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EDXRF1552 - Nutrients in Grass Silage



Scope

The analysis of important mineral elements in grass is demonstrated.

Background

Silage is made by fermenting various grasses or other crops and is the main base for most animal feeds, especially cattle. The nutrient content of silage is carefully blended and monitored to ensure optimal animal health and product quality. Grass-fed cattle require the optimum balance of the major minerals calcium, potassium, magnesium, and phosphorus and the trace minerals copper, manganese, and zinc. Proper mineral balance ensures optimum milk quality and production. To meet the industry's need of monitoring the mineral content, Rigaku offers the [NEX QC+](#) EDXRF analyzer for fast and simple measurement of grass and other silages such as haylage, wheat silage, and corn silage.

Calibration

A set of twelve assayed grass samples were submitted by an industry user for demonstration. Empirical regressions calibrations were built to provide optimum accuracy.

Element	Units	Concentration range
K	%	1.8 – 3.2 %
Ca	%	0.4 – 0.8 %
Mg	%	0.14 – 0.22 %

P	%	0.22 – 0.32 %
S	%	0.13 – 0.30 %
Mn	ppm	45 – 105 ppm
Cu	ppm	5 – 12 ppm
Zn	ppm	20 – 50 ppm

Note: 1 ppm = 1 mg/kg

Precision

Representative calibration standards were measured ten consecutive times each in a static position to demonstrate effective recovery and analytical precision.

Sample I.D.: Standard #73			
Element	ICP value	NEX QC+ average value	Std. dev
K	2.713 %	2.738 %	0.054
Ca	0.536 %	0.540 %	0.006
Mg	0.180 %	0.163 %	0.009
P	0.254 %	0.249 %	0.002
S	0.300 %	0.288 %	0.0005
Mn	105.6 ppm	106.1 ppm	1.5
Cu	11.9 ppm	12.4 ppm	0.7
Zn	47.0 ppm	45.9 ppm	0.9

Sample I.D.: Standard #77			
Element	ICP value	NEX QC+ average value	Std. dev
K	1.912 %	1.947%	0.026
Ca	0.836 %	0.828 %	0.007
Mg	0.222 %	0.197 %	0.002
P	0.341 %	0.334 %	0.001
S	0.125 %	0.119 %	0.0002
Mn	84.8 ppm	85.6 ppm	2.8
Cu	6.9 ppm	7.3 ppm	0.2
Zn	48.8 ppm	49.5 ppm	0.1

Sample I.D.: Standard #79			
Element	ICP value	NEX QC+ Average value	Std. dev
K	3.241 %	3.199 %	0.024
Ca	0.543 %	0.533 %	0.008
Mg	0.143 %	0.131 %	0.008
P	0.308 %	0.302 %	0.001
S	0.201 %	0.195 %	0.0011
Mn	31.0 ppm	30.4 ppm	1.5
Cu	10.9 ppm	8.6 ppm	0.5
Zn	21.2 ppm	20.7 ppm	0.5

Sample I.D.: Standard #87			
Element	ICP value	NEX QC+ average value	Std. dev
K	1.379 %	1.440 %	0.010
Ca	0.424 %	0.431 %	0.002
Mg	0.168 %	0.142 %	0.002
P	0.252 %	0.244 %	0.001
S	0.127 %	0.124 %	0.0004
Mn	73.4 ppm	73.6 ppm	0.8
Cu	5.7 ppm	5.9 ppm	0.2
Zn	23.1 ppm	22.6 ppm	0.3

Analysis of unknown samples

Unknown samples with ICP values were submitted by the user for measurement against the calibrations built. Results are shown here.

Sample I.D.: Sample #76			
Element	ICP value	NEX QC+ average value	Std. dev
K	2.508 %	2.474 %	0.026
Ca	0.652 %	0.666 %	0.002
Mg	0.169 %	0.171 %	0.001
P	0.288 %	0.290 %	0.0002
S	0.198 %	0.197 %	0.0005

Mn	36.7	37.5	2.1
Cu	7.8	8.5	0.2
Zn	30.5	30.6	0.4

Sample I.D.: Sample #84			
Element	ICP value	NEX QC+ average value	Std. dev
K	2.619 %	2.580 %	0.003
Ca	0.455 %	0.477 %	0.002
Mg	0.168 %	0.175 %	0.0048
P	0.315 %	0.289 %	0.001
S	0.259 %	0.246 %	0.0011
Mn	77.9 ppm	75.2 ppm	0.7
Cu	6.9 ppm	7.0 ppm	0.2
Zn	30.8 ppm	31.7 ppm	0.2

Conclusion

The NEX QC+ offers analysts a simple yet powerful and versatile system for quantifying elemental composition using the empirical approach. The results of this study indicate that given stable samples, proper sample handling, and proper calibration technique, the Rigaku NEX QC+ EDXRF can achieve excellent results for measuring the key mineral elements in grass and other silages.

Related products



NEX QC II Series

Compact, intuitive benchtop EDXRF for everyday elemental testing