Using MUN Data to Determine N Status for Dairy Herds in the Chesapeake Bay Watershed

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Photo credit: Penn State Extension

PennState Extension

A Changed Dairy Industry – Improved Nitrogen Efficiency

- MOU with ARPAS and USDA-NRCS
  - American Registry of Professional Animal Scientists
  - Consultants Certified in Feed Management
- Collaboration with Extension and USDA-NRCS
  - Joe Harrison – WSU
  - MD, VA, PA (Rick Kohn, Charles Stallings and Virginia Ishler) and NRCS (Jana Malot and Dan Ludwig) – Developed educational programming on precision feeding

Time frame – started 2007. Funding from the Mid-Atlantic Water Quality Project

A Changed Dairy Industry – Improved Nitrogen Efficiency

Double cropping – utilizing the cover crop for feed

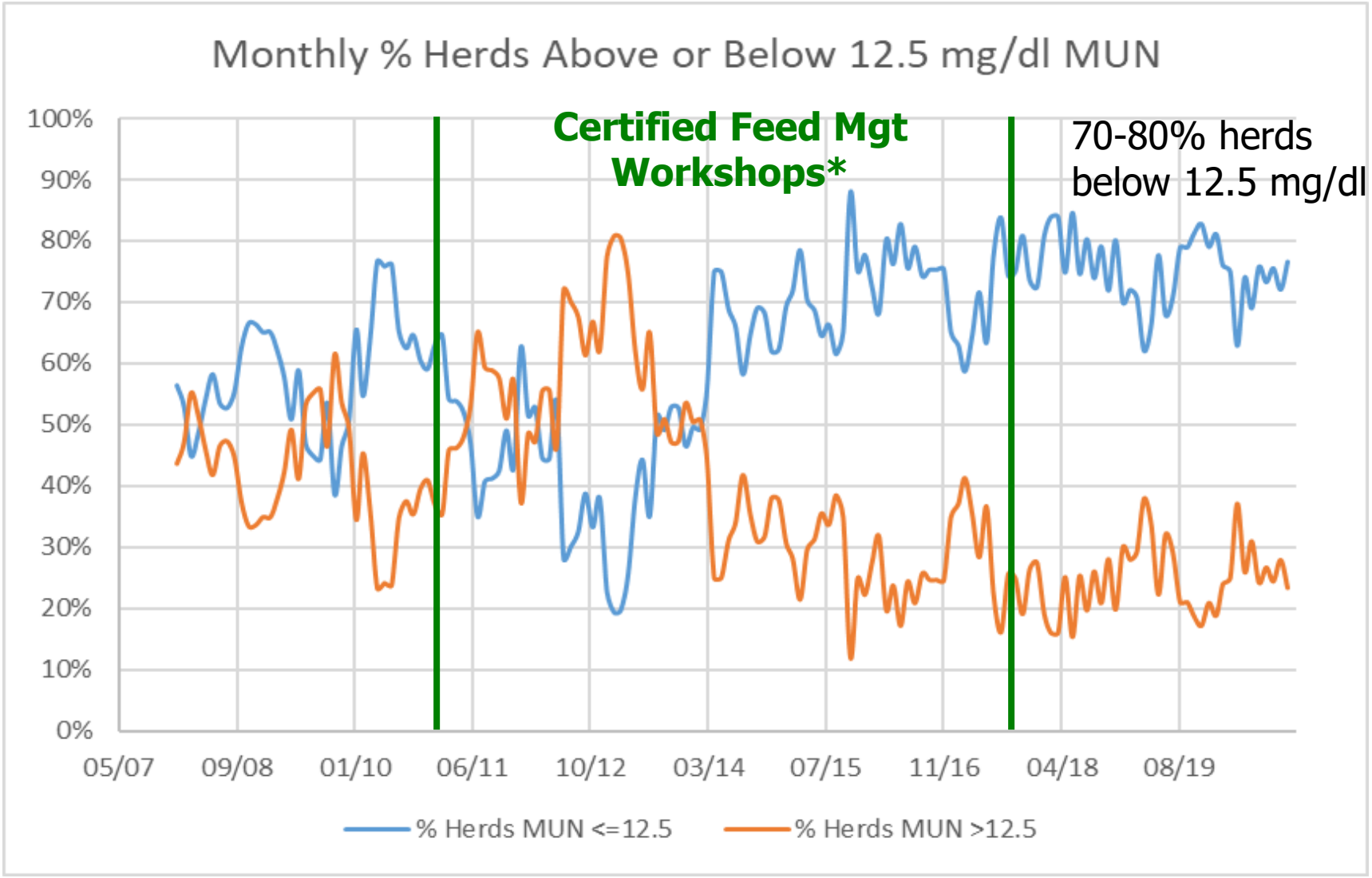
- Heavy corn silage-based diets coupled with small grain silage
- Reduction in alfalfa being fed
- Improved protein-carbohydrate balance for cows

Penn State research – Drs. Heather Karsten & Doug Beegle on double cropping

- Environmental benefits as well as economic benefits to producers.

Time frame – started 2009 to present. Funding from NESARE

Percent Herds with MUN less than or greater than 12.5 mg/dl



Source: DHIA data – 580 dairy operations – Jan 2008 – Dec 2020 (DRMS.org)

***2011 - 51 operations received EQIP funding for Feed Management**

Predicting N Excretion

- Over 114 published papers on MUN and Urinary N excretion in the Journal of Dairy Science

- Of the total N consumed – approximately
  - 26% is excreted in milk
  - 33% is excreted in urine
  - 35% is excreted in feces
  - 6% is retained for growth and reserves

Predicting N Excretion

Summary of N data collected from 1995 to 2015.

Item	Observations Number	Min g/d	Median g/d	Mean (SD) g/d	Max g/d
Lactating cows					
Urine N	**215**	**39.5**	**187.5**	**192.9 (70.5)**	**331.0**
Fecal N	213	69.2	176.0	177.3 (51.3)	308.0
Total manure N	211	151.2	368.0	370.1 (98.9)	606.4

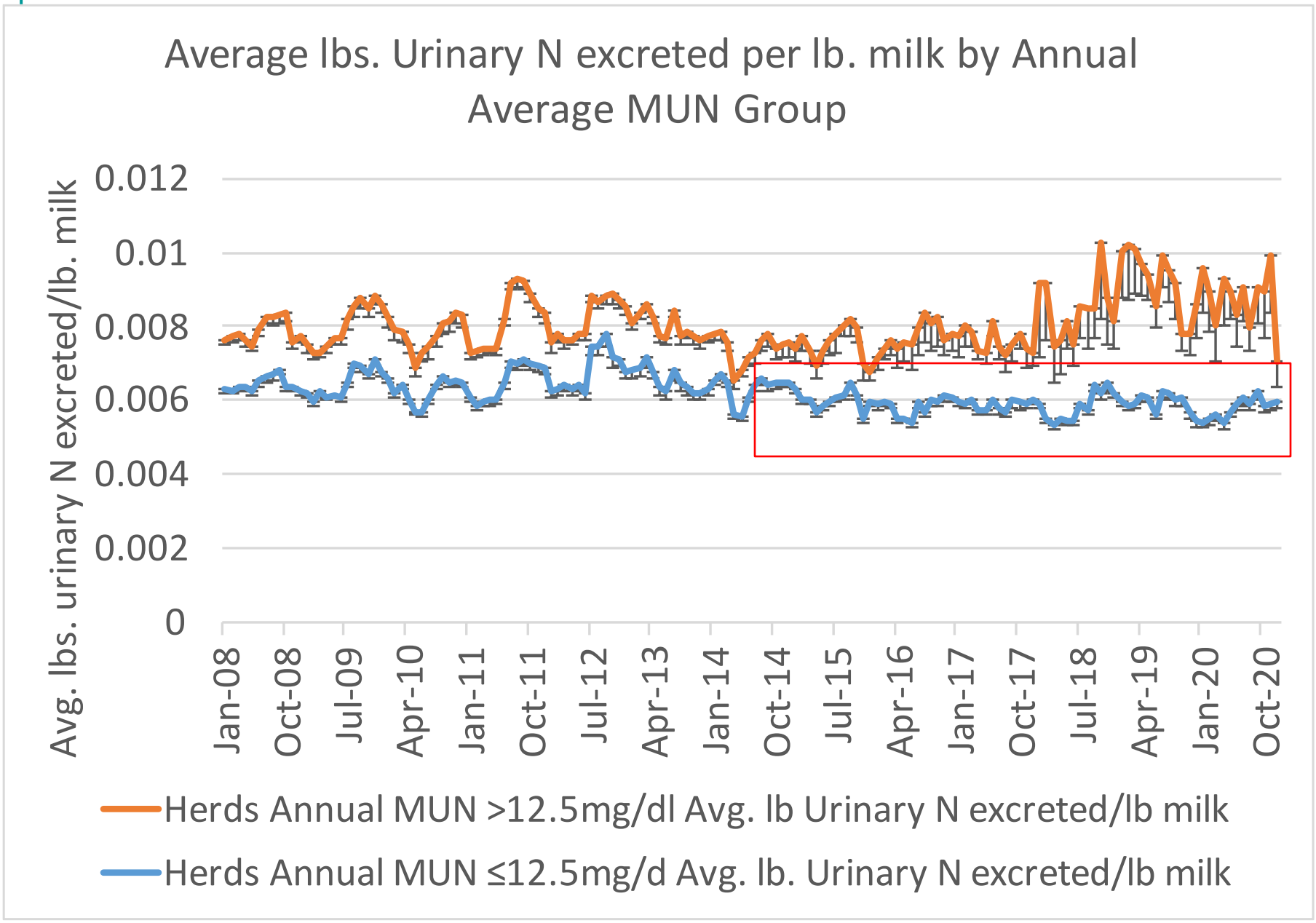
Source: Johnson et. al. Journal of Dairy Science, 2016.

Note: 27 papers/equations developed over the 20 years

Predicting Urinary N Excretion

MUN	Grams N excreted/ cow/day	Lbs. N excreted/ cow/day
8	148.6	0.33
9	163.7	0.36
10	178.8	0.39
11	193.9	0.43
12	209.0	0.46
13	224.1	0.49
14	239.2	0.53
15	254.3	0.56
16	269.4	0.59

- Kohn et. al. Journal of Dairy Science, 2002
- (15.1*MUN)+27.8
- MUN ideal range is 8 to 12.5 mg/dl.



Source: DHIA data – Jan 2008 – Dec 2020 – 580 herds

Predicting lbs. Urinary N Excreted

Lb. Urinary N excreted/ lb. of Milk

MUN mg/dl	Grams N excreted/ cow/day	Lbs. N excreted/ cow/day	65 lbs. of milk	70 lbs. of milk	75 lbs. of milk
10	178.8	0.39	0.0061	0.0056	0.0053
11	193.9	0.43	0.0066	0.0061	0.0057
12	209.0	0.46	0.0071	0.0066	0.0061

- Kohn et. al. Journal of Dairy Science, 2002

Predicting lbs. Urinary N Excreted

Lb. Urinary N excreted/ lb. of Milk

MUN mg/dl	Grams N excreted/ cow/day	Lbs. N excreted/ cow/day	65 lbs. of milk	70 lbs. of milk	75 lbs. of milk
13	224.1	0.49	0.0075	0.0070	0.0065
14	239.2	0.53	0.0080	0.0076	0.0071
15	254.3	0.56	0.0086	0.0080	0.0075

- Kohn et. al. Journal of Dairy Science, 2002

Updated N Excretion Numbers vs. ASAE D384.2 Mar2005 Standards

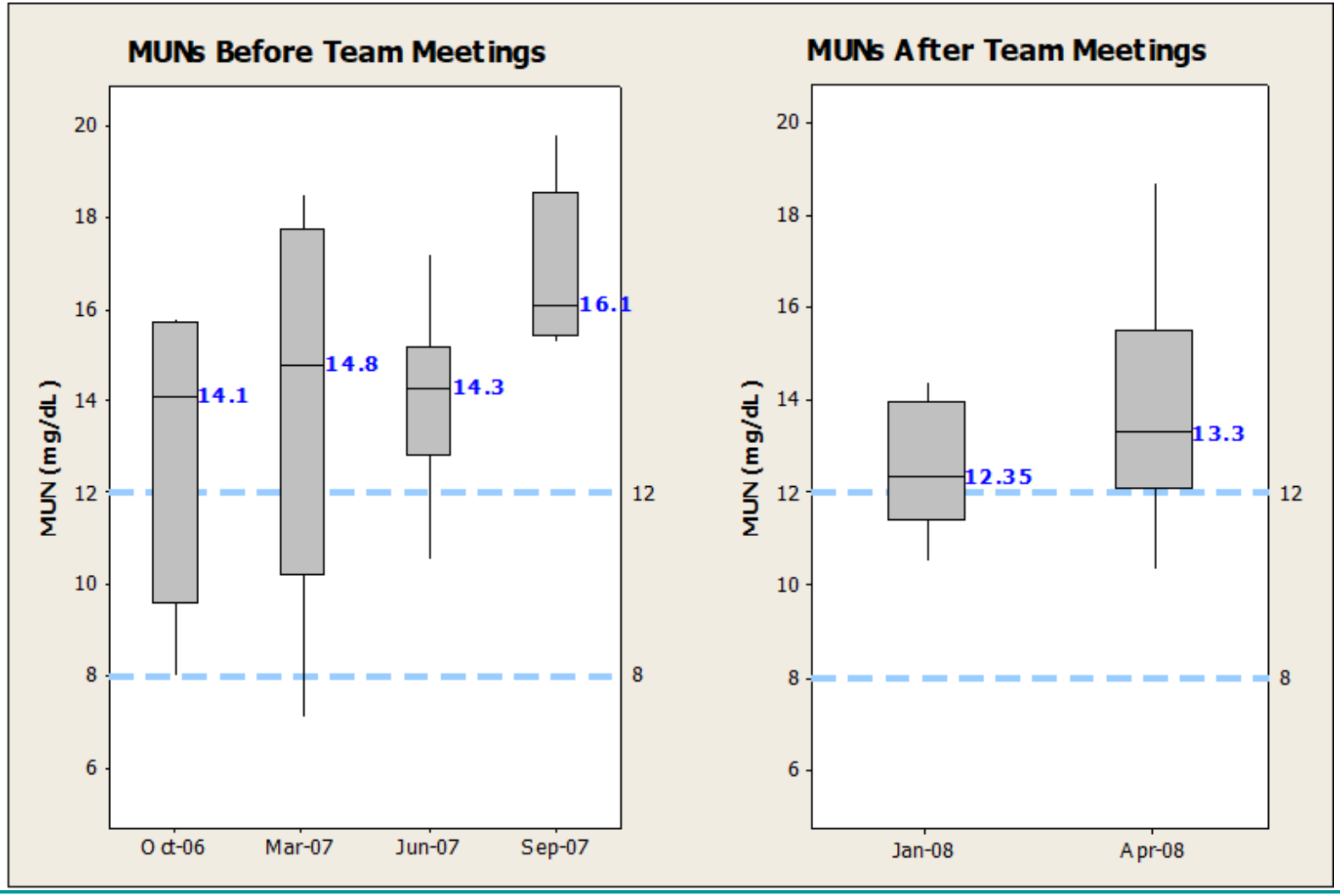
		JDS, 2016		ASAE, 2005
		Mean (SD)		
Total Manure N, g/d		370.0 (98.9)		450.0
Urinary N, g/d		192.9 (70.5)		234.6*
MUN, mg/dl**		11		14

*Estimated using 52% of total manure N like JDS 2016 data.

**Kohn et al. 2002 equation for estimated MUN

Note: MUN recommendation in 2005 was 12-14 mg/dl compared to current recommendation of 8 to 12 mg/dl.

Monocacy Watershed Project on 6 dairy farms (2006-2008)



V. Ishler and R. Kohn, Enhancing Nutrient Efficiencies on Dairy Farms in the Monocacy Watershed, MD and PA. 2008

Initial DHI Review Summaries

- Increase in % herds with avg MUN <=12.5 mg/dl since 2014
- Herds <=12.5mg/dl average less lbs. Urinary N excreted per pound of milk

Next Steps Moving Forward

- DHIA provides a robust data set
  - Monthly data along with cow numbers and milk production
  - Limitation – limited number of herds are testing MUNs.

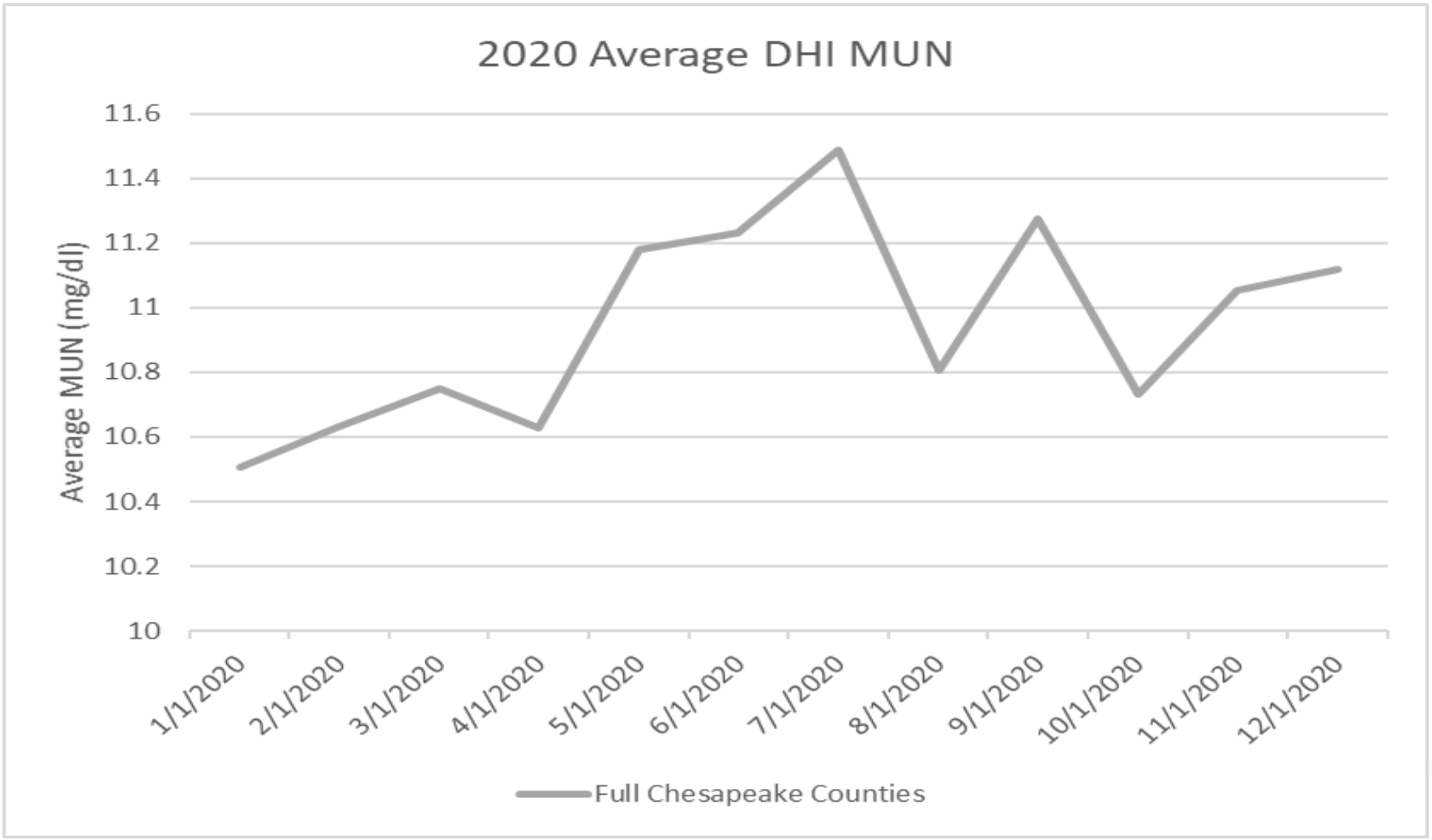
- Milk cooperatives
  - **Potential** for a robust data set – MUNs tested on every pick-up
  - Data lacking – cow numbers and average milk production to determine urinary N excretion

Next Steps Moving Forward

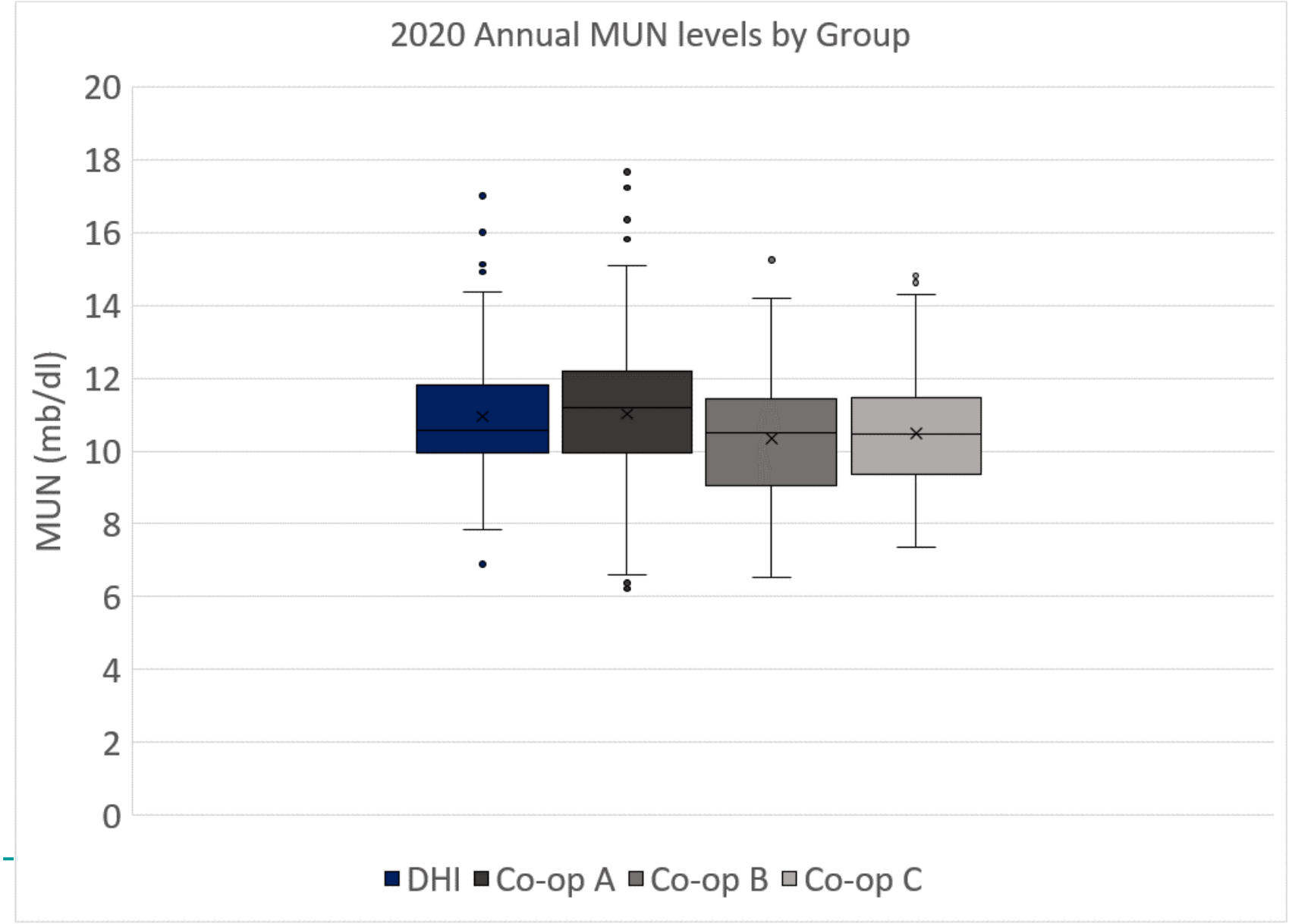
- 3 Milk Cooperatives provided data
  - 2 co-ops provided only ANNUAL numbers for 2020
  - 1 co-op provided monthly data for 2020
  - Total herds -1431

- Missing information
  - Cow numbers
  - Average production
  - Historical information

Monthly Results from Milk Cooperative A - 2020



Comparison of DHIA and Co-ops using Annual Data



Comparison of DHIA and Co-ops using Annual Data

MUNS Results for 2020	*DHI-Monthly*	*Co-op A-Monthly*	*Co-op B - Annual*	*Co-op C - Annual*
Mean	10.95	10.54	11.02	10.34
Standard Error	0.07	0.01	0.07	0.12
Median	11.00	10.40	11.20	10.50
Standard Deviation	2.51	2.36	1.74	1.66
Minimum	6.00	6.00	6.22	6.54
Maximum	24.00	29.30	17.66	15.24

Is there a connection between MUNs and Phosphorus?

	Milk production	DMI	TMR - P	TMR-P	P % of Requirement	Standard	MUNS	Standard
	Average lbs./d	Average lbs/cow	%	lbs.	Average (2001 NRC)	Deviation	Average mg/dl	Deviation
Farm-86	48.2	48.2	0.34	0.164	117	13.3	10.2	2.7
Farm-96	63.4	44.6	0.35	0.156	112	17.2	12.0	2.5
Farm-153	70.3	47.1	0.38	0.179	112	9.8	12.1	2.4
Farm-192	70.9	48.6	0.38	0.185	103	19.6	10.2	2.7
Farm-52	71.4	48.0	0.42	0.202	112	25.7	10.7	2.2
Farm-195	73.1	50.4	0.40	0.202	112	16.4	13.0	1.4
Farm-139	75.5	50.6	0.38	0.192	107	5.1	13.4	2.2
Farm-178	75.7	47.9	0.38	0.182	101	11.3	11.4	1.4
Farm-196	76.3	47.0	0.42	0.197	99	11.7	13.7	1.6
Farm-335	78.0	50.1	0.39	0.195	98	6.5	11.4	2.1
Farm-208	78.3	47.1	0.34	0.160	80	26.0	11.5	2.6

E. Schurman and V. Ishler, NESARE project ONE07-075: Improving air quality and dairy profitability through reduced proton feeding, 2009.

11 dairy farms sampled every other month from June 2007 – Feb 2009

P as a % of requirement – recommended <110%

Recent Work on Precision Feeding and Phosphorus

Drought Year - 2016						
Production range pounds	Farms number	Average production pounds	Average DMI pounds	Average ration P %	Average ration P pounds	2001 NRC P-requirement %
<70	2	68.7	51.2	0.40	0.20	121.8
70-75	9	73.4	50.5	0.41	0.21	114.9
76-83	7	79.8	51.7	0.41	0.21	104.9
>83	4	89.8	57.0	0.41	0.24	107.6
High Moisture Year - 2017						
Production range pounds	Farms number	Average production pounds	Average DMI pounds	Average ration P %	Average ration P pounds	2001 NRC P-requirement %
<70	1	68.7	49.7	0.40	0.20	123.5
70-75	8	73.4	50.7	0.42	0.21	116.6
76-83	9	77.8	52.0	0.40	0.21	106.0
>83	4	88.4	56.5	0.39	0.22	101.5

Ishler et. al. NESARE project ENE-15-136 The impact of corn silage harvesting and feeding decisions on income over feed costs, 2018.

22 dairy farms sampled 2 times per season from Fall 2016 – Spring 2018

Take Away Messages

MUNs are decreasing and fall within ideal range of 8 to 12 mg/dl since 2014.

DHIA and Co-op data agree that this declining MUN trend is real.

Co-op data would provide a more robust data set to validate N reductions in the Chesapeake Bay Watershed

- Need more discussions with co-ops on collecting cow numbers, milk production and herd identifiers.

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