



Statistical reports have been updated to a new organizational format. ***Statistical analysis remains the same and there are the same number of reports for each sample in a round.***

This file contains the Analyte Summary Statistics Report and the Analyte All Tests Report. Information on the content of the reports are included as appendices to each report.



# Magruder Fertilizer Proficiency Testing

## ANALYTE Summary Statistics

### 250911 (Urea, Regular Scheme)



Issue Date: 10/31/2025

Code	Analyte	Trueness (Lab Value)						Precision (range)		
		Robust Mean	# Obs	Robust StDev	Robust Uncert.	Robust %RSD	Horwitz %RSD	IA ratio	Robust Mean	# Obs
005	Urea N (%)	45.48	9	1.38	0.5748	3.03	1.48		0.1144	9
007	Urea (%)	46.2	3	0.0265	0.0191	0.06	1.47		0.0933	3
008	Biuret (%)	0.942	10	0.141	0.0557	15	4.03		0.046	8
<b>010</b>	<b>Total N (46%)</b>	<b>46.32</b>	<b>66</b>	<b>0.3821</b>	<b>0.0588</b>	<b>0.82</b>	<b>1.47</b>	<b>1.01</b>	<b>0.1832</b>	<b>61</b>
050	Soluble K2O (%)	0.0293	3	0.0275	0.0198	93.9	6.78		0.0178	3
060	Water (Free) (%)	0.2779	9	0.1826	0.0761	65.7	4.84		0.0164	6
121	Acid Soluble Mg (%)	0.0601	3	0.0555	0.04	92.3	6.08		0.0134	3

**Statistical parameters of the population:** Robust statistics was used if number of observations  $\geq 6$  for estimate of trueness (blue background) and precision (green background). Classical statistics was used if number of observations = 3, 4, or 5 (no color background).

**Horwitz %RSD and IA ratio:** These values are benchmarks that can be used to evaluate the variability of a population of data in the round. Horwitz %RSD is a standard benchmark on variability from proficiency testing programs. IA ratio is population variability divided by variability expected from AAPFCO investigational allowance. IA ratios greater than 1 indicate population variability is greater than that expected from the IA.

---

## Appendix

### **Content Description of Analyte and Method Summary Statistics Report**

Data collected from all the labs provides an estimate of trueness and precision for determination of an analyte regardless of method (Analyte Summary Statistics) or for determination of analyte by specific methods (Method Summary Statistics). Determination of summary statistics followed protocols in ISO 13528:2015(E) (Statistical methods for use in proficiency testing by interlaboratory comparison). Robust statistics was used to determine statistical parameters for sets with 6 or more observations. Classical statistics was used for sets with 3, 4, or 5 observations. Robust statistics has an advantage of removing undesired influence outlying data can have on the mean and standard deviation without removing data from the statistical analysis.

For trueness, the mean and standard deviation are presented for the number of observations in the population. The uncertainty is a measure of where the “real” value for the concentration lies around the mean with a 68% certainty. The larger the number of observations, the smaller the uncertainty. The relative standard deviation (%RSD) is a percentage of the standard deviation divided by the mean. The Horwitz %RSD is a standard benchmark on variability developed by Horwitz ([https://www.rsc.org/images/horwitz-function-technical-brief-17\\_tcm18-214859.pdf](https://www.rsc.org/images/horwitz-function-technical-brief-17_tcm18-214859.pdf)) that can be used to compare program results with Horwitz expectation. The IA ratio is a measure of how disperse the data is in a population compared to dispersion expected by the AAPFCO investigational allowance (IA). The ratio is the data dispersion in the population divided by IA expected data dispersion. Values greater than 1 indicate data dispersion was greater than IA expected dispersion.

Precision in the data populations is estimated by the range of duplicate results reported. The robust or classical mean is presented along with the number of observations. Any duplicate results that are exactly the same are removed in the determination of the mean to remove undue influence of entries from labs reporting one result twice.



# Magruder Fertilizer Proficiency Testing

**ANALYTE All Tests Report**  
**250911 (Urea, Regular Scheme)**



Issue Date: 10/31/2025

Code	Analyte	Method	Lab Num	Result1	Result2	Lab Value	Z score	Population of Lab Values			
								Robust Mean	Robust StDev	# Obs	Flag
<b>Ammoniacal N (%)</b>											
001.99	Ammoniacal N (%)	Other	524	0.6073	0.8297	0.7185					
<b>Urea N (%)</b>											
005.99	Urea N (%)	Other	524	39.9809	40.053	40.02	-3.66	45.48	1.38	9	
005.00	Urea N (%)	Urease (as N)	389	44	44.05	44.02	-0.97	45.48	1.38	9	
005.99	Urea N (%)	Other	29	44.34	44.37	44.36	-0.75	45.48	1.38	9	
005.99	Urea N (%)	Other	476	45.915	45.8878	45.9	0.28	45.48	1.38	9	
005.99	Urea N (%)	Other	584	46.24	45.68	45.96	0.32	45.48	1.38	9	
005.99	Urea N (%)	Other	602	46.16	46.25	46.2	0.48	45.48	1.38	9	
005.00	Urea N (%)	Urease (as N)	368	46.237	46.179	46.21	0.49	45.48	1.38	9	
005.99	Urea N (%)	Other	605	46.61	46.34	46.48	0.66	45.48	1.38	9	
005.99	Urea N (%)	Other	309	46.72	46.87	46.8	0.88	45.48	1.38	9	
<b>Biuret N (%)</b>											
006.99	Biuret N (%)	Other	558	0.75	0.76	0.755					

Code	Analyte	Method	Lab Num	Result1	Result2	Lab Value	Z score	Population of Lab Values			
								Robust Mean	Robust StDev	# Obs	Flag
006.99	Biuret N (%)	Other	534	1	1	1					
<b>Urea (%)</b>											
007.10	Urea (%)	HPLC, H2O mobile phase	394	46.135	46.195	46.16	-1.13	46.2	0.0265	3	
007.99	Urea (%)	Other	602	46.16	46.25	46.2	0.38	46.2	0.0265	3	
007.99	Urea (%)	Other	536	46.15	46.28	46.22	0.76	46.2	0.0265	3	
<b>Biuret (%)</b>											
008.00	Biuret (%)	AA (as Biuret)	498	0.79	0.79	0.79	-1.00	0.942	0.141	10	
008.99	Biuret (%)	Other	394	0.8049	0.8422	0.8236	-0.78	0.942	0.141	10	
008.10	Biuret (%)	Spectrophotometric (as Biuret)	572	0.86	0.85	0.855	-0.57	0.942	0.141	10	
008.99	Biuret (%)	Other	220	0.81	0.91	0.86	-0.54	0.942	0.141	10	
008.10	Biuret (%)	Spectrophotometric (as Biuret)	405	0.89	0.89	0.89	-0.34	0.942	0.141	10	
008.10	Biuret (%)	Spectrophotometric (as Biuret)	510	0.9357	0.9697	0.9527	0.07	0.942	0.141	10	
008.99	Biuret (%)	Other	548	0.96	0.99	0.975	0.22	0.942	0.141	10	
008.10	Biuret (%)	Spectrophotometric (as Biuret)	513	0.98	0.99	0.985	0.28	0.942	0.141	10	
008.99	Biuret (%)	Other	536	1.05	1.22	1.135	1.27	0.942	0.141	10	
008.10	Biuret (%)	Spectrophotometric (as Biuret)	476	1.2828	1.2474	1.265	2.13	0.942	0.141	10	
<b>Total N (46 %)</b>											
010.60	Total N (%)	Combustion	360	43.35	42.67	43.01 †	-8.67	46.32	0.3821	66	
010.99	Total N (%)	Other	524	44.5898	44.9674	44.78 †	-4.04	46.32	0.3821	66	
010.60	Total N (%)	Combustion	35	45.1	45.2	45.15 †	-3.07	46.32	0.3821	66	
010.60	Total N (%)	Combustion	292	45.43	45.45	45.44 †	-2.31	46.32	0.3821	66	
010.60	Total N (%)	Combustion	389	45.93	45.62	45.78	-1.44	46.32	0.3821	66	
010.12	Total N (%)	Salicylic	117	45.9	45.8	45.85	-1.24	46.32	0.3821	66	

Code	Analyte	Method	Lab Num	Result1	Result2	Lab Value	Z score	Population of Lab Values			
								Robust Mean	Robust StDev	# Obs	Flag
010.99	Total N (%)	Other	577	45.82	45.9	45.86	-1.21	46.32	0.3821	66	
010.60	Total N (%)	Combustion	612	45.61	46.14	45.88	-1.17	46.32	0.3821	66	
010.12	Total N (%)	Salicylic	498	45.8	46	45.9	-1.11	46.32	0.3821	66	
010.60	Total N (%)	Combustion	234	45.79	46.06	45.92	-1.04	46.32	0.3821	66	
010.99	Total N (%)	Other	558	45.6	46.3	45.95	-0.98	46.32	0.3821	66	
010.99	Total N (%)	Other	538	45.9	46.1	46	-0.85	46.32	0.3821	66	
010.60	Total N (%)	Combustion	423	45.99	46.09	46.04	-0.74	46.32	0.3821	66	
010.99	Total N (%)	Other	553	45.94	46.16	46.05	-0.72	46.32	0.3821	66	
010.60	Total N (%)	Combustion	561	46.04	46.07	46.06	-0.70	46.32	0.3821	66	
010.11	Total N (%)	Modified Comprehensive	510	46.0611	46.1983	46.13	-0.51	46.32	0.3821	66	
010.60	Total N (%)	Combustion	307	46.6	45.69	46.14	-0.47	46.32	0.3821	66	
010.99	Total N (%)	Other	600	46.1	46.2	46.15	-0.45	46.32	0.3821	66	
010.99	Total N (%)	Other	551	46.16	46.17	46.16	-0.41	46.32	0.3821	66	
010.60	Total N (%)	Combustion	521	46.171	46.171	46.17	-0.40	46.32	0.3821	66	
010.60	Total N (%)	Combustion	405	46.17	46.19	46.18	-0.38	46.32	0.3821	66	
010.60	Total N (%)	Combustion	291	46.18	46.19	46.18	-0.36	46.32	0.3821	66	
010.60	Total N (%)	Combustion	422	46.14	46.25	46.2	-0.34	46.32	0.3821	66	
010.60	Total N (%)	Combustion	451	46.1	46.3	46.2	-0.32	46.32	0.3821	66	
010.12	Total N (%)	Salicylic	602	46.16	46.25	46.2	-0.31	46.32	0.3821	66	
010.99	Total N (%)	Other	602	46.16	46.25	46.2	-0.31	46.32	0.3821	66	
010.60	Total N (%)	Combustion	368	46.237	46.179	46.21	-0.30	46.32	0.3821	66	
010.99	Total N (%)	Other	371	46.35	46.1	46.22	-0.26	46.32	0.3821	66	
010.99	Total N (%)	Other	559	46.23	46.22	46.22	-0.26	46.32	0.3821	66	
010.99	Total N (%)	Other	513	46.28	46.2	46.24	-0.22	46.32	0.3821	66	
010.99	Total N (%)	Other	394	46.184	46.299	46.24	-0.21	46.32	0.3821	66	
010.60	Total N (%)	Combustion	624	46.196	46.311	46.25	-0.18	46.32	0.3821	66	

Code	Analyte	Method	Lab Num	Result1	Result2	Lab Value	Z score	Population of Lab Values			
								Robust Mean	Robust StDev	# Obs	Flag
010.60	Total N (%)	Combustion	34	46.11	46.4	46.26	-0.18	46.32	0.3821	66	
010.60	Total N (%)	Combustion	86	46.415	46.13	46.27	-0.13	46.32	0.3821	66	
010.60	Total N (%)	Combustion	169	46.26	46.3	46.28	-0.11	46.32	0.3821	66	
010.60	Total N (%)	Combustion	43	46.08	46.49	46.28	-0.10	46.32	0.3821	66	
010.60	Total N (%)	Combustion	231	46.3	46.3	46.3	-0.06	46.32	0.3821	66	
010.60	Total N (%)	Combustion	95	46.27	46.33	46.3	-0.06	46.32	0.3821	66	
010.60	Total N (%)	Combustion	572	46.31	46.31	46.31	-0.04	46.32	0.3821	66	
010.60	Total N (%)	Combustion	220	46.39	46.29	46.34	0.04	46.32	0.3821	66	
010.60	Total N (%)	Combustion	136	46.65	46.07	46.36	0.10	46.32	0.3821	66	
010.60	Total N (%)	Combustion	255	45.909	46.907	46.41	0.22	46.32	0.3821	66	
010.60	Total N (%)	Combustion	233	46.5	46.33	46.42	0.24	46.32	0.3821	66	
010.10	Total N (%)	Reduced Iron	548	46.45	46.39	46.42	0.25	46.32	0.3821	66	
010.60	Total N (%)	Combustion	421	46.67	46.21	46.44	0.31	46.32	0.3821	66	
010.60	Total N (%)	Combustion	106	46.55	46.44	46.5	0.45	46.32	0.3821	66	
010.60	Total N (%)	Combustion	40	46.5	46.5	46.5	0.46	46.32	0.3821	66	
010.60	Total N (%)	Combustion	55	46.41	46.6	46.5	0.48	46.32	0.3821	66	
010.60	Total N (%)	Combustion	452	46.53	46.6	46.56	0.63	46.32	0.3821	66	
010.60	Total N (%)	Combustion	177	46.461	46.726	46.59	0.71	46.32	0.3821	66	
010.60	Total N (%)	Combustion	534	46.7	46.5	46.6	0.72	46.32	0.3821	66	
010.60	Total N (%)	Combustion	527	46.66	46.56	46.61	0.75	46.32	0.3821	66	
010.60	Total N (%)	Combustion	377	46.72	46.57	46.64	0.84	46.32	0.3821	66	
010.60	Total N (%)	Combustion	543	46.83	46.5	46.66	0.89	46.32	0.3821	66	
010.60	Total N (%)	Combustion	29	46.81	46.59	46.7	0.99	46.32	0.3821	66	
010.60	Total N (%)	Combustion	131	46.782	46.724	46.75	1.12	46.32	0.3821	66	
010.60	Total N (%)	Combustion	49	47.15	46.39	46.77	1.17	46.32	0.3821	66	
010.60	Total N (%)	Combustion	494	46.79	46.77	46.78	1.19	46.32	0.3821	66	

Code	Analyte	Method	Lab Num	Result1	Result2	Lab Value	Z score	Population of Lab Values			
								Robust Mean	Robust StDev	# Obs	Flag
010.60	Total N (%)	Combustion	354	46.9	46.9	46.9	1.51	46.32	0.3821	66	
010.60	Total N (%)	Combustion	324	46.7	47.1	46.9	1.51	46.32	0.3821	66	
010.99	Total N (%)	Other	545	46.99	46.9	46.94	1.63	46.32	0.3821	66	
010.60	Total N (%)	Combustion	27	46.92	46.98	46.95	1.64	46.32	0.3821	66	
010.60	Total N (%)	Combustion	260	47.4	46.9	47.15	2.16	46.32	0.3821	66	
010.60	Total N (%)	Combustion	23	47.192	47.267	47.23 ‡	2.37	46.32	0.3821	66	
010.60	Total N (%)	Combustion	25	46.48	48.63	47.56 ‡	3.22	46.32	0.3821	66	1
010.60	Total N (%)	Combustion	542	47.59	47.58	47.58 ‡	3.30	46.32	0.3821	66	
010.60	Total N (%)	Combustion	472	49.1	49.3	49.2 ‡	7.53	46.32	0.3821	66	

**Total P2O5 (%)**

020.50	Total P2O5 (%)	ICP	422	0.0007	0	0.0004					5
020.50	Total P2O5 (%)	ICP	524	0.0011	0.005	0.003					
020.50	Total P2O5 (%)	ICP	472	0.06	0.09	0.075					

**Direct Available P2O5 (%)**

041.21	Direct Available P2O5 (%)	Spectrophotometric, Citrate-EDTA	472	<0.1	<0.1	<0.1					6
041.21	Direct Available P2O5 (%)	Spectrophotometric, Citrate-EDTA	354	0.011	0.011	0.011					

**Water Soluble P2O5 (%)**

048.20	Water Soluble P2O5 (%)	Spectrophotometric	472	<0.1	<0.1	<0.1					6
--------	------------------------	--------------------	-----	------	------	------	--	--	--	--	---

**Soluble K2O (%)**

050.32	Soluble K2O (%)	AA (Citrate-EDTA)	472	<0.1	<0.1	<0.1		0.0293	0.0275	3	6
050.99	Soluble K2O (%)	Other	524	0.0101	0.0127	0.0114	-0.65	0.0293	0.0275	3	

Code	Analyte	Method	Lab Num	Result1	Result2	Lab Value	Z score	Population of Lab Values			
								Robust Mean	Robust StDev	# Obs	Flag
050.52	Soluble K2O (%)	ICP (Citrate-EDTA)	354	0.015	0.016	0.0155	-0.50	0.0293	0.0275	3	
050.50	Soluble K2O (%)	ICP (Oxalate)	422	0.0858	0.036	0.0609	1.15	0.0293	0.0275	3	

**Water (Free) (%)**

060.30	Water (Free) (%)	AFPC No. 2B (105°C oven for 2	394	0.132	0.131	0.1315	-0.74	0.2779	0.1826	9	
060.20	Water (Free) (%)	Karl Fischer	498	0.135	0.129	0.132	-0.74	0.2779	0.1826	9	
060.00	Water (Free) (%)	Vacuum Oven	405	0.14	0.14	0.14	-0.70	0.2779	0.1826	9	
060.00	Water (Free) (%)	Vacuum Oven	220	0.17	0.18	0.175	-0.52	0.2779	0.1826	9	
060.99	Water (Free) (%)	Other	136	0.2	0.2	0.2	-0.39	0.2779	0.1826	9	
060.20	Water (Free) (%)	Karl Fischer	513	0.294	0.297	0.2955	0.09	0.2779	0.1826	9	
060.20	Water (Free) (%)	Karl Fischer	234	0.4	0.4	0.4	0.62	0.2779	0.1826	9	
060.00	Water (Free) (%)	Vacuum Oven	561	0.49	0.46	0.475	1.00	0.2779	0.1826	9	
060.99	Water (Free) (%)	Other	510	0.5984	0.6936	0.646	1.86	0.2779	0.1826	9	
060.99	Water (Free) (%)	Other	572	5	4.8	4.9	23.36	0.2779	0.1826	9	1

**Acid Soluble Ca (%)**

101.33	Acid Soluble Ca (%)	ICP, 2017.02	472	0.01	0.01	0.01					
101.30	Acid Soluble Ca (%)	ICP, test portion inorganic 965.09	354	0.08	0.1	0.09					

**Acid Soluble Mg (%)**

121.30	Acid Soluble Mg (%)	ICP, test portion inorganic 965.09	354	<0.01	0.02	<0.01		0.0601	0.0555	3	6
121.99	Acid Soluble Mg (%)	Other	524	0.0002	0.0005	0.0004	-1.08	0.0601	0.0555	3	
121.33	Acid Soluble Mg (%)	ICP, 2017.02	472	0.06	0.08	0.07	0.18	0.0601	0.0555	3	
121.30	Acid Soluble Mg (%)	ICP, test portion inorganic 965.09	371	0.12	0.1	0.11	0.90	0.0601	0.0555	3	

Code	Analyte	Method	Lab Num	Result1	Result2	Lab Value	Z score	Population of Lab Values			
								Robust Mean	Robust StDev	# Obs	Flag
<b>Total S (%)</b>											
148.99	Total S (%)	Other	422	0	0.0157	0.0078				5	
148.07	Total S (%)	ICP, test portion as in 2017.02	472	0.03	0.03	0.03					
148.99	Total S (%)	Other	354	0.09	0.05	0.07					
<b>S - HNO3 soluble (%)</b>											
149.04	S - HNO3 soluble (%)	ICP	524	0.0004	0.0008	0.0006					
<b>Acid Soluble As (ppm)</b>											
151.30	Acid Soluble As (ppm)	ICP	524	0.0008	0.0017	0.0012					
<b>Acid Soluble B (%)</b>											
165.30	Acid Soluble B (%)	ICP, test portion in 982.01	354	<0.01	<0.01	<0.01				6	
165.99	Acid Soluble B (%)	Other	472	<0.01	<0.01	<0.01				6	
165.30	Acid Soluble B (%)	ICP, test portion in 982.01	371	0	0	0				5	
<b>Acid Soluble Cd (ppm)</b>											
181.30	Acid Soluble Cd (ppm)	ICP	524	0.0152	0.0399	0.0276					
<b>Acid Soluble Cr (ppm)</b>											
191.30	Acid Soluble Cr (ppm)	ICP	524	0.3236	0.3536	0.3386					
<b>Acid Soluble Co (ppm)</b>											
202.30	Acid Soluble Co (ppm)	ICP	524	0.0373	0.1455	0.0914					

Code	Analyte	Method	Lab Num	Result1	Result2	Lab Value	Z score	Population of Lab Values			
								Robust Mean	Robust StDev	# Obs	Flag
<b>Acid Soluble Cu (%)</b>											
221.33	Acid Soluble Cu (%)	ICP, 2017.02	472	<0.01	<0.01	<0.01				6	
221.30	Acid Soluble Cu (%)	ICP, test portion inorganic 965.09	354	<0.01	<0.01	<0.01				6	
221.30	Acid Soluble Cu (%)	ICP, test portion inorganic 965.09	371	0	0	0				5	
<b>Acid Soluble Fe (%)</b>											
241.33	Acid Soluble Fe (%)	ICP, 2017.02	472	<0.01	<0.01	<0.01				6	
241.30	Acid Soluble Fe (%)	ICP, test portion inorganic 965.09	354	<0.01	<0.01	<0.01				6	
241.99	Acid Soluble Fe (%)	Other	524	0.0003	0.0007	0.0005					
241.30	Acid Soluble Fe (%)	ICP, test portion inorganic 965.09	371	0.01	0.01	0.01					
<b>Acid Soluble Pb (ppm)</b>											
251.30	Acid Soluble Pb (ppm)	ICP	524	0.2392	0.3058	0.2725					
<b>Acid Soluble Mn (%)</b>											
261.30	Acid Soluble Mn (%)	ICP, test portion 972.02a	354	<0.01	<0.01	<0.01				6	
261.35	Acid Soluble Mn (%)	ICP, 2017.02	472	<0.01	<0.01	<0.01				6	
261.32	Acid Soluble Mn (%)	ICP, test portion inorganic 965.09	371	0	0	0				5	
<b>Acid Soluble Mo (ppm)</b>											
289.30	Acid Soluble Mo (ppm)	ICP	524	0.2095	0.3284	0.269					
<b>Acid Soluble Ni (ppm)</b>											
291.30	Acid Soluble Ni (ppm)	ICP	524	0.2971	0.3813	0.3392					

Code	Analyte	Method	Lab Num	Result1	Result2	Lab Value	Z score	Population of Lab Values			
								Robust Mean	Robust StDev	# Obs	Flag
<b>Acid Soluble Se (ppm)</b>											
301.30	Acid Soluble Se (ppm)	ICP	524	0.0089	0.0043	0.0066					
<b>Sodium (%)</b>											
311.99	Sodium (%)	Other	354	0.03	0.04	0.035					
<b>Acid Soluble Zn (%)</b>											
321.33	Acid Soluble Zn (%)	ICP, 2017.02	472	<0.01	<0.01	<0.01				6	
321.30	Acid Soluble Zn (%)	ICP, test portion inorganic 965.09	354	<0.01	<0.01	<0.01				6	
321.30	Acid Soluble Zn (%)	ICP, test portion inorganic 965.09	371	0.01	0.01	0.01					

**Lab Data:** Value is the average of 2 reported lab results and range is the difference between 2 reported lab results. † or ‡ beside Lab Value denotes the value exceeds the investigational allowance (IA) around the analyte mean. † denotes value is less than IA and ‡ denotes value is greater than IA. This is noted for guaranteed analytes with # of observations >= 6. Method code and analyte name are shown in green for guaranteed analytes along with guaranteed concentration.

**Statistical parameters of the population:** Robust statistics was used to determine mean, %RSD, and range if number of observations >=6 (blue background). Classical statistics was used if number of observations = 3, 4, or 5 (pink background). The number of observations in parentheses is the number of values used in the statistical calculation. Footnote on flags below identifies flag numbers where data was rejected and the reason why.

**Z scores:** Red = Z value >3 or <-3 (action required), Orange = Z value between 2 and 3 or -2 and -3 (warning), Green = Z value between -2 and 2 (pass). Z values are determined for data populations with number of observation >= 3 for values that are not an analytical limit or 0. Color ratings shown for number of observations >=6.

**Flags:** Flag number denotes whether or not Lab Value was used in the population to determine statistical parameters. No flag number indicates data was used, 1 = data rejected for dups too far apart, 2 = rejected as extreme outlier, 3 = rejected for both dups too far apart and extreme outlier, 4 = removed after manual inspection, 5 = rejected due to zero(s) submitted, 6 = rejected due to analytical limit submitted (eg "<0.1").

---

## Appendix

### **Content Description of Analyte and Method All Tests Report**

The All Tests reports have results listed for every lab grouped by Analyte or by Method with data in each group sorted by lab value. The reports are helpful to see where your lab result fell within the whole set of data for the Analyte or Method by identifying your results by your lab number. Data on the right side of the report shows the mean, standard deviation, and number of observations (obs) used in the analysis of each group. An observation was a lab value for a test which was the average of reported duplicate results. Determination of mean and standard deviation followed protocols in ISO 13528:2015(E) (Statistical methods for use in proficiency testing by interlaboratory comparison) where robust statistics was used to determine the mean and standard deviation for 6 or more observations. Robust statistics has an advantage of removing undesired influence outlying data can have on the mean and standard deviation without removing data from the statistical analysis. Robust statistics is only appropriate for use on data sets with 6 or more observations. For data sets with 3, 4, or 5 observations, classical calculation of mean and standard deviation was performed. Z scores for data sets with a small number of observations are given less importance as indicated by no color coding of Z score with less than 6 observations. No Z scores were determined for 1 or 2 observations.

Before determining mean and standard deviation for a set of data, data was removed from statistical analysis for various reasons. Mandel statistical analysis was used to identify and remove extreme outliers and lab values from duplicate results that were too far apart (ISO 5725-2:1994, Accuracy (trueness and precision) of measurement methods and results – Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method.). Any individual result report of zero or less than a limit had lab value removed from analysis. The lab values removed from analysis are denoted with numerical flags on the far right-hand side of the report. Z scores are reported for data removed due to extreme outlier or duplicates too far apart even though data was not used in the determination of mean and standard deviation. However, Z scores are not reported for results reported as 0 or less than a limit. Also, any submission of just one lab result is removed for consideration in statistical analysis and presentation on reports.

The American Association of Plant Food Control Officials (AAPFCO) recommends limits around a nutrient guarantee that should initiate an investigation if observed nutrient concentration falls outside of the limits. These limits are referred to as Investigational Allowances (IAs). Lab Values that fall outside of the IA limits around the analyte mean are denoted with † (below limit) or ‡ (above limit). These same symbols are also used to denote Lab Values beyond IA limits on Laboratory Report Cards.