Statistical Reports in the Magruder Program

Statistical reports are available for each sample through "LAB PORTAL" with laboratory log in and on the Magruder web site. Review the instruction steps 11 through 13 under the "Data Entry Instructions" link on how to access reports with laboratory log in through "LAB PORTAL".

There are general reports and lab specific reports for each sample. The general reports compare all laboratory results. The lab specific reports are referred to as "Report Cards" and compares individual lab results to consensus values. The reports compare laboratory results for a particular analyte or method. The first three numbers in the method code defines the analyte and the last two numbers define the method (see method code list on web site). The analyte reports evaluate all results for the analyte regardless of method performed. This is the data to be used to evaluate a laboratories proficiency in testing a particular analyte. The method reports evaluate results for a specific method and are suited to evaluate and compare different methods used for an analyte. Following is a description of the contents of the various reports.

Robust Statistics

Outlying results can affect the mean and standard deviation which are critical parameters used to evaluate individual lab results. Robust statistics are recommended by International Harmonized Protocols for proficiency testing. This statistical approach avoids the effect of outlying data so more appropriate values for mean and standard deviation (SD) can be obtained. These values are referred to as robust mean and robust SD. The first step with robust statistic calculation is to remove extreme outlier results. The number of labs used in robust calculations in the reports is the number of labs used after removing extreme outliers. Remaining outlier results are then normalized to assigned percentiles of the data prior to determining mean and standard deviation.

Magruder z scores are used to show a normalized value for how close a lab result was to the robust mean in comparison to the robust SD. If the lab result was equal to the robust mean, z is 0. If the lab result was one robust SD below or above the robust mean, z is -1 or +1 respectively. If the lab result was two robust SDs below or above the robust mean, z is -2 or +2 respectively. Lab results with a z score between -2 and +2 are acceptable and shown in green. Z scores less than -3 and greater than +3 are shown in red and indicate the lab result was much different than other lab results and requires some action from the laboratory to correct laboratory procedures. Z scores between -3 and +3, but less than -2 and greater than +2, are shown in orange and indicate the lab result was slightly different than other lab results and is a warning that the laboratory should watch that procedure more carefully in their lab.

Investigational Allowance

The reports compare a laboratory's result to the central tendency (mean) and variation (standard deviation) of results from other participating laboratories for an analyte or method using robust statistics as recommended by the International Harmonized Protocols for proficiency testing. Laboratories have another range that can be used to evaluate fertilizer analyses. The American Association of Plant Food Control Officials (AAPFCO) defines an accepted variance for laboratory results around a guaranteed analyte concentration that is called the Investigational Allowance (IA). Guaranteed concentrations are presented on the reports but often times the actual concentration can be quite different from the guarantee. Therefore, IA for data evaluation on reports is determined at the robust mean for all results of an analyte (analyte value) rather than the guaranteed concentration and is referred to as "IA at analyte value". Individual lab results are compared to analyte value and IA. A lab result is noted with an asterisk on All Labs Proficiency reports or square bracket on Lab Report Cards if the result is less than the analyte value minus the IA.

All Labs Proficiency Reports

Analyte Reports

The ***Analyte Statistical Summary*** report contains a statistical summary of results for each analyte tested in the program (see below). The first two columns identify the analyte with the first three numbers in the method code in the first column. The analyte numbers are highlighted in green if the analyte is guaranteed in the sample. The concentration that the manufacturer guarantees the analyte is shown in parentheses containing the unit reported for results.

STRIVING FOR EXCELLENCE IN ANALYSIS

Analyte Proficiency From All Labs
Sample # 201408
Grade 5-8-21

Statistical Summary

Issue Date : 09/30/2014

Analyte Code	Analyte	Total # Labs Submitting	# Labs in Robust Calculations	Raw Mean	Raw SD	Assigned Value Robust Mean	IA at Analyte Value	Robust sd	Robust Uncertainty (U)	Robust % RSD	IA %RSD	Average Range (R-bar)	Horwitz %RSD
001	Ammoniacal nitrogen (%)	16	15	4.727	0.2888	4.678		0.1617	0.0295	3.46%		0.0387	3.17%
009	Ammoniacal and nitrate N (%)	6	6	4.787	0.1042	4.777		0.1010	0.0292	2.11%		0.0700	3.16%
010	Total nitrogen (5%)	64	61	4.804	0.2071	4.794	0.5059	0.0975	0.0088	2.03%	5.28%	0.0486	3.16%
020	Total phosphate (%)	44	43	8.069	0.3031	8.039		0.2251	0.0243	2.80%		0.0975	2.92%
030	Citrate- insoluble phosphate (%)	1		0.0000									
040	Indirect available phosphate (8%)	1		7.885									
041	Direct available phosphate (8%)	32	30	8.034	0.3046	8.017	0.6800	0.1299	0.0168	1.62%	4.24%	0.0703	2.92%
048	Water soluble phosphate (%)	2	2	6.218	0.0743								
050	Soluble potash (21%)	67	66	20.83	1.050	20.91	1.1118	0.4131	0.0360	1.98%	2.66%	0.2213	2.53%
060	Free water (%)	5	5	0.6914	0.1364	0.6914		0.1364	0.0431	19.73%		0.0209	4.23%
101	Acid soluble calcium (%)	17	17	5.595	1.183	5.854		0.2756	0.0473	4.71%		0.1039	3.07%
121	Acid soluble magnesium (1%)	39	38	1.227	0.2398	1.274	0.2637	0.0840	0.0096	6.59%	10.35%	0.0186	3.86%
131	Water soluble magnesium (%)	6	6	1.049	0.2769	1.101		0.1889	0.0545	17.16%		0.0183	3.94%
144	Sulfur (10%)	40	38	10.15	0.4506	10.18	0.7088	0.4221	0.0484	4.15%	3.48%	0.1143	2.82%
151	Total arsenic (ppm)	9	9	24.06	4.697	24.45		4.371	1.030	17.88%		0.6638	9.89%
165	Acid soluble boron (0.35%)	25	25	0.3444	0.0387	0.3402	0.0540	0.0324	0.0046	9.53%	7.94%	0.0091	4.70%
171	Water soluble boron (%)	1		0.3490									
181	Total cadmium (ppm)	12	12	11.26	1.196	11.52		0.6276	0.1281	5.45%		0.3795	11.07%
190	Water soluble chlorine (%)	13	13	16.27	1.169	16.13		0.3605	0.0707	2.23%		0.2336	2.63%
191	Total chromium (ppm)	8	8	35.17	7.151	33.52		4.487	1.122	13.39%		0.7905	9.43%
202	Acid soluble cobalt (ppm)	9	8	5.059	3.482	4.120		1.312	0.3280	31.84%		0.1734	12.93%
221	Acid soluble copper (%)	23	22	0.0482	0.0056	0.0482		0.0034	0.0005	7.07%		0.0024	6.31%
241	Acid soluble iron (0.1%)	44	44	0.4396	0.0650	0.4488	0.0499	0.0499	0.0053	11.11%	5.56%	0.0175	4.51%
251	Total lead (ppm)	13	13	122.9	39.37	127.3		29.18	5.723	22.92%		6.866	7.71%
261	Acid soluble manganese (%)	39	38	0.0384	0.0063	0.0378		0.0041	0.0005	10.85%		0.0025	6.55%
281	Total mercury (ppm)	2	2	4.220	5.841								
289	Total molybdenum (ppm)	11	11	19.09	6.157	17.37		2.581	0.5503	14.86%		2.031	10.41%
291	Total nickel (ppm)	10	9	12.47	4.421	11.77		1.962	0.4624	16.67%		1.092	11.04%
301	Total selenium (ppm)	1		0.0000									
311	Sodium (%)	7	7	0.5731	0.0174	0.5670		0.0078	0.0021	1.37%		0.0126	4.36%
321	Acid soluble zinc (1.4%)	44	41	1.423	0.0878	1.420	0.1470	0.0858	0.0095	6.04%	5.18%	0.0447	3.79%

The subsequent columns show various measurements of central tendency and variation of results reported for each analyte. Raw and robust describe the method in which the values were determined. Raw mean and SD were calculated with all laboratory results. Robust mean and SD were calculated using robust statistics to avoid the effect of outlying data (see section entitled Robust Statistics).

The IA defines a range around the guaranteed concentration accepted by AAPFCO for a laboratory result to occur before the concentration could be stated to be lower or higher than the guaranteed value. This AAPFCO accepted variance is shown for guaranteed analytes as “IA at analyte value”. The IA is determined at the robust mean of the analyte rather than the guaranteed concentration since the actual concentration in the sample is often different than the guarantee.

There are three measures of relative standard deviation (%RSD = SD/mean x 100) that evaluates the variation of data around the central mean. One is a measure of the laboratory results using robust mean and standard deviation (Robust %RSD). The other is a measure of the IA variation around the robust mean (IA %RSD). The IA is defined as two times the allowed standard deviation. Thus, IA %RSD is half the IA divided by the robust mean times 100. The last is a widely accepted measure of a normalized variation independent of analyte,

matrix, and method (Horwitz %RSD). The average range (R-bar) shows the average difference between two replicate results reported from each lab.

The ***Analyte All Tests Report*** contains all lab values sorted by analyte (see below). As in the statistical summary, guaranteed analytes have the guaranteed concentration shown in parentheses and the analyte group number is shown in green. The average and range of two replications reported from each lab is shown for each analyte in ascending order. The lab code identifies the lab providing the result and next to last column identifies the method used. The robust mean, SD, average range of two replicates, and #labs are shown under Method Values column grouping. The last column shows if a lab result was rejected from robust calculations if duplicate values were too far apart (=1) or result was an extreme outlier (=2). The rejected results are shown last in the grouped data for each analyte.

STRIVING FOR EXCELLENCE IN ANALYSIS

Analyte Proficiency From All Labs
Sample # 201408
Grade 5-8-21

Lab Values

Issue Date : 09/30/2014

Analyte Group	Analyte (Units)	Lab Code	Lab Data Value	Lab Data Range	Method Values Rob Mean	Method Values Rob SD	Method Values R-bar	# Labs	Magruder CS Z Score	Your Method	Flag
001	Ammoniacal nitrogen (%)	0415	4.433	0.0000	4.678	0.1617	0.0387	15	-1.51	001.10	0
001	Ammoniacal nitrogen (%)	0368	4.445	0.0300	4.678	0.1617	0.0387	15	-1.44	001.99	0
001	Ammoniacal nitrogen (%)	0416	4.485	0.0100	4.678	0.1617	0.0387	15	-1.19	001.10	0
001	Ammoniacal nitrogen (%)	0027	4.565	0.0500	4.678	0.1617	0.0387	15	-0.70	001.99	0
001	Ammoniacal nitrogen (%)	0498	4.600	0.0000	4.678	0.1617	0.0387	15	-0.48	001.10	0
001	Ammoniacal nitrogen (%)	0230	4.605	0.0500	4.678	0.1617	0.0387	15	-0.45	001.10	0
001	Ammoniacal nitrogen (%)	0117	4.700	0.0400	4.678	0.1617	0.0387	15	0.14	001.99	0
001	Ammoniacal nitrogen (%)	0481	4.710	0.1600	4.678	0.1617	0.0387	15	0.20	001.10	0
001	Ammoniacal nitrogen (%)	0090	4.710	0.0400	4.678	0.1617	0.0387	15	0.20	001.10	0
001	Ammoniacal nitrogen (%)	0456	4.720	0.0200	4.678	0.1617	0.0387	15	0.26	001.10	0
001	Ammoniacal nitrogen (%)	0371	4.735	0.0500	4.678	0.1617	0.0387	15	0.36	001.99	0
001	Ammoniacal nitrogen (%)	0405	4.760	0.0200	4.678	0.1617	0.0387	15	0.51	001.10	0
001	Ammoniacal nitrogen (%)	0504	4.780	0.0400	4.678	0.1617	0.0387	15	0.63	001.10	0
001	Ammoniacal nitrogen (%)	0506	5.045	0.0500	4.678	0.1617	0.0387	15	2.27	001.99	0
001	Ammoniacal nitrogen (%)	0500	5.610	0.0200	4.678	0.1617	0.0387	15	5.77	001.99	0
001	Ammoniacal nitrogen (%)	0487	4.850	0.7000	4.678	0.1617	0.0387	15	1.07	001.99	1
009	Ammoniacal and nitrate N (%)	0090	4.685	0.0300	4.777	0.1010	0.0700	6	-0.91	009.10	0
009	Ammoniacal and nitrate N (%)	0498	4.700	0.0000	4.777	0.1010	0.0700	6	-0.76	009.10	0
009	Ammoniacal and nitrate N (%)	0169	4.740	0.0600	4.777	0.1010	0.0700	6	-0.37	009.10	0
009	Ammoniacal and nitrate N (%)	0258	4.765	0.1100	4.777	0.1010	0.0700	6	-0.12	009.10	0
009	Ammoniacal and nitrate N (%)	0452	4.895	0.1700	4.777	0.1010	0.0700	6	1.17	009.10	0
009	Ammoniacal and nitrate N (%)	0504	4.935	0.0500	4.777	0.1010	0.0700	6	1.56	009.10	0
010	Total nitrogen (5%)	0489	4.000*	0.0400	4.794	0.0975	0.0486	61	-8.14	010.60	0
010	Total nitrogen (5%)	0275	4.430	0.0400	4.794	0.0975	0.0486	61	-3.73	010.60	0
010	Total nitrogen (5%)	0042	4.465	0.0100	4.794	0.0975	0.0486	61	-3.37	010.60	0
010	Total nitrogen (5%)	0472	4.568	0.0430	4.794	0.0975	0.0486	61	-2.32	010.60	0
010	Total nitrogen (5%)	0402	4.585	0.0100	4.794	0.0975	0.0486	61	-2.14	010.60	0
010	Total nitrogen (5%)	0105	4.645	0.1700	4.794	0.0975	0.0486	61	-1.53	010.11	0
010	Total nitrogen (5%)	0390	4.665	0.0500	4.794	0.0975	0.0486	61	-1.32	010.60	0
010	Total nitrogen (5%)	0460	4.690	0.0200	4.794	0.0975	0.0486	61	-1.06	010.99	0
010	Total nitrogen (5%)	0043	4.695	0.0100	4.794	0.0975	0.0486	61	-1.01	010.60	0
010	Total nitrogen (5%)	0117	4.705	0.0500	4.794	0.0975	0.0486	61	-0.91	010.12	0
010	Total nitrogen (5%)	0105	4.705	0.0500	4.794	0.0975	0.0486	61	-0.91	010.60	0

The Magruder z score is shown for each lab result. Values between -2 and +2 are acceptable and shown in green. Values less than -2 or greater than +2 are shown in orange or red and denote the laboratory result deviated from the population of other lab results and should alert the laboratory to evaluate their procedures carefully. An orange denotes a warning with z scores between -3 and -2 or +2 and +3. Red denotes action required since the lab value deviated significantly from other lab results with z score less than -3 or greater than +3. Any lab value that is less than the analyte value minus the IA is denoted with an asterisk.

Method Reports

The ***Individual Method Performance Summary*** report begins with summary statistics of results grouped by method performed for each analyte (see below). As with the ***Analyte Statistical Summary*** report, green method codes identify guaranteed analytes with guaranteed concentrations shown in parentheses after the text description of the method. The statistical values include raw statistics, robust statistics, and IA values that were described in the section on the *Analyte Reports*. The Method report groups data by methods performed for each analyte. This is the report that can be used to evaluate and compare different methods used for an analyte.

STRIVING FOR EXCELLENCE IN ANALYSIS

Method Proficiency For All Labs (Lab Values)
Sample # 201408 **Statistical Summary**
Grade 5-8-21 **Issue Date : 09/30/2014**

Method Code	Analyte & Method	Total # Labs Submitting	# Labs in Robust Calculations	Raw Mean	Raw SD	Assigned Value Robust Mean	IA at Analyte Value	Robust sd	Robust Uncertainty (U)	Robust % RSD	IA %RSD	Average Range (R-bar)	Horwitz %RSD
001.10	Ammoniacal nitrogen, Magnesium Oxide Method (%)	9	8	4.637	0.1281	4.642		0.1353	0.0338	2.92%		0.0225	3.17%
001.99	Ammoniacal nitrogen, Other (%)	7	6	4.850	0.4235	4.780		0.3229	0.0932	6.75%		0.0400	3.16%
009.10	Ammoniacal and nitrate N, Devarda (%)	6	6	4.787	0.1042	4.777		0.1010	0.0292	2.11%		0.0700	3.16%
010.11	Total nitrogen, Modified Comprehensive (5%)	7	6	5.135	0.6773	4.826	0.5059	0.1281	0.0370	2.65%	5.24%	0.0237	3.16%
010.12	Total nitrogen, Salicylic (5%)	4	4	4.824	0.1232	4.824	0.5059	0.1232	0.0436	2.55%	5.24%	0.0375	3.16%
010.60	Total nitrogen, Combustion (5%)	49	47	4.779	0.1767	4.796	0.5059	0.0866	0.0089	1.81%	5.27%	0.0513	3.16%
010.99	Total nitrogen, Other (5%)	4	4	5.029	0.4163	5.029	0.5059	0.4163	0.1472	8.28%	5.03%	0.0225	3.14%
020.10	Total phosphate, Gravimetric Quinolinium Molybdoph... (%)	7	7	8.125	0.1098	8.110		0.0644	0.0172	0.79%		0.0307	2.92%
020.20	Total phosphate, Spectrophotometric Molybdovanadop... (%)	12	12	8.008	0.1588	8.008		0.1801	0.0368	2.25%		0.1033	2.92%
020.40	Total phosphate, Automated, test solution preparat... (%)	7	7	8.059	0.4081	7.997		0.2783	0.0744	3.48%		0.1029	2.93%
020.50	Total phosphate, ICP (%)	14	14	8.116	0.4239	8.081		0.4009	0.0758	4.96%		0.1335	2.92%
020.99	Total phosphate, Other (%)	4	4	8.194	0.4335	8.194		0.4335	0.1533	5.29%		0.1875	2.91%
030.20	Citrate- insoluble phosphate, Spectrophotometric M... (%)	1		0.0000									
040.20	Indirect available phosphate, Spectrophotometric (8%)	1		7.885									
041.10	Direct available phosphate, Gravimetric Quimociac (8%)	8	8	8.036	0.1891	7.983	0.6800	0.0642	0.0160	0.80%	4.26%	0.0441	2.93%
041.20	Direct available phosphate, Spectrophotometric (8%)	1		7.715									
041.40	Direct available phosphate, Automated (8%)	3	3	8.237	0.5746	8.237	0.6800	0.5746	0.2346	6.98%	4.13%	0.3400	2.91%
041.50	Direct available phosphate, ICP (8%)	9	9	8.024	0.1843	8.014	0.6800	0.0909	0.0214	1.13%	4.24%	0.0900	2.92%
041.60	Direct available phosphate, EDTA Extract (8%)	9	8	8.056	0.1377	8.049	0.6800	0.1304	0.0326	1.62%	4.22%	0.0532	2.92%
041.99	Direct available phosphate, Other (8%)	2	2	7.545	0.7849								
048.20	Water soluble phosphate, Spectrophotometric (%)	2	2	6.218	0.0743								
050.00	Soluble potash, STPB Oxalate (21%)	13	12	20.80	0.3035	20.82	1.1118	0.1817	0.0371	0.87%	2.67%	0.0558	2.53%
050.30	Soluble potash, Atomic Absorption (21%)	4	4	21.07	0.5210	21.07	1.1118	0.5210	0.1842	2.47%	2.64%	0.3325	2.53%
050.31	Soluble potash, Atomic Absorption (21%)	1		14.87									
050.50	Soluble potash, ICP (21%)	6	6	21.57	1.278	21.35	1.1118	0.9346	0.2698	4.38%	2.60%	0.3657	2.52%
050.51	Soluble potash, ICP (21%)	10	9	21.21	0.6245	21.20	1.1118	0.4934	0.1163	2.33%	2.62%	0.1189	2.53%
050.60	Soluble potash, Flame Photometric (21%)	3	3	20.78	0.1909	20.78	1.1118	0.1909	0.0779	0.92%	2.67%	0.0800	2.53%
050.61	Soluble potash, Flame Photometric (21%)	6	6	21.02	0.3020	20.97	1.1118	0.2165	0.0625	1.03%	2.65%	0.1312	2.53%
050.99	Soluble potash, Other (21%)	24	23	20.66	0.8723	20.79	1.1118	0.5474	0.0807	2.63%	2.67%	0.2407	2.53%
060.00	Free water, Vacuum Oven (%)	4	4	0.6505	0.1168	0.6505		0.1168	0.0413	17.96%		0.0187	4.27%
060.20	Free water, Karl Fischer (%)	1		0.8550									

For guaranteed analytes, the IA at analyte value is determined at the robust mean for the analyte as reported on the analyte proficiency report. The IA %RSD is the AAPFCO allowed variance of results for an analyte with respect to the robust mean of results for a specific method. The IA is defined as two times the allowed standard deviation. Thus, IA %RSD is half the IA divided by the robust mean times 100. This value can be compared to the Robust %RSD, which is the relative variation of laboratory values for a method, and the Horwitz %RSD, which is the expected variation defined by the Horwitz equation at the robust mean for the method. The robust mean, robust RSD, and number of labs in robust calculation can be compared across different methods of an analyte to compare method performance.

The ***Method All Tests Report*** includes all lab values grouped by method along with robust statistics for the method (see below). As in the statistical summary, guaranteed analytes have the guaranteed concentration shown in parentheses and the method group number is shown in green. The average and range of two replications reported from each lab is shown for each method in ascending order. The lab code identifies the lab providing the result. The robust mean, SD, average range of two replicates, and #labs are shown under Method

Values column grouping. The last column shows if a lab result was rejected from robust calculations if duplicate values were too far apart (=1) or result was an extreme outlier (=2). The rejected results are shown last in the grouped data for each method.

STRIVING FOR EXCELLENCE IN ANALYSIS

Method Proficiency For All Labs (Lab Values)

Sample # 201408 **Statistical Summary**

Grade 5-8-21 **Issue Date : 09/30/2014**

Method Code	Analyte & Method	Total # Labs Submitting	# Labs in Robust Calculations	Raw Mean	Raw SD	Assigned Value Robust Mean	IA at Analyte Value	Robust sd	Robust Uncertainty (U)	Robust % RSD	IA %RSD	Average Range (R-bar)	Horwitz %RSD
001.10	Ammoniacal nitrogen, Magnesium Oxide Method (%)	9	8	4.637	0.1281	4.642		0.1353	0.0338	2.92%		0.0225	3.17%
001.99	Ammoniacal nitrogen, Other (%)	7	6	4.850	0.4235	4.780		0.3229	0.0932	6.75%		0.0400	3.16%
009.10	Ammoniacal and nitrate N, Devarda (%)	6	6	4.787	0.1042	4.777		0.1010	0.0292	2.11%		0.0700	3.16%
010.11	Total nitrogen, Modified Comprehensive (5%)	7	6	5.135	0.6773	4.826	0.5059	0.1281	0.0370	2.65%	5.24%	0.0237	3.16%
010.12	Total nitrogen, Salicylic (5%)	4	4	4.824	0.1232	4.824	0.5059	0.1232	0.0436	2.55%	5.24%	0.0375	3.16%
010.60	Total nitrogen, Combustion (5%)	49	47	4.779	0.1767	4.796	0.5059	0.0866	0.0089	1.81%	5.27%	0.0513	3.16%
010.99	Total nitrogen, Other (5%)	4	4	5.029	0.4163	5.029	0.5059	0.4163	0.1472	8.28%	5.03%	0.0225	3.14%
020.10	Total phosphate, Gravimetric Quinolinium Molybdoph... (%)	7	7	8.125	0.1098	8.110		0.0644	0.0172	0.79%		0.0307	2.92%
020.20	Total phosphate, Spectrophotometric Molybdovanadop... (%)	12	12	8.008	0.1588	8.008		0.1801	0.0368	2.25%		0.1033	2.92%
020.40	Total phosphate, Automated, test solution preparat... (%)	7	7	8.059	0.4081	7.997		0.2783	0.0744	3.48%		0.1029	2.93%
020.50	Total phosphate, ICP (%)	14	14	8.116	0.4239	8.081		0.4009	0.0758	4.96%		0.1335	2.92%
020.99	Total phosphate, Other (%)	4	4	8.194	0.4335	8.194		0.4335	0.1533	5.29%		0.1875	2.91%
030.20	Citrate- insoluble phosphate, Spectrophotometric M... (%)	1		0.0000									
040.20	Indirect available phosphate, Spectrophotometric (8%)	1		7.885									
041.10	Direct available phosphate, Gravimetric Quimociac (8%)	8	8	8.036	0.1891	7.983	0.6800	0.0642	0.0160	0.80%	4.26%	0.0441	2.93%
041.20	Direct available phosphate, Spectrophotometric (8%)	1		7.715									
041.40	Direct available phosphate, Automated (8%)	3	3	8.237	0.5746	8.237	0.6800	0.5746	0.2346	6.98%	4.13%	0.3400	2.91%
041.50	Direct available phosphate, ICP (8%)	9	9	8.024	0.1843	8.014	0.6800	0.0909	0.0214	1.13%	4.24%	0.0900	2.92%
041.60	Direct available phosphate, EDTA Extract (8%)	9	8	8.056	0.1377	8.049	0.6800	0.1304	0.0326	1.62%	4.22%	0.0532	2.92%
041.99	Direct available phosphate, Other (8%)	2	2	7.545	0.7849								
048.20	Water soluble phosphate, Spectrophotometric (%)	2	2	6.218	0.0743								
050.00	Soluble potash, STPB Oxalate (21%)	13	12	20.80	0.3035	20.82	1.1118	0.1817	0.0371	0.87%	2.67%	0.0558	2.53%
050.30	Soluble potash, Atomic Absorption (21%)	4	4	21.07	0.5210	21.07	1.1118	0.5210	0.1842	2.47%	2.64%	0.3325	2.53%
050.31	Soluble potash, Atomic Absorption (21%)	1		14.87									
050.50	Soluble potash, ICP (21%)	6	6	21.57	1.278	21.35	1.1118	0.9346	0.2698	4.38%	2.60%	0.3657	2.52%
050.51	Soluble potash, ICP (21%)	10	9	21.21	0.6245	21.20	1.1118	0.4934	0.1163	2.33%	2.62%	0.1189	2.53%
050.60	Soluble potash, Flame Photometric (21%)	3	3	20.78	0.1909	20.78	1.1118	0.1909	0.0779	0.92%	2.67%	0.0800	2.53%
050.61	Soluble potash, Flame Photometric (21%)	6	6	21.02	0.3020	20.97	1.1118	0.2165	0.0625	1.03%	2.65%	0.1312	2.53%
050.99	Soluble potash, Other (21%)	24	23	20.66	0.8723	20.79	1.1118	0.5474	0.0807	2.63%	2.67%	0.2407	2.53%
060.00	Free water, Vacuum Oven (%)	4	4	0.6505	0.1168	0.6505		0.1168	0.0413	17.96%		0.0187	4.27%
060.20	Free water, Karl Fischer (%)	1		0.8550									

The Magruder z score is shown for each lab result. Values between -2 and +2 are acceptable and shown in green. Values less than -2 or greater than +2 are shown in orange or red denotes the laboratory result deviated from the population of other lab results and should alert the laboratory to evaluate their procedures carefully. An orange denotes a warning with z scores between -3 and -2 or +2 and +3. Red denotes action required since the lab value deviated significantly from other lab results with z score less than -3 or greater than +3. Any lab value that is less than the analyte value minus the IA is denoted with an asterisk.

A Threshold %RSD for a lab's result is shown in the next to last column and is a value in addition to the Z score that can be used to evaluate the laboratory's proficiency with a particular method. The Z score is calculated from the mean and standard deviation of other lab values. The Z score evaluates how close the lab's value came to the robust mean for the method with respect to the variability of all results for that method. If the variability of the other results was very good, the lab's Z score may be less than -2 or greater than +2 but the lab result may still be close enough to the mean to be acceptable with regards to a variability accepted by the lab and their clients. The Threshold %RSD shown in the next to last column value is the variability of a population of values that would yield a Z score of -2 or +2 for the individual lab value. The advantage of the Threshold %RSD is that it evaluates how close the lab's value is to the robust mean of the method regardless of the variability of the other lab values. The Threshold %RSD can be compared to an accepted %RSD for the method such as a lab's intralaboratory variation, Horwitz %RSD, or the IA %RSD from AAPFCO-allowed interlaboratory variation.

Lab Report Cards

Analyte Proficiency

The ***Analyte Report Card*** (see below) for a lab evaluates the lab's value compared to all other lab values for an analyte regardless of method. This is the appropriate comparison to evaluate laboratory proficiency in determining analyte concentration in the sample according to the International Harmonized Protocol for proficiency testing. The analyte group number is shown in the first column and is green for analytes guaranteed in the sample. Guaranteed concentration of analytes is shown in parentheses with the unit of measurement. The next to last column shows the method performed with the method code.

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Sample # 201401: Grade 13-13-13
Analyte Report Card for Lab Code XXXX

Proficiency Testing For 17 Analytes — **Issue Date : 02/28/2014**

Analyte Group	Analyte Group (Units)	Lab 0300 Data		Analyte Values				Magruder	Lab 0300	
		Value	range	Rob Mean	Rob SD	R-bar	# Labs	Z Score	Method	Flag
010	Total nitrogen (13%)	12.55	0.0000	12.56	0.1817	0.0938	67	-0.03	010.99	0
020	Total phosphate (%)	13.33	0.0500	13.19	0.2959	0.1321	50	0.45	020.40	0
040	Indirect available phosphate (13%)	13.04	0.0600	13.09	0.1536	0.1225	8	-0.36	040.40	0
050	Soluble potash (13%)	[12.29]	0.0000	13.25	0.2964	0.1479	76	-3.24	050.99	0
121	Acid soluble magnesium (2%)	2.085	0.0500	2.106	0.0878	0.0392	45	-0.24	121.30	0
131	Water soluble magnesium (%)	1.650	0.0000	1.545	0.3334	0.1079	9	0.32	131.30	0
144	Sulfur (9%)	11.96	0.0500	11.89	0.6488	0.1910	44	0.10	144.99	0
165	Acid soluble boron (0.1%)	0.1400	0.0000	0.1400	0.0089	0.0043	32	0.00	165.99	0
181	Total cadmium (ppm)	3.960	0.0000	3.934	0.3943	0.2224	14	0.06	181.00	0
181	Total cadmium (ppm)	4.000	0.0000	3.934	0.3943	0.2224	14	0.17	181.30	0
191	Total chromium (ppm)	44.00	0.0000	70.89	10.65	2.662	12	-2.53	191.30	0
221	Acid soluble copper (%)	0.0066	0.0001	0.0073	0.0010	0.0004	27	-0.78	221.30	0
241	Acid soluble iron (0.1%)	[0.3100]	0.0000	0.3983	0.0280	0.0110	49	-3.15	241.30	0
251	Total lead (ppm)	10.00	0.0000	18.35	2.775	1.541	13	-3.01	251.30	0
261	Acid soluble manganese (0.4%)	0.4300	0.0000	0.4445	0.0280	0.0126	48	-0.52	261.30	0
271	Water soluble manganese (%)	0.0370	0.0000	0.0425	0.0292	0.0075	8	-0.19	271.30	0
321	Acid soluble zinc (0.2%)	0.2000	0.0000	0.2106	0.0180	0.0117	45	-0.59	321.30	0

Interpreting Z Scores: Red indicates a normally distributed Z value >3 or <-3 (requires action), Orange = Z between 2 and 3 or -2 and -3 (warning) and Green = Z < 2 and >-2 (OK at 95%). Flags indicate data usage: 0 = Used, 1 = Rejected for duplicates too far apart and 2 = Rejected as extreme outlier. Robust statistics not used if < 6 labs reporting, in this case the Z Scores are included for information only (Grey). Square brackets indicate that [your value] is lower than the Robust Analyte value less the Investigational Allowance. Method or Analyte codes in light green indicate a guaranteed analyte.

Robust statistics for all values for the analyte are shown in the column grouping entitled Analyte Values. The last column displays a code denoting if the lab value was used in the robust statistic calculation (0) or if the value was not used due to replicates being too far apart (1) or lab value being an extreme outlier (2).

The lab value and range of replicates are shown in the third and fourth columns, respectively. If the lab result was less than the analyte value minus the IA, the lab value is shown in square brackets. Magruder Z scores are shown that evaluates the lab value with respect to the robust mean for the analyte and variation of other lab values. If the lab value is close to the robust mean with respect to variation from other labs, Z scores lie between -2 and +2 and are shown in green. Lab values not close to the robust mean with respect to variation from other labs have Z scores less than -2 and greater than +2 and are shown in orange or red. The preceding section entitled Robust Statistics has a fuller explanation on interpreting Z scores.

The second page of the ***Analyte Report Card*** contains a box and whisker plot that provides a graphical display of the lab's Z score compared to the population of Z scores from all other labs for the analyte (see below). The lab Z score is shown as a solid black circle. The middle horizontal line in the box is the median Z score of all other lab values. The bottom and top of the box are the 25 and 75 percentiles of the Z scores, respectively, of all lab values. The bottom and top of the lines are the 5 and 95 percentiles, respectively, of all lab values. The upper x axis displays the method used by the lab as the method code. Method codes in brackets denote a

guaranteed analyte. The lower x axis displays the number of lab values considered in the population of values producing the box and whisker. The table next to the plot shows the analytes guaranteed in the sample along with the analyte value and IA.

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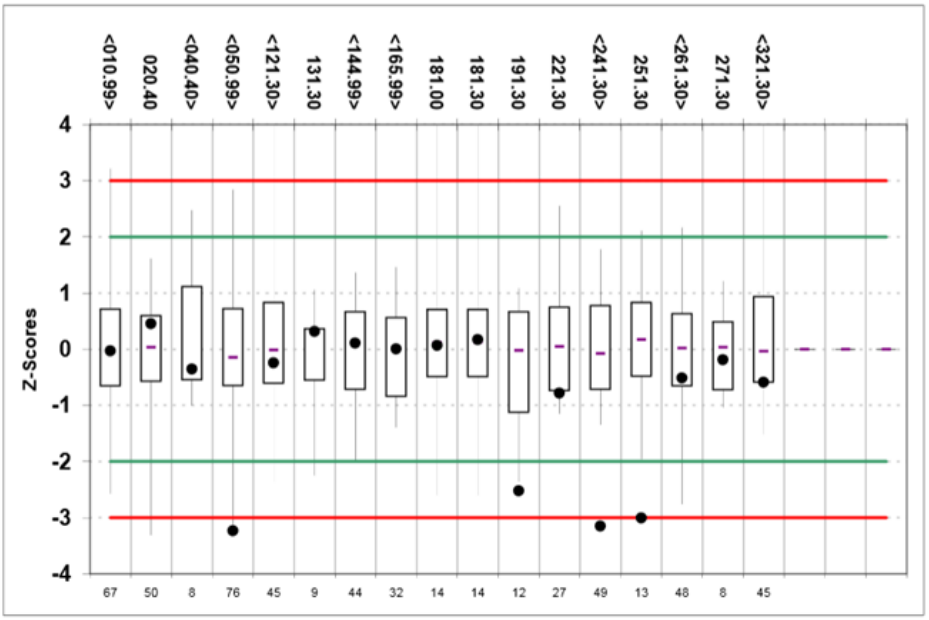
Sample # 201401: Grade 13-13-13
Analyte Report Card for Lab Code XXXX
Z-Score Box Plot and Guarantees

Proficiency Testing For 17 Analytes
Issue Date : 02/28/2014

Z-Score Box and Whisker Plots for Lab # 0300 <guaranteed analyte>



Guaranteed in This Sample			
Analyte	Code	Value*	IA
N	010	12.555	0.616
P2O5	041	13.190	0.696
K2O	050	13.249	0.840
Mg	121	2.106	0.305
S	144	11.887	0.794
B	165	0.140	0.024
Fe	241	0.398	0.045
Mn	261	0.444	0.049
Zn	321	0.211	0.026

* Value is the Robust Analyte Value estimated using the primary Analyte Code for this sample.

Notes: The Methods you used are indicated above and the # Labs involved are below the Box and Whisker.
Your Z-Score is indicated by the Dot. If you do not see a Dot your score is off the chart.
Dots between the Green lines are acceptable Z-Scores. Dots outside the Red lines are actionable.
The Bar, Box and Whisker represent Median, 25% to 75% percentile and 5% to 95% percentile respectively.

Method Proficiency

The ***Method Report Card*** for a lab evaluates the lab's value compared to all other lab values for a specific method to test an analyte (see below). The first column contains the method code and is shown in green for analytes guaranteed in the sample. Guaranteed concentrations are shown in parenthesis with the measurement unit next to the name and method in the second column.

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STRIVING FOR EXCELLENCE IN ANALYSIS

Sample # 201401: Grade 13-13-13
Method Report Card for Lab Code XXXX

Proficiency For 17 Methods — **Issue Date : 02/28/2014**

Method Code	Analyte Name and Method (Units)	Lab 0300 Data		Method Values				Magruder	Threshold	
		Value	range	Rob Mean	Rob SD	R-bar	# Labs	Z Score	%RSD	Flag
010.99	Total nitrogen, Other (Identify) (13%)	12.55	0.0000	12.17	0.5907	0.0900	5	0.65	2%	0
020.40	Total phosphate, Automated, test solution pre... (%)	13.33	0.0500	13.17	0.1664	0.0900	7	0.96	1%	0
040.40	Indirect available phosphate, Automated (13%)	13.04	0.0600	13.04	0.0071	0.0700	2	0.71	0%	0
050.99	Soluble potash, Other (Identify) (13%)	[12.29]	0.0000	13.18	0.3659	0.1578	24	-2.42	3%	0
121.30	Acid soluble magnesium, ICP, test portion pre... (2%)	2.085	0.0500	2.105	0.0960	0.0378	32	-0.21	0%	0
131.30	Water soluble magnesium, ICP (%)	1.650	0.0000	1.637	0.1005	0.0999	6	0.13	0%	0
144.99	Sulfur, Other (Identify) (9%)	11.96	0.0500	11.62	0.5967	0.2884	28	0.56	1%	0
165.99	Acid soluble boron, Other (Identify) (0.1%)	0.1400	0.0000	0.1422	0.0076	0.0043	26	-0.28	1%	0
181.00	Total cadmium, Atomic Absorption (ppm)	3.960	0.0000	3.955	0.0071	0.0500	2	0.71	0%	0
181.30	Total Cadmium , ICP (ppm)	4.000	0.0000	3.914	0.5128	0.3478	12	0.17	1%	0
191.30	Total Chromium , ICP (ppm)	44.00	0.0000	70.89	10.65	2.662	12	-2.53	19%	0
221.30	Acid soluble copper, ICP (%)	0.0066	0.0001	0.0073	0.0010	0.0004	22	-0.75	5%	0
241.30	Acid soluble iron, ICP (0.1%)	[0.3100]	0.0000	0.3963	0.0244	0.0112	39	-3.54	11%	0
251.30	Total lead, ICP (ppm)	10.00	0.0000	17.90	2.763	1.493	11	-2.86	22%	0
261.30	Acid soluble manganese, ICP, Ext. 972.02a (0.4%)	0.4300	0.0000	0.4425	0.0223	0.0142	33	-0.56	1%	0
271.30	Water soluble manganese, ICP, Ext. 972.03 (%)	0.0370	0.0000	0.0383	0.0198	0.0064	5	-0.06	2%	0
321.30	Acid soluble zinc, ICP (0.2%)	0.2000	0.0000	0.2132	0.0205	0.0124	35	-0.65	3%	0

Interpreting Z Scores: Red indicates a normally distributed Z value >3 or <-3 (requires action), Orange = Z between 2 and 3 or -2 and -3 (warning) and Green = Z < 2 and >-2 (OK at 95%). Flags indicate data usage: 0 = Used, 1 = Rejected for duplicates too far apart and 2 = Rejected as extreme outlier. Robust statistics not used if < 6 labs reporting, in this case the Z Scores are included for information only (Grey). Square brackets indicate that [your value] is lower than the Robust Analyte value less the Investigational Allowance. Method or Analyte codes in light green indicate a guaranteed analyte.

Robust statistics for all values for the method used to determine the analyte concentration are shown in the column grouping entitled Method Values. The last column displays a code denoting if the lab value was used in the robust statistic calculation (0) or if the value was not used due to replicates being too far apart (1) or lab value being an extreme outlier (2).

The lab value and range of replicates are shown in the third and fourth columns, respectively. If the lab result was less than the analyte value minus the IA, the lab value is shown in square brackets. Magruder Z scores are shown that evaluates the lab value with respect to the robust mean for the method and variation of other lab values. If the lab value is close to the robust mean with respect to variation from other labs, Z scores lie between -2 and +2 and are shown in green. Lab values not close to the robust mean with respect to variation from other labs have Z scores less than -2 and greater than +2 and are shown in orange or red. The preceding section entitled Robust Statistics has a fuller explanation on interpreting Z scores.

A poor Z score may not always mean poor laboratory performance with a method. This can occur with methods having a small variation in other lab values. A %RSD Threshold value is shown for the laboratory value for each method which is a measure of how close the laboratory's value came to the robust method mean that is independent of variation of other lab results. If the %RSD Threshold is less than a %RSD accepted by the lab and it's client, the laboratory value for the method can be considered adequate. Accepted %RSD values by the lab may be intralaboratory variation, Horwitz %RSD, or the IA %RSD. Further explanation of %RSD Threshold is provided in the section describing All Labs Report for method proficiency.

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