SampleSense *FAST* UHT-S
on the Optima 8300 ICP

Six Second Soil Mehlich-3-ICP SampleSense *FAST* UHT-S Upgrade for Optima ICP Series

Introduction

Mehlich-3-ICP is a method for determining bioavailable concentrations of 11 extractable micronutrient elements in soil samples. Mehlich-3-ICP is invaluable for determining the amount of fertilizer to apply to farm fields. Because soil analyses must be completed in a narrow time window, ultra-high sample throughtput with high-reliability is required.

SampleSense *FAST* UHT-S* uses an inert injection valve with built-in optical sensors that automatically detect the liquid sample, inject the valve and trigger the ICP read in a tightly-timed analytical sequence. SampleSense *FAST* UHT-S eliminates wasted time from the ICP method and can double or even triple sample throughput while recording missing or empty tubes.

SampleSense *FAST* UHT-S Upgrade Benefits

- 10 samples per minute Mehlich-3-ICP
- Automatic sensing, injection, and triggering of the ICP analytical read
- Detection and reporting of missing or empty sample tubes as “unsensed” samples
- Adding SampleSense *FAST* UHT-S can double or even triple sample throughput
- Upgrade available for Optima 4300, 5300, 7300, 8300
- View the video at: http://www.icpms.com/SSFAST8300

** Formerly SampleSense Soil*

Elemental Scientific

SampleSense *FAST* UHT-S Advantages for Mehlich-3 ICP

Ease of Use

- Optical detection of the filled sample loop automatically triggers ICP analysis
- Removes timing and read delay adjustments
- Eliminates method development when changing sample loop size for other methods

Automated Compensation of Physical Clogs and Timing Variables

- Compensates for:
  - Partial clogs from filter paper fibers, particles, etc.
  - Accidental line kinks
  - Timing variables caused by high or low sample tube levels
  - ICP computer slow-down from software and data storage

Increased Productivity

- Produces long analytical runs without operator intervention
- Minimized sample consumption allows reanalysis
- Doubles or triples throughput of ICP instrument
- Reduces argon consumption

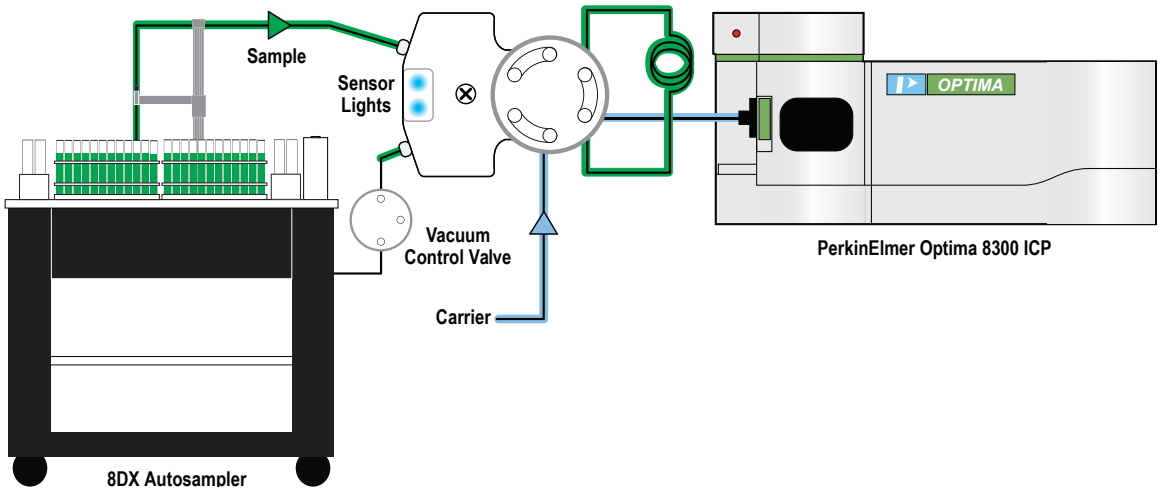
SampleSense valve with dual optical sensors

SampleSense *FAST* UHT-S with 8DX Autosampler for Mehlich-3-ICP Soil Analysis

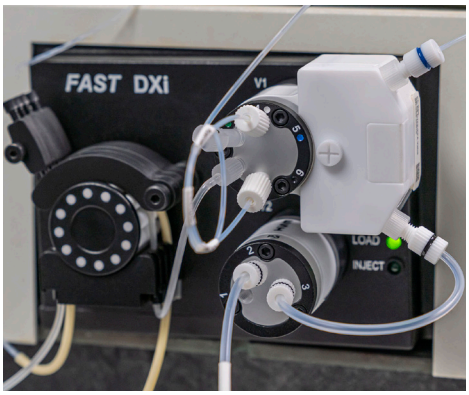
- SampleSense *FAST* UHT-S ICP (Optima 8300)
- 11 Elements determined: B, Ca, Cu, Fe, K, Mg, Mn, Na, S, P, Zn
- ICP read triggered from dual sensor optical sample detection
- 720 samples analyzed in <70 minutes
- 6 second sample-to-sample time
- <2 mL of sample consumed (vacuum control)
- Automatic detection of empty or missing sample tubes
- Most reliable high-throughput system on the market

SampleSense *FAST* UHT-S

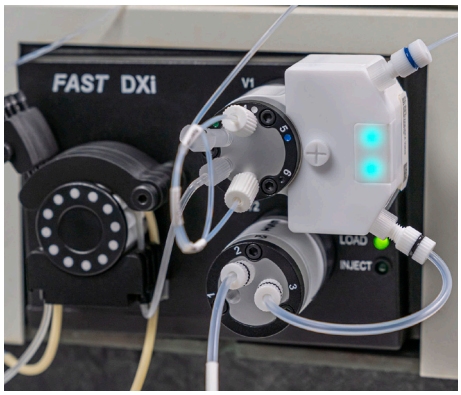
SampleSense *FAST* UHT-S Flow Diagram



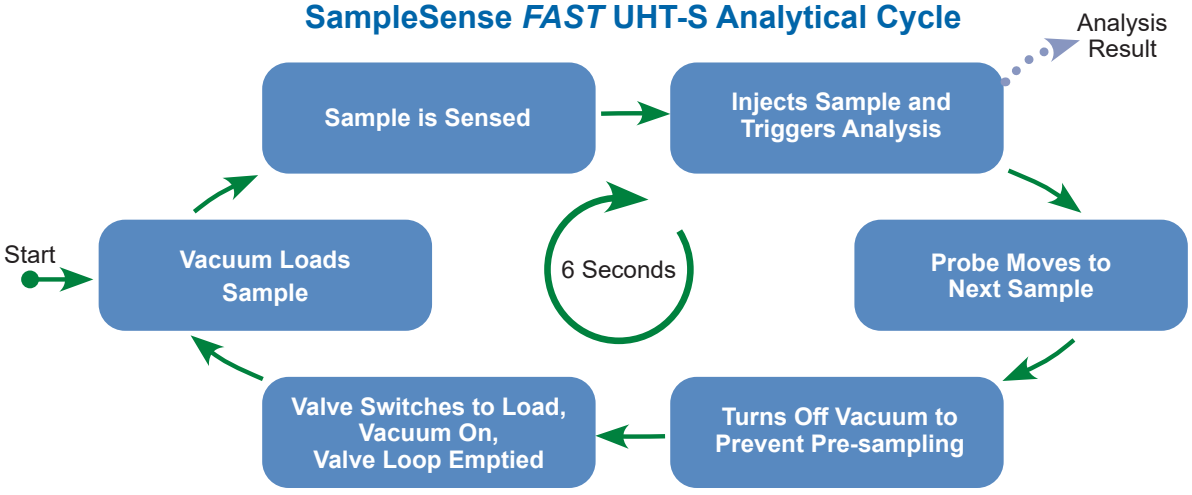
Sample not present, valve sensors not activated



Valve sensors activated, sample is sensed



SampleSense *FAST* UHT-S Analytical Cycle



ICP Method for Optima 8300 ICP

ICP Conditions

- Plasma Gas Flow: 8 L/min
- Aux Gas Flow: 0.2 L/min
- Nebulizer Gas Flow: 0.6 L/min
- Plasma Power: 1500 W
- Plasma View: Radial
- Replicates: 2
- Total Analysis Time ~6 sec per sample

Mehlich Soil Analytes (nm):

- B – 249.677
- Ca – 317.933
- Cu – 327.393
- Fe – 238.204
- K – 766.490
- Mg – 279.077
- Mn – 257.610
- Na – 589.592
- P – 214.914
- S – 180.669
- Zn – 213.857

PerkinElmer Optima 8300 ICP method conditions

Method Editor : SampleSenseFAST M-3

Spectrometer | Sampler | Process | Calibration | Checks | QC | Options

Plasma

Source equilibration delay 0 sec

Plasma conditions ◉ Same for all analytes ○ Vary by analyte

☐ Monitor nebulizer back pressure

Check upper % 10

Action taken after alarm is triggered: Alarm and Continue

	F'n	Analyte	Plasma (L/min)	Aux (L/min)	Neb (L/min)	Power (watts)	View Dist.	Plasma View
	--	All	8	0.2	0.65	1500	15.0	Radial
1	A	Mg 279.077	8	0.2	0.65	1500	15.0	Radial
2	A	Ca 317.933	8	0.2	0.65	1500	15.0	Radial
3	A	K 766.490	8	0.2	0.65	1500	15.0	Radial
4	A	Na 589.592	8	0.2	0.65	1500	15.0	Radial
5	A	Fe 238.204	8	0.2	0.65	1500	15.0	Radial
6	A	Mn 257.610	8	0.2	0.65	1500	15.0	Radial
7	A	Cu 327.393	8	0.2	0.65	1500	15.0	Radial
8	A	S 180.669	8	0.2	0.65	1500	15.0	Radial
9	A	Tm 313.126	8	0.2	0.65	1500	15.0	Radial
10	A	P 214.914	8	0.2	0.65	1500	15.0	Radial
11	A	Zn 213.857	8	0.2	0.65	1500	15.0	Radial
12	A	B 249.677	8	0.2	0.65	1500	15.0	Radial

Experimental

Optima 8300 Calibration Standards

Concentrations

Correlation coefficient limit: 0.999 | Standard additions

Include blank in calibration: ☑ | Use reagent blank

Enable Reslope:

Number of standards: 4

Solution Label	B	Ca	Cu	Fe	K	Mg	Mn	Na	P	S	Tm	Zn
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Blank	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bottom Standard	0.20	10.00	0.80	8.00	40.00	24.00	2.00	6.00	8.00	4.00		0.40
Lower Mid Standard	0.50	25.00	2.00	20.00	100.00	60.00	5.00	15.00	20.00	10.00		1.00
Higher Mid Standard	1.00	50.00	4.00	40.00	200.00	120.00	10.00	30.00	40.00	20.00		2.00
Top Standard	2.00	100.00	8.00	80.00	400.00	240.00	20.00	60.00	80.00	40.00		4.00

The ICP system was calibrated for the 11 elements of interest with a blank and 4 standards at varying concentrations across the PPM range. The additional element Tm was introduced to assess injection completeness and stability. The linearity of the resulting calibrations are shown in the table above.

Missing Samples Detected

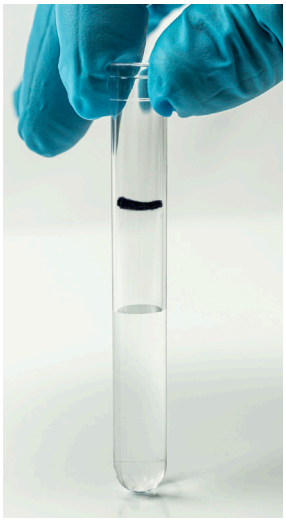
Message

Unsensed Samples

	SC Rack Number	SC Vial Number	Instrument Rack	Instrument Vial	Time
▶	1	45	1	45	20190813 9:05:00
	1	90	1	90	20190813 9:09:34
	2	45	2	45	20190813 9:14:08
	2	90	2	90	20190813 9:18:42
	3	45	3	45	20190813 9:23:16
	3	90	3	90	20190813 9:27:50

This table demonstrates the automatic missed sample logging capabilities provided by the SampleSense *FAST* UHT-S sensors. Empty sample vials were placed in the first three sample racks at positions 45 and 90. SampleSense *FAST* UHT-S identified the missing samples and provides this information in the software log shown here.

Low Sample Consumption

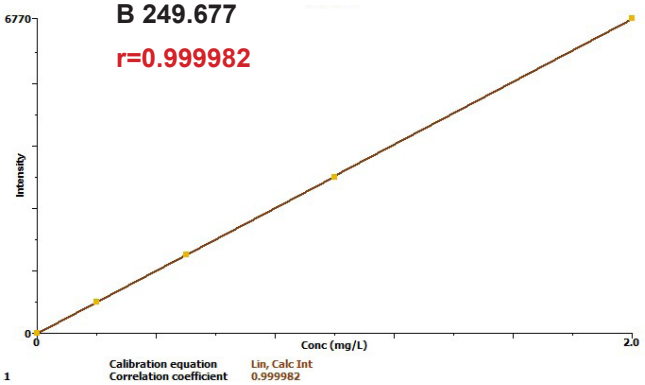


SampleSense *FAST* UHT-S consumes <2 mL of sample. The black line shows the original level of 5 mL extract. Post analysis 3.5 mL remains. Samples can be reanalyzed without re-extraction.

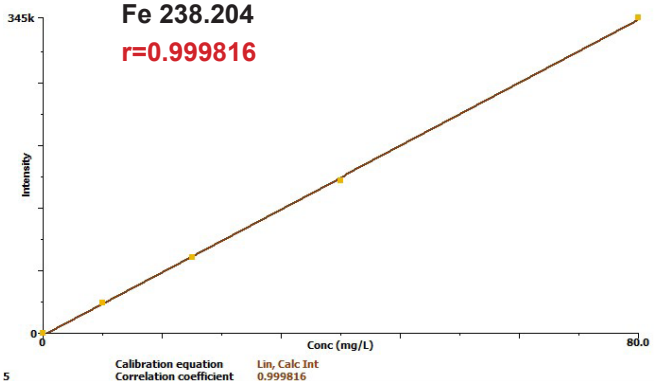
Experimental *(Continued)*

Calibration Curves 6 s Soil Method Optima 8300

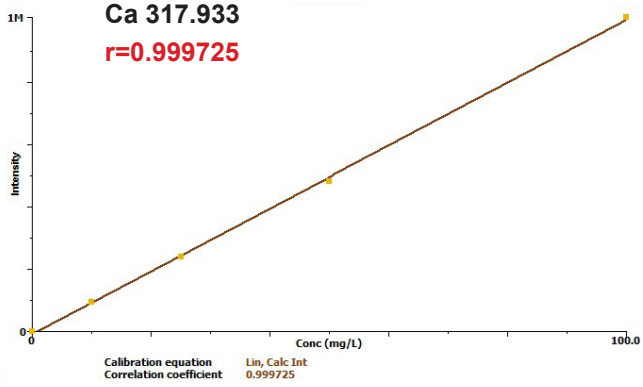
B 249.677
r=0.999982



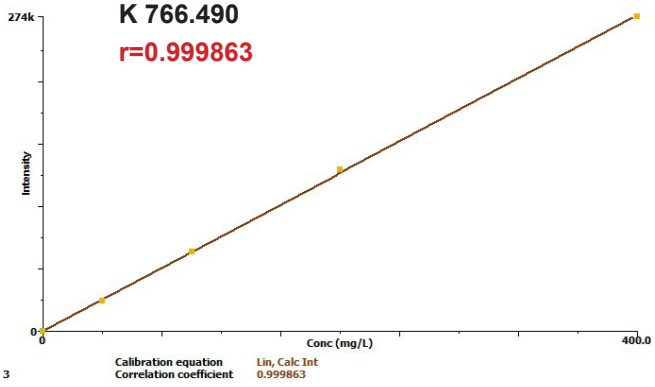
Fe 238.204
r=0.999816



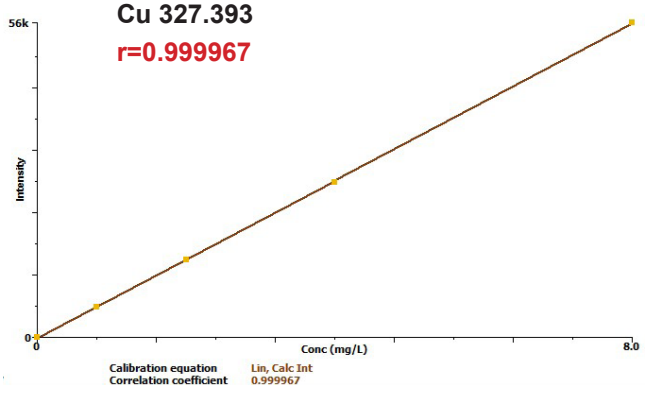
Ca 317.933
r=0.999725



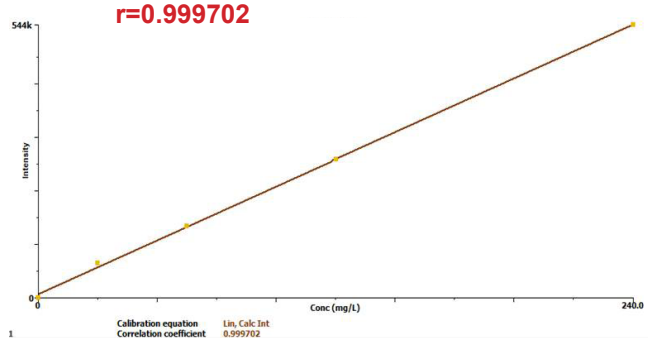
K 766.490
r=0.999863



Cu 327.393
r=0.999967

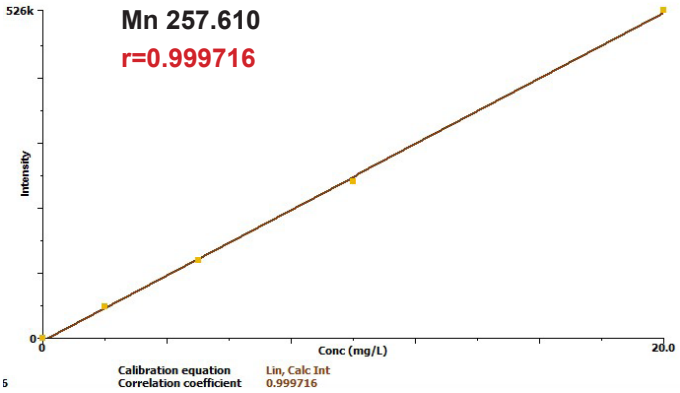


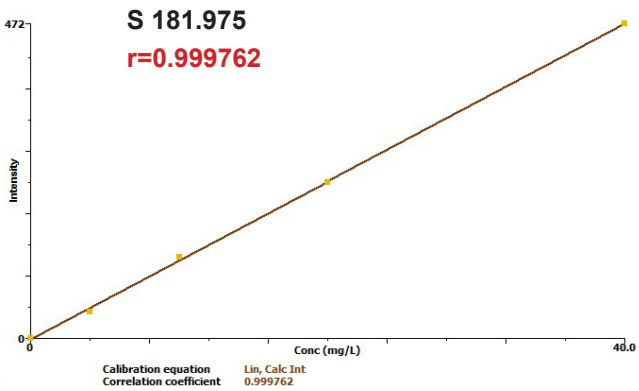
Mg 279.077
r=0.999702

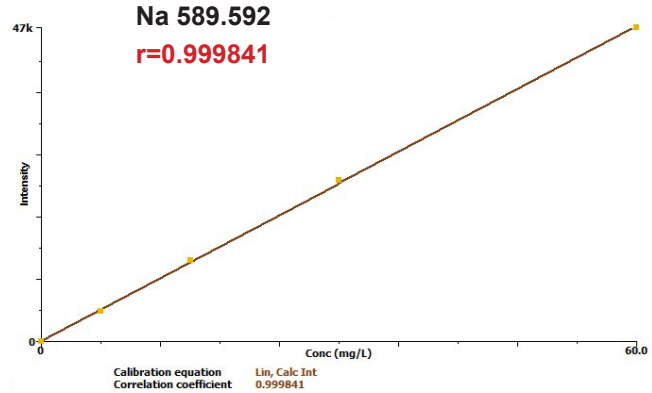


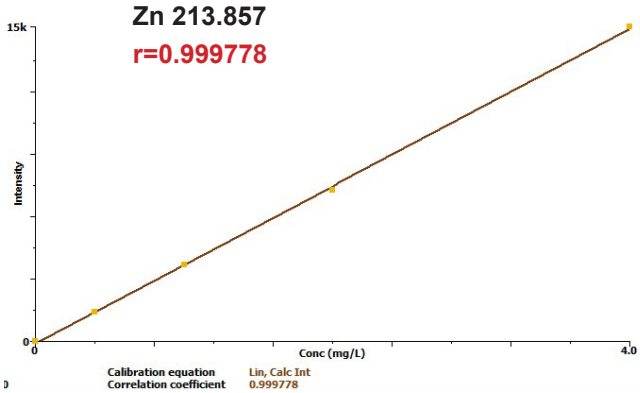
Experimental *(Continued)*

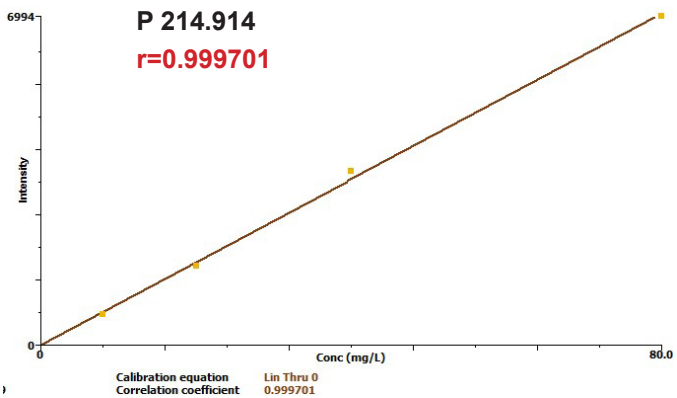
Calibration Curves 6 s Soil Method Optima 8300









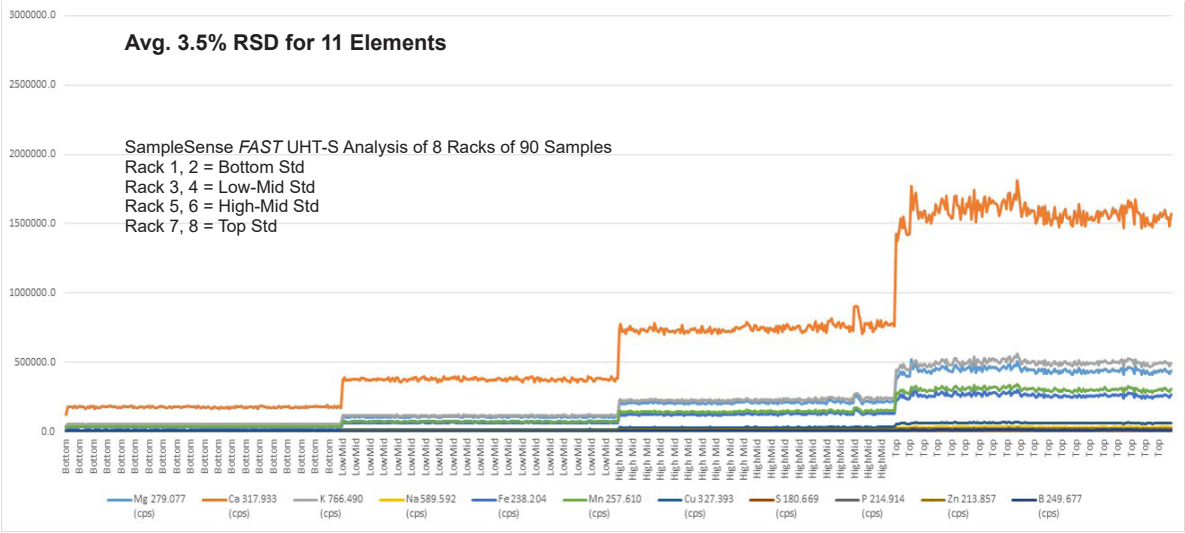


Calibration Results

Element	Correlation Coefficient
B	1.000
Ca	0.999
Cu	1.000
Fe	0.999
K	0.999
Mg	0.999
Mn	0.999
Na	0.999
P	0.999
S	0.999
Zn	0.999

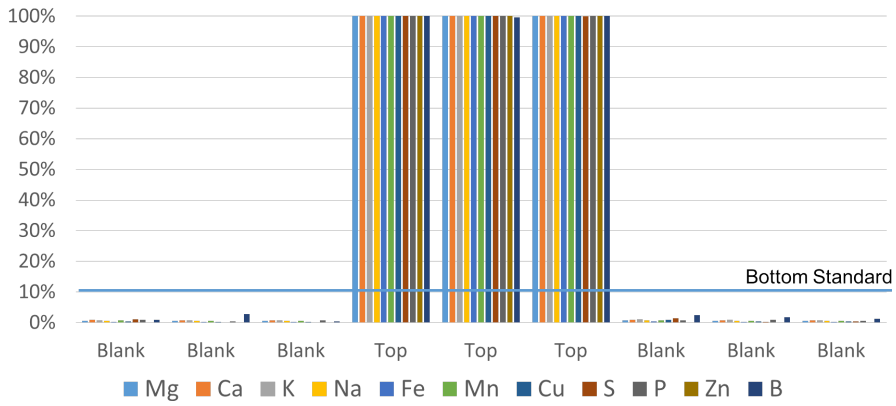
Results

720 samples in 70 minutes Optima 8300



Analysis of 720 samples in 70 minutes. The four levels represent two racks of 90 samples, with each of the four calibration standards levels individually loaded with 5 mL of liquid into each of the 90 positions contained in each set of racks. Excellent stability observed from within each of the four concentration levels.

Rinseout



The SampleSense *FAST* UHT-S rinse-out immediately reduces all elements to concentrations well below the bottom standard when using the six second Mehlich-3-ICP procedure. Additional seconds can be added to the rinse-out to meet lab requirements. The system can deliver rinse-out factors of 1,000x, 10,000x or more depending on how clear the spray chamber needs to be before the next sample is introduced.

Conclusion

At 10 samples per minute, SampleSense Soil for Mehlich-3-ICP method can more than double the productivity of the ICP instrument. It delivers reliable and reproducible data, while providing quick and effective sample rinse out.

Description	Part Numbers
SampleSense *FAST* UHT-S 2DXCi	2F-SS6-UHT-57
SampleSense *FAST* UHT-S 4DXCi	4F-SS6-UHT-57
SampleSense *FAST* UHT-S 8DXCi	8F-SS6-UHT-57
SampleSense *FAST* UHT-S 14DXCi	14F-SS6-UHT-57

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