

2019 Dairy Byproduct Rulemaking – Soil Test Experiment

Part A: Consistency & Accuracy of Private Laboratories

Five (5) private laboratories in Idaho currently offer soil phosphorus testing services. Five different soil samples were prepared by USDA ARS in Kimberly, ID to be submitted to each private soil testing lab to determine how much variation exists in each testing protocol. ARS extensively homogenized each of the five samples to make them as uniform and consistent as possible, before submitting the samples to each private lab. Prior to submitting the samples to the private labs, ARS conducted extensive and repetitive phosphorus testing of each sample by four (4) different lab personnel that tested each sample at least eight different times. In the end, each of the five soil samples sent to the private labs had been tested 32 times by ARS. The average value of those 32 tests was used as a baseline for accuracy in comparing the results from the private labs.

Raw Data – Phosphorus Testing (ppm)

Laboratory	Field 1	Field 2	Field 3	Field 4	Field 5	
1 (Analytical)	148	85.5	40.8	19.9	11.5	
2 (Stukenholtz)	140	68	42	21	17	
3 (Tremblay)	126	77	38	19	13	
4 (U of I)	130	78	34	17	8.8	
5 (Western)	139	82	41	21	5	
6 (ARS)	147	81	42	19	10.5	baseline lab

Analysis – Percent difference from baseline (ARS) value

Laboratory	Field 1	Field 2	Field 3	Field 4	Field 5		
1 (Analytical)	0.6803	5.5556	-2.857	4.7368	9.5238	14/25	less than 10%
2 (Stukenholtz)	-4.762	-16.05	0	10.526	61.905	5/25	10 to 15%
3 (Tremblay)	-14.29	-4.938	-9.524	0	23.81	6/25	>15%
4 (U of I)	-11.56	-3.704	-19.05	-10.53	-16.19		
5 (Western)	-5.442	1.2346	-2.381	10.526	-52.38		

Part B: Consistency & Accuracy of Soil Samplers

ISDA selected ten (10) fields operated by dairies in the Magic Valley. Fields 1-4 receive liquid nutrient applications through a pivot; Field 5 receives liquid nutrients applied through a wheel line; and Fields 6-10 receive solid nutrient applications using a manure spreader. Three (3) different ISDA employees, on separate days, were asked to collect soil samples for phosphorus testing from each of the ten fields selected. The instructions were to perform their usual method to collect soil samples to determine the soil phosphorus concentration of a field, pursuant to the Univ. of Idaho Soil Sampling Guide. Each sampler submitted their ten samples to the same private lab (Stukenholtz) for soil phosphorus testing to determine if the same fields, sampled on different days by different people, would influence the outcome of the soil test.

Raw Data – Phosphorus Testing (ppm)

Sampler	liquid nutrients					solid nutrients				
	Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9	Field 10
1	48	143	115	122	165	60	110	113	149	114
2	67	80	162	146	114	54	66	62	120	105
3	36	70	125	165	101	51	118	98	197	136
Percent change high/low value	86	104	40	35	63	17	78	82	64	29
Average soil phos	59.25	99.25	110.5	144.33	126.67	45.5	93	88.75	132.5	96

Analysis – Percent difference from average soil P value

Sampler	Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9	Field 10		
1	-4.629	46.516	-14.18	-15.28	29.921	9.0909	12.245	24.176	-3.871	-3.39	10/30	less than 10%
2	33.121	-18.03	20.896	1.3889	-10.24	-1.818	-32.65	-31.87	-22.58	-11.02	3/30	10 to 15%
3	-28.47	-28.28	-6.716	14.583	-20.47	-7.273	20.408	7.6923	27.097	15.254	17/30	>15%

Results Summary

Part A of the experiment demonstrated that a variability of up to 62% was observed when five different private labs were given the same five soil samples to analyze for phosphorus concentration, when compared to the baseline laboratory. Out of 25 soil samples (5 samples analyzed by 5 labs), a variability of less than 10% from the baseline lab was observed 56% of the time; a variability of 10-15% was observed 20% of the time; and a variability of greater than 15% was observed 24% of the time. Given the small sample set, a more advanced statistical analysis was not available.

Part B of the experiment demonstrated that soil collected by different samplers from the same fields and analyzed by the same lab could vary up to 46% when compared to the average of the three samples.

Out of 30 soil samples (10 fields sampled by 3 people), a variability of less than 10% from the averaged value was observed 33% of the time; a variability of 10-15% from the average value was observed 10% of the time; and a variability of greater than 15% from the average was observed 57% of the time. However, when the lowest value of the three samples is compared to the highest value, a variability of up to 104% was observed. This means that, such as in the case of Field 2 in Part B (low value 70ppm, high value 143ppm), depending on who collected the sample and how it was done, the soil P concentration could be more than double what another person collected and submitted from the same field.