Economic Impacts of Changes in Phosphorus Regulation

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Background: Cropland application as highest value use of poultry litter (Lichtenberg, Parker and Lynch 2002)

- Value estimated at $11-25/ton, compared to $8.50/ton for pelletized product, $3-4/ton for compost, negative values as energy feedstock.
- More than enough cropland available for application at (previously estimated) environmentally sustainable rates.
- Emergence of market for poultry litter with prices $15-25/ton and reports of shortages supports analysis.

Intuition: Delmarva as an Integrated Broiler Production System

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Caveat: Cropland absorption capacity may have been overestimated.

- Allowable application rates may have continued to be excessive, leading to continued P buildup in soils.
  - Delmarva may be a net importer of P (imports in corn likely > exports in meat and eggs).
- Past practice may have led to oversaturation of P in more soils than previously acknowledged.
- Coale/McGrath analysis as corrective: conservative estimates of P status (err on the high side) and allowable application rates (err on the low side).

Implications of Coale/McGrath for Cropland Application Rates

Class	Share of Land		Application Rate	
	PSI	PMT	PSI	PMT
Upper Shore Maryland				
Low	85%	35%	5	3.5
Medium	12%	24%	2.667	1.5
High	3%	41%	1.5	0
Very High	0%		0	
Weighted Average			4.615	1.585
% Difference				-66%
Lower Shore Maryland				
Low	70%	5%	5	3.5
Medium	28%	14%	2.667	1.5
High	2%	81%	1.5	0
Very High	0%		0	
Weighted Average			4.277	0.385
% Differerence				-91%

Implications of Coale/McGrath Estimates for Cropland Application

	PSI	PMT
Upper Shore Maryland		
Corn Acreage	196,000	196,000
Average Litter Application Rate (Tons/Acre)	4.615	1.585
Potential Litter Usage on Corn	904,540	310,660
Total Litter Produced (Tons)	124,800	124,800
Poultry Litter Surplus (Deficit) Usage Capacity (Tons)	779,740	185,860
Lower Shore Maryland		
Corn Acreage	105,000	105,000
Average Litter Application Rate (Tons/Acre)	4.277	0.385
Potential Litter Usage on Corn	449,050	40,425
Total Litter Produced (Tons)	271,847	271,847
Poultry Litter Surplus (Deficit) Usage Capacity (Tons)	177,203	(231,422)
Maryland Eastern Shore Total		
Potential Litter Usage on Corn	1,353,590	351,085
Total Litter Produced (Tons)	396,647	396,647
Poultry Litter Surplus (Deficit) Usage Capacity (Tons)	956,943	(45,562)
Surplus (Deficit) as Percentage of Total Produced	241%	-11%

Implication: Stricter Regulation Unlikely to Require Much Export or Alternative Use of Poultry Litter

- Preceding analysis: deficit cropland application capacity in Maryland Eastern Shore as a whole amounts to only 11% of total litter produced.
- Coale/McGrath estimates may overstate phosphorus in soils, understate allowable application rates.
  - Caveat: Phosphorus may continue to build up in soils, reducing future absorption capacity.
- Perdue AgriRecycle takes ~80,000 tons of poultry litter annually, reducing supply available for cropland allocation by more than total estimated deficit.

Value of Poultry Litter as Fertilizer

	Application Rate (Tons/Acre)			
	1.5	**3.5**	**2.667**	**5**
N Value	$ 34.01	$ 79.37	$ 60.48	$ 113.38
P Value				
K Value	$ 25.90	$ 25.90	$ 25.90	$ 25.90
Hauling and Application Cost	$ 25.51	$ 25.51	$ 25.51	$ 25.51
Manure Test	$ 0.12	$ 0.05	$ 0.07	$ 0.04
Replacement Cost (Total)	$ 34.28	$ 79.71	$ 60.80	$ 113.74
Net Nutrient Value per Ton	$ 22.86	$ 22.77	$ 22.80	$ 22.75

Replacement Cost of Poultry Litter Nutrients

Maryland Region	Nutrient Value per Acre		Difference	Relative Increase in Production Expenses
	PSI	PMT		
Upper Shore	$ 105.00	$ 36.12	$ 68.87	11%
Lower Shore	$ 97.32	$ 8.78	$ 88.54	15%

Per-acre corn production expenses estimated at $600 (Maryland Crop Budgets 2015).

Conclusions

- Stricter regulation of poultry litter cropland allocation likely to have modest effects on
  - Need to export or find alternative uses of poultry litter.
  - Corn production costs.
- Caveat: Long run restrictions may need to be tighter if phosphorus continues to build up in soils.

Appendix: Assumptions Used to Calculate Nutrient Value of Poultry Litter

N Price	$ 0.52		
P Price	$ 0.59	per pound	Maryland Field Crop Budgets
K Price	$ 0.37	per pound	Maryland Field Crop Budgets
N Content	60	pounds per ton	Glancey, Udel Phosphorus in Poultry Litter Guidelines
P2O5 Content	40	pounds per ton	Glancey, Udel Phosphorus in Poultry Litter Guidelines
K Content	46.86	pounds per ton	MCE Manure Summary Report for 1995-2001, Solid with Litter
P2O5 Uptake-Corn	50	pounds per acre	
P2O5 Uptake-Soybeans	60	pounds per acre	
P2O5 Uptake-Wheat	60	pounds per acre	
K Uptake-Corn	70	pounds per acre	
K Uptake-Soyeans	50	pounds per acre	
K Uptake-Wheat	60	pounds per acre	
Poultry Litter Hauling	$ 8.69	per ton	MD Crop Budget Inputs worksheet
Poultry Litter Loading	$ 9.00	per ton	MD Crop Budget Inputs worksheet
Poultry Litter Spreading	$ 7.82	per ton	MD Crop Budget Inputs worksheet
Manure Test Cost	$40.00	per test	AgroLab (Delaware) Standard plus Water Extractable Phosphorus
Manure Test Cost	$60.00	per test	AgroLab (Delaware) NPK Plus Manure Nutrient Test
Average Corn Acres per Farm	221		Census of Agriculture 2012, Mid-Atlantic Lower Chesapeake Watershed
Nitrogen Availability Year 1	50.0%	30	
Nitrogen Availability Year 2	20.0%	12	
Nitrogen Availability Year 3	5.0%	3	
Discount Rate	8.5%		MD Crop Budget Inputs worksheet