Orange-Green
Backflush Syringe	HPQ-24 mL

**Figure 6.** Sample injected and analyzed while FilterProbe is backflushed and rinsed.

## Reproducibility Across Calibration Ranges

Analysis of 1000 calibration standards (STDs) in under 3 hours to evaluate *FASTFluidic FilterProbe Soil*'s stability and reproducibility across the calibration range. The calibration levels consisted of blanks and four concentration levels spanning low to high (low, mid-low, mid-high and high), representing soil nutrient conditions from deficient to highly enriched. Excellent stability was observed within each concentration level, along with consistent return to

baseline for blanks (Figure 7). Carryover performance was assessed by analyzing three blanks after three high standards. Low relative standard deviations (RSDs) across all concentration levels, including the low end of the calibration range, demonstrate *FASTFluidic FilterProbe Soil*'s reproducibility and effectiveness in identifying nutrient-deficient soils.



**Figure 7.** Signal stability of *FASTFluidic FilterProbe Soil* over a 1000-sample sequence measured in under 3 hours, with an average RSD of <2% across the entire method. This performance demonstrates *FASTFluidic FilterProbe Soil*'s ability to reliably identify nutrient-deficient soils across a wide calibration range.

## Sample Throughput and Rinse Out

### Read Time

F'n	Analyte	Integration Time (sec)	Read Time (sec)
1	A	0.100	3.000
2	A	0.100	3.000
3	A	0.010	0.050
4	A	0.100	3.000
5	A	0.100	3.000
6	A	0.100	3.000
7	A	0.100	3.000
8	A	0.100	3.000
9	IS	0.100	3.000
10	A	0.100	3.000
11	A	0.100	3.000
12	A	0.100	3.000

**Figure 8.** Each element was analyzed by ICP for  $\leq$ 3 seconds within the *FASTFluidic FilterProbe Soil* method.

### Acquisition Time

		Acquisition Time	S (cps)	Mg 279.077 (cps)
	Sample Id			
1110	Bottom Soil Std	12/15/2025 10:49:19 AM	1337.3	37597.1
1111	Low Mid Soil Std	12/15/2025 10:49:29 AM	3272.6	91375.7
1112	Low Mid Soil Std	12/15/2025 10:49:38 AM	3300.7	92306.2
1113	Low Mid Soil Std	12/15/2025 10:49:48 AM	3336.6	93173.3
1114	High Mid Soil Std	12/15/2025 10:49:58 AM	6747.0	187370.2
1115	High Mid Soil Std	12/15/2025 10:50:08 AM	6645.8	183501.8
1116	High Mid Soil Std	12/15/2025 10:50:19 AM	6638.9	183373.4
1117	Top Soil Std	12/15/2025 10:50:28 AM	13467.8	370985.0
1118	Top Soil Std	12/15/2025 10:50:38 AM	13429.2	368930.1
1119	Top Soil Std	12/15/2025 10:50:48 AM	13288.1	364503.1
1120	Blank	12/15/2025 10:50:58 AM	29.3	561.7
1121	Blank	12/15/2025 10:51:08 AM	-26.3	-52.8
1122	Blank	12/15/2025 10:51:18 AM	-36.2	-6.3
1123	Bottom Soil Std	12/15/2025 10:51:28 AM	1417.4	40146.2

**Figure 9.** Screen capture of Syngistix ICP showing 10 second sample-to-sample time.

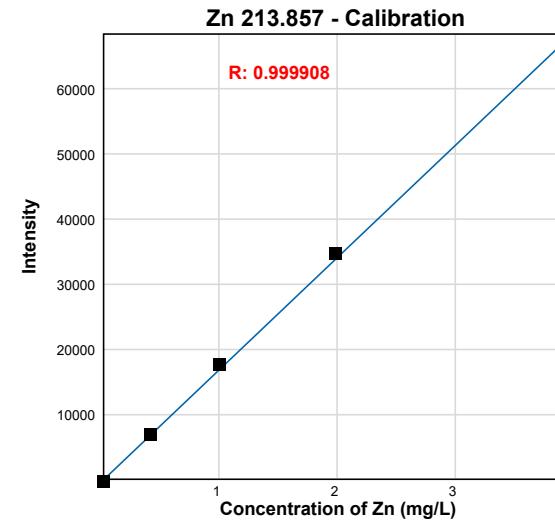
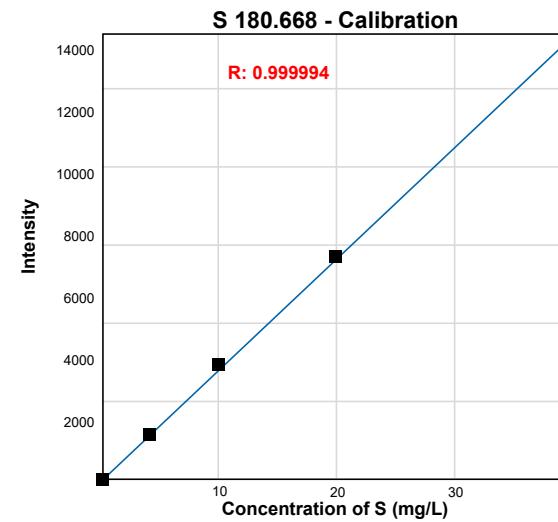
### Rinse Out

**Table 3.** Rinse out from the highest standard to the blank was evaluated using the *FASTFluidic FilterProbe Soil*  $\leq$ 10 second method, achieving rinse out factors of  $>500x$  for all analytes, except boron.

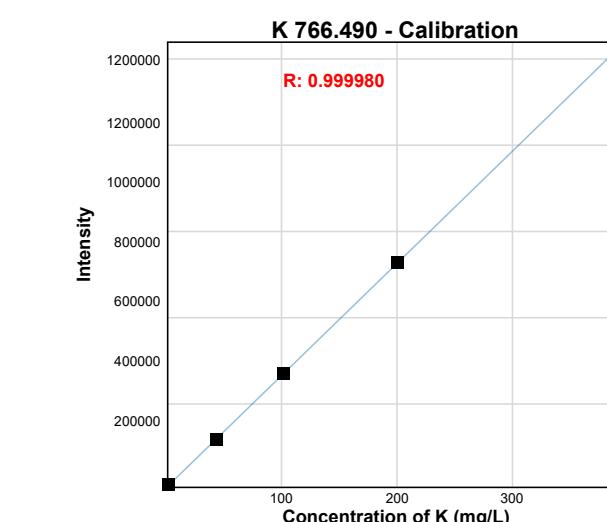
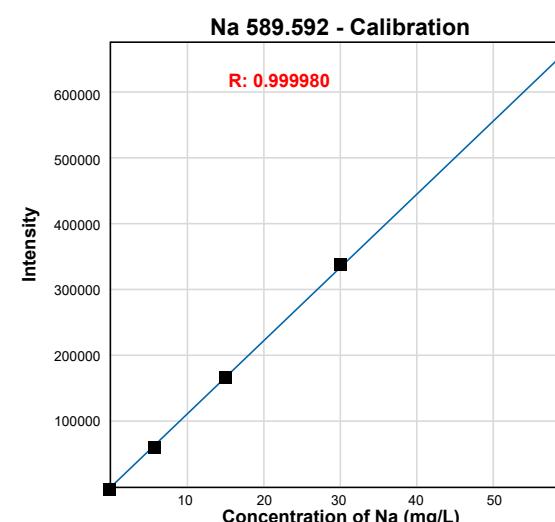
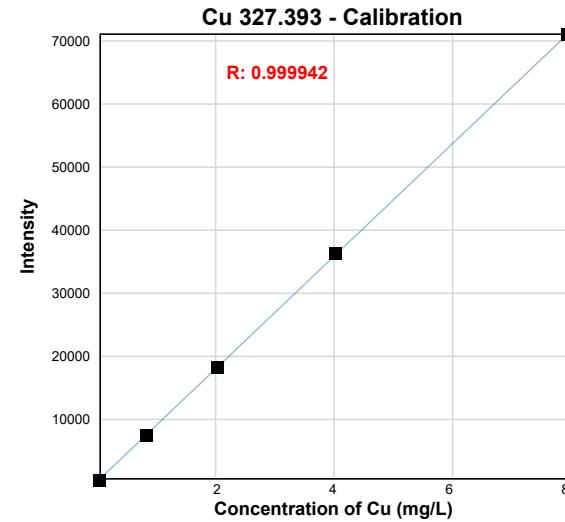
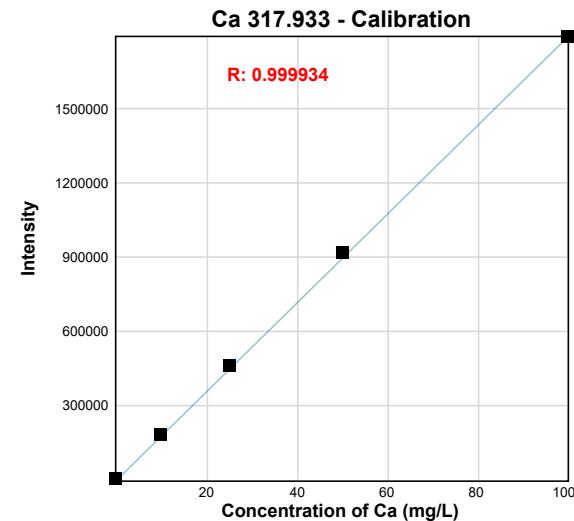
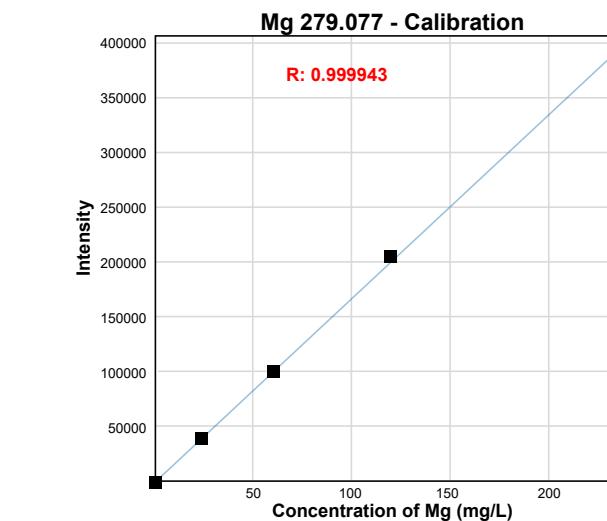
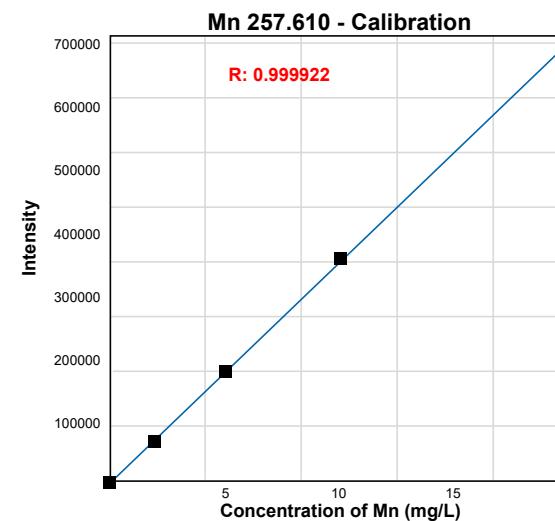
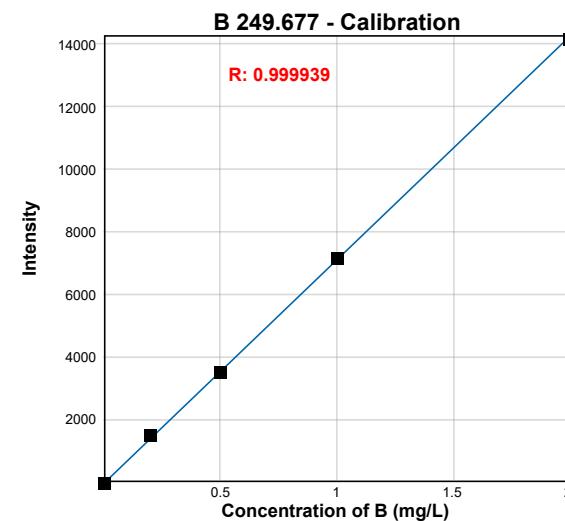
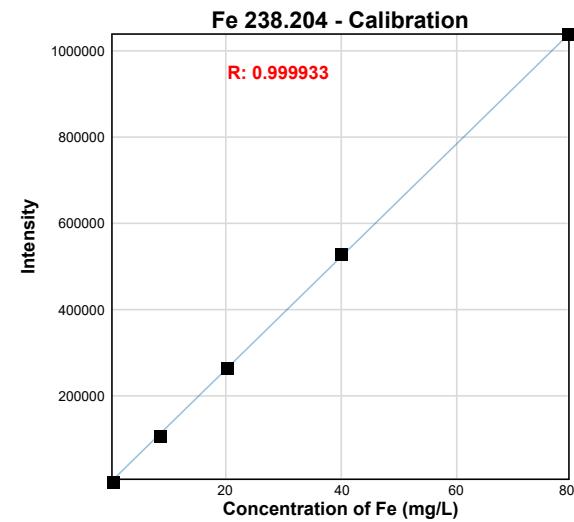
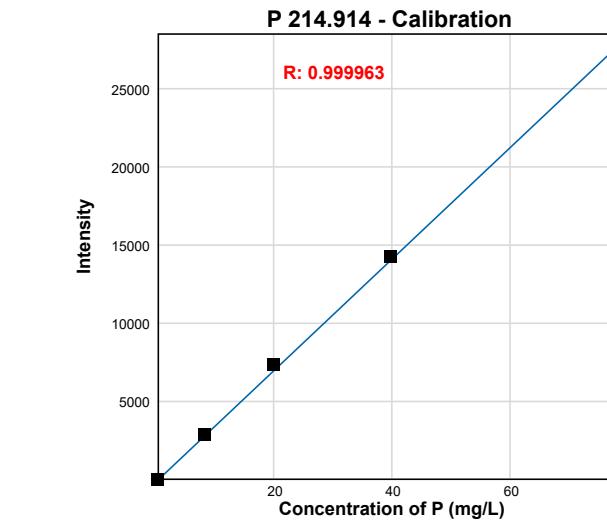
	S	Mg	Ca	K	Na	Fe	Mn	Cu	P	Zn	B
	180.668	279.077	317.933	766.490	589.592	238.204	257.610	327.393	214.914	213.857	249.677
$\leq$ 10 Second Method Rinse Out Factor											
	799	664	1592	507	701	645	642	566	514	659	325



## Calibration Curves for 11 Micronutrients in Soil



## Calibration Curves for 11 Micronutrients in Soil (continued)



Element ( $\lambda$ )	Low STD	Mid-Low STD	Mid-High STD	High STD
<b>S 180.668</b>	4	10	20	40
<b>Zn 213.857</b>	0.4	1	2	4
<b>P 214.914</b>	8	20	40	80
<b>Fe 238.204</b>	8	20	40	80
<b>B 249.677</b>	0.2	0.5	1	2
<b>Mn 257.610</b>	2	5	10	20
<b>Mg 279.077</b>	24	60	120	240
<b>Ca 317.933</b>	10	25	50	100
<b>Cu 327.393</b>	0.8	2	4	8
<b>Na 589.592</b>	6	15	30	60
<b>K 766.490</b>	40	100	200	400

**Figure 10.** Representative 5-point calibration curves for the 11 Mehlich analytes (Ca, Cu, Fe, K, Mg, Mn, Na, P, S, Zn, B) with calibration levels show above. The entire calibration takes less than 50 seconds, with  $R>0.9995$  for all elements.

## Conclusion

FASTFluidic FilterProbe Soil automates high-throughput soil analysis while delivering rinse out performance previously unattainable at these operating speeds. By maintaining rapid sample-to-sample operation with minimal carryover, FASTFluidic FilterProbe Soil ensures accurate determination of micronutrient levels across all analytes, improving both reliability and efficiency in soil testing workflows.

# FASTFluidic FilterProbe

## FASTFluidic

- Syringe-driven backflushing for uninterrupted high-throughput analysis
- Improves rinse out and prevents clogs

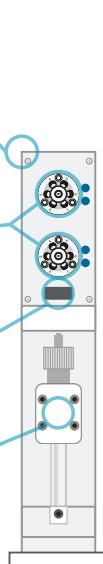
## Magnetic SnapValves with SampleSense 3

- Simplifies typical user maintenance with magnetic coupling technology
- Automatically sense and inject samples

## LED Display

## High Pressure Quartz Syringe

- PFA plunger and threaded base
- Wetted for low contamination and extended lifetime



## FilterProbe

- Prevent particulates from entering sample flowpath
- Automatically syringe-backflushed to prevent clogging

## RidingRinse

- Rinse station moves with autosampler carriage
- Minimizes translational autosampler movement

## DXW Autosampler

- Fractionally larger footprint than conventional 4-rack autosampler - 55% greater sample capacity
- Holds up to 560 samples



**Enhance Your High-Throughput Soil Analysis Today!**

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