Comparison of Methods for Estimating Poultry Manure Nutrient Generation in the Chesapeake Bay Watershed

Jim Glancey, Bill Brown & Jennifer Volk
University of Delaware

Sec. Ed Kee, Mark Davis & Larry Towle
Delaware Department of Agriculture

Jennifer Timmons
University of Maryland

Jen Nelson
USDA NRCS Maryland

ASAE Standard, 2003

Table 2 – Fresh manure production and characteristics per 1,000 lb live animal mass per day

Parameter	Units*		Animal Type†										
			Dairy	Beef	Veal	Swine	Sheep	Goat	Horse	Layer	Broiler	Turkey	Duck
Total manure‡	lb	mean§	86	58	62	84	40	41	51	64	85	47	110
		std. deviation	17	17	24	24	11	8.6	7.2	19	13	13	**
Urine	lb	mean	26	18	**	39	15	**	10	**	**	**	**
		std. deviation	4.3	4.2	**	4.8	3.6	**	0.74	**	**	**	**
Density	lb/ft^3	mean	62	63	62	62	64	63	63	60	63	63	**
		std. deviation	4.0	4.7	**	1.5	4.0	**	5.8	2.4	**	**	**
Total solids	lb	mean	12	8.5	5.2	11	11	13	15	16	22	12	31
		std. deviation	2.7	2.6	2.1	6.3	3.5	1.0	4.4	4.3	1.4	3.4	15
Volatile solids	lb	mean	10	7.2	2.3	8.5	9.2	**	10	12	17	9.1	19
		std. deviation	0.79	0.57	**	0.66	0.31	**	3.7	0.84	1.2	1.3	**
Biochemical oxygen demand, 5-day	lb	mean	1.6	1.6	1.7	3.1	1.2	**	1.7	3.3	**	2.1	4.5
		std. deviation	0.48	0.75	**	0.72	0.47	**	0.23	0.91	**	0.46	**
Chemical oxygen demand	lb	mean	11	7.8	5.3	8.4	11	**	**	11	16	9.3	27
		std. deviation	2.4	2.7	**	5.3	2.5	**	**	2.7	18	1.2	**
pH		mean	7.0	7.0	8.1	7.5	**	**	7.2	6.9	**	**	**
		std. deviation	0.45	0.34	**	0.57	**	**	**	0.56	**	**	**
Total Kjeldahl nitrogen‖	lb	mean	0.45	0.34	0.27	0.52	0.42	0.45	0.30	0.84	1.1	0.62	1.5
		std. deviation	0.096	0.073	0.045	0.21	0.11	0.12	0.063	0.22	0.24	0.13	0.54
Ammonia nitrogen	lb	mean	0.079	0.086	0.12	0.29	**	**	**	0.21	**	0.080	**
		std. deviation	0.083	0.052	0.016	0.10	**	**	**	0.18	**	0.018	**
Total phosphorus	lb	mean	0.094	0.092	0.066	0.18	0.087	0.11	0.071	0.30	0.30	0.23	0.54
		std. deviation	0.024	0.027	0.011	0.10	0.030	0.016	0.026	0.081	0.053	0.093	0.21

DDA Lab Analysis of Poultry Manure

2005 through 2009

Year	No. Samples	Total N %	Total N lbs/ton	Phosphate (P2O5) %P2O5	Phosphate (P2O5) lbs P2O5/ton	Total P % P	Total P lbs P/ton
2005	462	2.93	58.6	2.23	44.7	0.98	19.5
2006	589	2.77	55.4	2.05	41.1	0.90	17.9
2007	522	2.86	57.2	2.36	46.4	1.03	20.2
2008	472	2.83	56.6	2.35	48.5	1.02	21.1
2009	721	2.77	55.5	2.24	44.7	0.98	19.5
	2766 (total No. of samples)	2.83	56.7	2.25	45.1	0.98	19.7

averages

Manure Generation Estimates

- University of Delaware ..... 1.25 tons per 1000 birds
- University of Maryland ..... 1.0 tons per 1000 birds
- Penn State ..... 20 lbs per 1000 lbs of birds
  1.07 tons per 1000 small birds
  1.65 tons per 1000 large birds
- Arkansas ..... 1.025 tons per 1000 birds
- NRAES ..... 1.25 tons per 1000 birds
- Alabama ..... 0.6 lbs per lb of meat produced
  (~ 1.7 tons per 1000 birds)

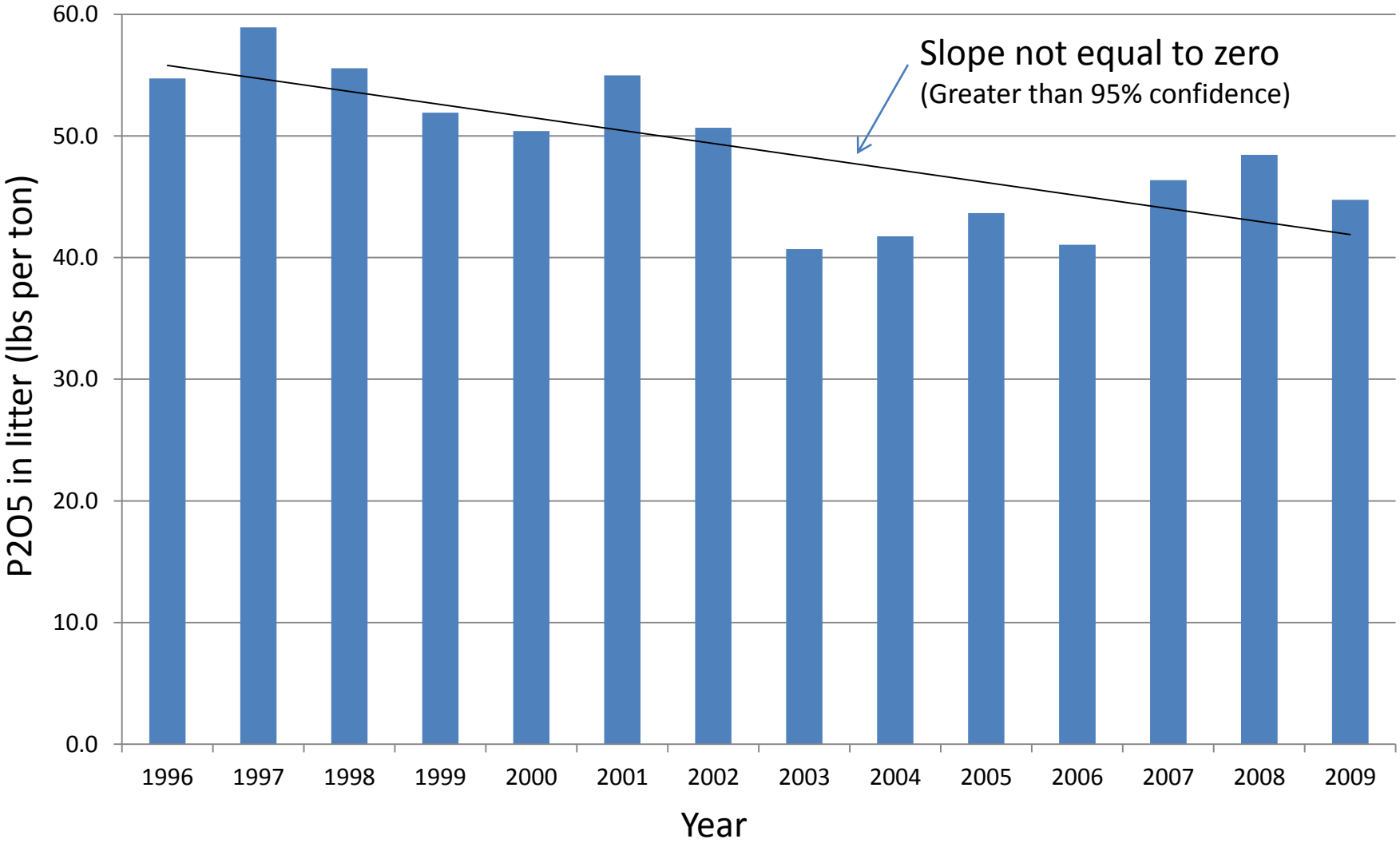
Case Study: *Sussex County, Delaware*

	EPA/ASAE Approach	units
Bird Inventory	43,620,576	# of birds on any given day (2007 Census)
Animal Unit Definition	455	# of birds per 1000 lbs of animal mass
Total Animal Unit Inventory	95,869	animal units on any given day
Manure Production	85	lbs of manure per animal unit per day
Total Manure Produced	1,487,174	tons wet excretion per year
Nitrogen Concentration	0.0129	lbs TKN per lb of manure
Phosphorous Concentration	0.0035	lbs Total P per lb of manure
Total Nitrogen Produced	38,491,563	lbs Total N per year
Total Nitrogen Not Volatized	35,332,221	lbs Total N per year
Total Phosphorous Produced	10,497,699	lbs Total P per year
Total Phosphorous Produced with 16% phytase credit	8,818,067	lbs Total P per year

	UD/DDA/UMD Approach	units
No of Birds	43,620,576	# of birds
No of Flocks per Year	4.8	flock per year
Total Number of Birds Produced	209,378,765	birds per year
Manure Production	1.25	tons per 1000 birds
Total Manure Produced	261,723	tons per year
Nitrogen Concentration	56.80	lbs Total N per ton
Phosphorous Concentration	19.50	lbs Total P per ton
Total Nitrogen Produced	14,839,720	lbs Total N per year
Total Phosphorous Produced	5,103,607	lbs Total P per year

Phosphorous Concentration Trend

Delaware



Implications and Current Status

- Genetics, feed technologies and improved growing environments have reduced waste produced from the poultry industry.

- Daily loading of nutrients may be much lower from agriculture and food production systems. (significant TMDL implications).

- Chesapeake Bay Program modelers are working with us to better understand/develop modern nutrient generation prediction models.

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- Five of six states analyzing local data
  - N and P concentrations
  - Delaware analyzing manure generation amounts from 800 poultry houses on Delmarva.

Questions?

Comments?