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Can We Reduce Manure Nutrient Loading by Helping Producers to Calculate Its Economic Value?

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MAIN POINTS ADDRESSED BY MANURWKST.XLS AND WORKSHOPS

- Recognize that manure is both a valuable resource and a potential environmental concern.
- Analyze soil nutrient levels and determine crop needs.
- Analyze manure plant-available nutrient levels.
- Calculate manure application rates that maximize profitability.
- Consider other land parcels with greater nutrient needs.

MANURE/COMMERCIAL FERTILIZER DIFFERENCE

- Nutrients in commercial fertilizer are priced per unit, plus a small application fee.
- Nutrients in manure are usually “purchased/utilized” with application costs.
(Issues like nutrient availability, nutrient ratio, crop need, nutrient concentration, field location, etc., complicate value determination.)

MANURE TENDS TO HAVE A HIGHER RATIO OF P TO N THAN NEEDED BY CROPS.

Per 1,000 gallons

	N	P	K
Dairy manure, lb	25	11	33
Ratio N/P	2.27		

Per acre

Corn grain, lb	140	45	80
Ratio N/P	3.11		

An N-based rate commonly results in over-application of P. For example, here a rate of 5,600 gallons/acre would provide 140 lb/acre but would provide 62 lb/acre of P while the crop only needs 45 lb/acre of P.

Variability of Nutrients in Manure Must be Considered – Southeast MN Example

Specie	Nutrient	Average	Range
		lbs/1000 gal	
Dairy	N	29	10 – 47
	P2O5	15	6 – 28
	K2O	24	11 – 38
Swine	N	48	7 – 107
	P2O5	28	3 – 64
	K2O	21	7 – 51

Manure tests aren't always perfect but they are the best option.



Dairy Manure Nutrient Availability - First Year (Also Varies Widely)

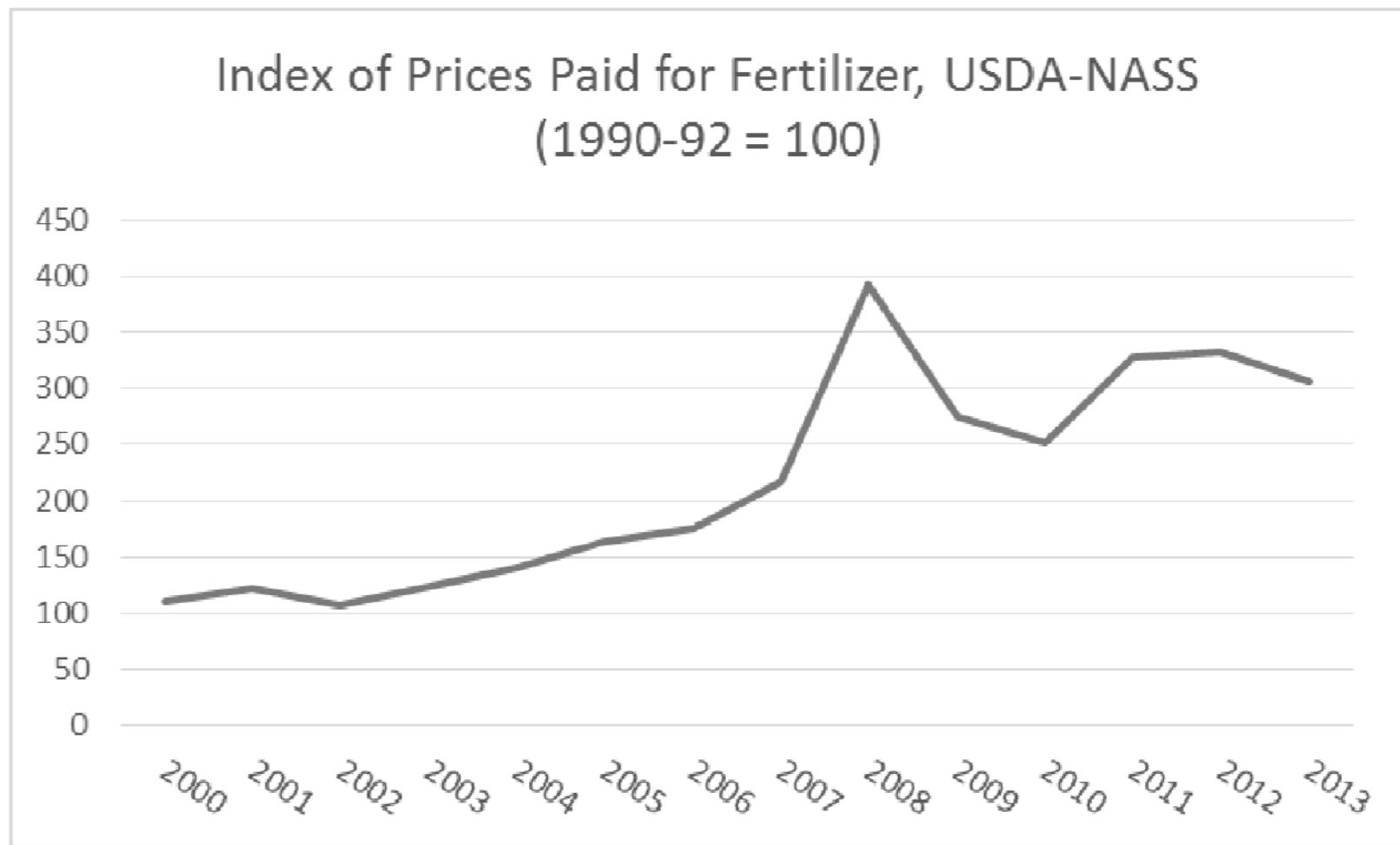
Nitrogen, by Manure Incorporation Method:

Broadcast - <12 Hours	55%
Broadcast - Incorporate 12-96 Hours	40%
Broadcast - No Incorporation	20%
Injection - Knife	50%
Injection - Sweep	55%
Phosphorus	80%
Potassium	90%

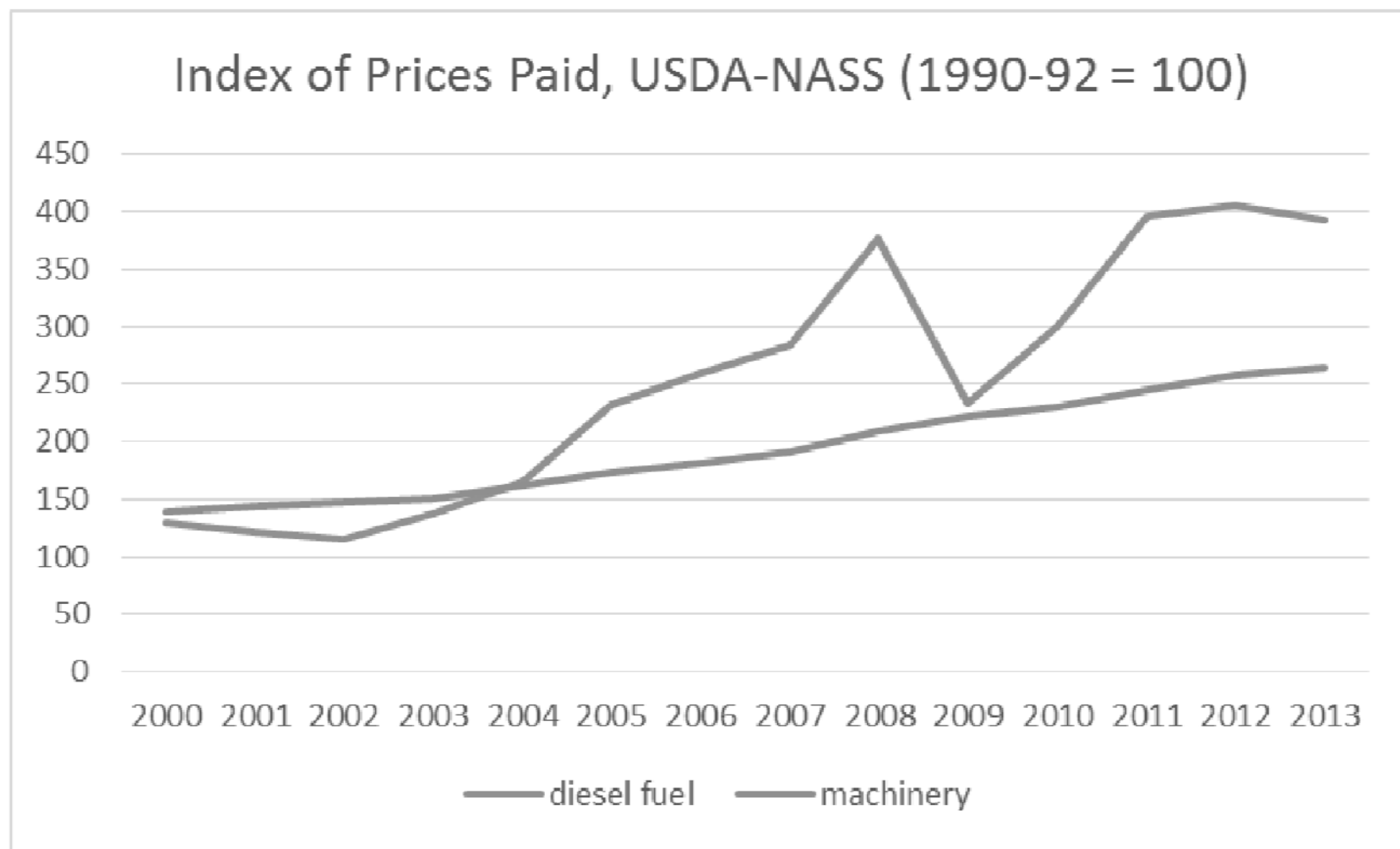
Source: N estimates are from Russelle, et al.,
<http://www.extension.umn.edu/distribution/livestocksystems/DI8583.html>



Corn fertilizer cost trends affect manure value.



Manure application costs have also been rising.



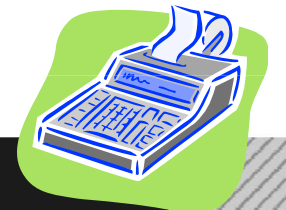
Net Economic Impact of Manure =
(usually on a per acre basis)

Value of Year 1 Fertilizer & Application Costs
Replaced

+ Residual Value (Mostly Year 2 if any)

+/- Yield (or other) Response/Cost

– Manure Application Costs



SPREADSHEET STEPS

- Step 1: Determine The Value of Nutrients Needed for First Year Crop Production.
- Step 2: Calculate the Value of Required Nutrients That Are Applied With Manure (for First Year Crop Production)
- Step 3: Calculate the Value of Applied Nutrients That Will Replace Second Year Purchases Or Are Desired to Improve Soil Fertility Levels



SPREADSHEET STEPS

- Step 4: Adjust For Yield or Other Factors
- Step 5: Subtract Application Costs
- Step 6: Calculate Total Net Value of Manure Application Per Acre, Per 1000 Gallons, and for Facility or Operation

Manurwkst.xls Spreadsheet Calculations – Dairy Slurry Manure

	9,000 gallon/acre rate			
	Total	N	P	K
1. Nutrients that would be applied to this field with commercial fertilizer if no manure was used - N, P, K # Per Acre		140	70	100
2. Commercial fertilizer value (applied) Per Unit of N, P & K, \$/lb.		\$0.41	\$0.41	\$0.35
3. Value of individual fertilizer nutrients that would be applied to this acre (line 1 x 2)		\$57	\$29	\$35
4. Cost of applying commercial fertilizer (per acre)	\$16			
5. Total value of fertilizer nutrients that would be applied to this acre (sum of line 3 values plus application cost)	\$137			
6. Gallons of manure applied per acre	9,000			

What is Manure Worth?

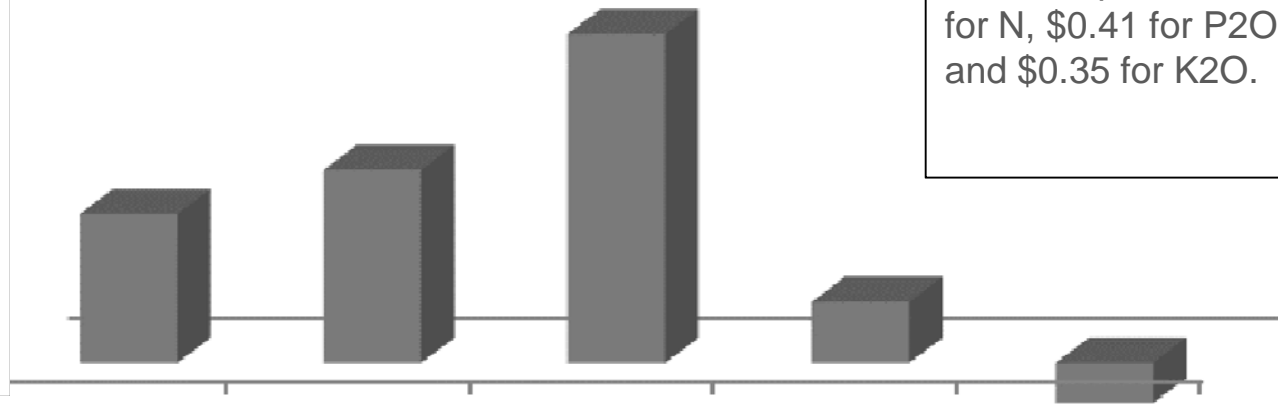
	9,000 gallon rate			
	Total	N	P	K
7. Nutrients per 1000 gallons (from manure test)		31	15	22
8. Estimated nutrient availability (%)		55%	80%	90%
9. Pounds of available nutrients applied with manure per acre (line 6 x line 7 x line 8 ÷ 1000)		153	108	178
10. Value of "needed" nutrients applied with manure, N, P, & K (line 2 x the smaller of lines 1 and 9)		\$57	\$29	\$35
11. Total value of "needed" nutrients applied with manure ((sum of N, P, & K in line 10) + cost of commercial fertilizer Application)	\$137			
12. Cost of applying these manure nutrients per gallon, \$/gal	\$0.01			
13. Total cost of manure application per acre (line 6 x line 12)	\$90			
14. Value of "needed" nutrients minus cost of manure application per acre (line 11 minus line 13)	\$47			
15. Per acre adjustment for yield impact (\$ Plus or Minus)	\$20			

What is Manure Worth?

	Scenario 1			
	10,200 gallon rate			
	Total	N	P	K
16. % of applied nitrogen available for year 2		25%		
17. Potential nutrients available in year 2		70	38	78
18. Nutrients that will be used and credited in year 2 (or later for P & K)		25	0	0
19. Individual value of residual nutrients (year 2), per acre		\$10	\$ -	\$ -
20. Total value of residual nutrients (year 2) per acre	\$10			
21. Net per acre value of manure application in excess of application cost (line 14 + line 15 + line 20)	\$78			
22. Net value of manure per 1000 gallons (line 21 ÷ line 6 (expressed in 1000 gallon units))	\$8.62			
Farm totals				
23. Gallons of manure to be applied	1,000,000			
24. Acres receiving manure	111			
25. Net value of manure application in excess of application cost	\$8,622			



Net Return Per 1,000,000 Gallons Manure

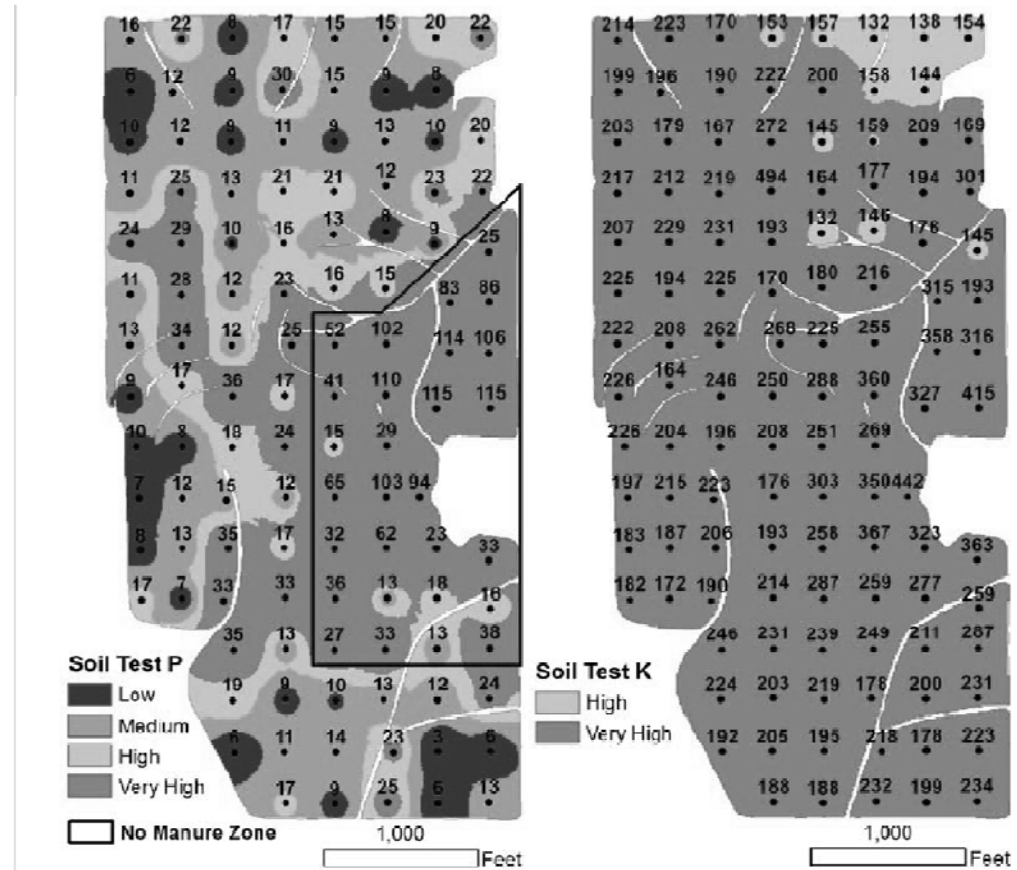


Fertilizer prices are \$0.41 for N, \$0.41 for P₂O₅, and \$0.35 for K₂O.

\$8,622 \$11,191 \$19,088 \$3,533 \$-2,338

	Dairy, N-based	Dairy, P	Swine, N	Swine, N	Swine, N
Crop Need	140-70-100	140-70-100	140-45-40	140-45-40	140-0-0
Manure Test	31-15-22	31-15-22	45-28-29	25-25-24	25-25-24
App. Rate, gal./acre	9,000	6,000	4,000	10,000	10,000
App Cost/ Gal., \$	\$0.01	\$0.0125	\$0.015	\$0.01	\$0.01
Residual Value, \$/a	\$10	\$10	\$10	\$10	\$10
Yield Impact, \$/a	\$30	\$30	\$30	\$30	\$0
# Avail. N Applied/a	153	102	144	138	138
# Avail. P₂O₅ Applied/a	108	72	90	200	200
Acres Covered	111	167	250	100	100

Grid Sampling Can Address Soil Test P and K Levels That Are Highest Near the Barn.



Soil Test P (Bray 1-P) and Soil Test K in ppm with University of Minnesota soil test classes

MAXIMIZING THE ECONOMIC BENEFITS OF MANURE TO REDUCE NUTRIENT LOADING (2008-2012)

- Funding for this study was provided by Minnesota Pollution Control Agency, Section 319 Nonpoint Source (NPS) Management Program from E.P.A.

PROJECT GOALS

- Present small-group educational workshops around the Minnesota to assist producers and agricultural professionals in determining the value of manure, and
- Conduct on-farm research addressing the timing of manure applications



THE TEAM

- Jim Anderson, Les Everett, Ann Lewandowski, Faye Sleeper (Water Resources Center)
- Bill Lazarus (U of M Extension, Applied Economics)
- Bob Koehler (U of M Extension, Livestock Systems)
- Jose Hernandez (U of M Extension, Nutrient Management)
- Gyles Randall (U of MN Extension, Soil, Water, and Climate)
- U of MN Extension Educators, SWCD, Feedlot Officers.

WORKSHOP GOALS

- Show how to determine what the \$ value is for a given amount of manure...
- in so doing recognize ways to adjust management to increase that amount...
- and benefit both economically and environmentally

WORKSHOPS

- 45 Workshops (2009 – 2010)
- 27 Counties in MN
- 418 producers
- ~9 producers per workshop



WORKSHOP METHODOLOGY

- 3-hour workshop is coordinated by Extension Educators, County Feedlot Officers, SWCD personnel.
- Pre- Workshop Survey
- “What is Manure Really Worth?”
- Manurwksst demonstration
- Hands-on work with Manurwksst
- Discussion
- Workshop Evaluation

What's Manure Worth?
 UNIVERSITY OF MINNESOTA
 EXTENSION
 by Bill Korte, Bill Larson, and Bill Weber
 Add the spreadsheet
 Fields and Limitations

Last modified on 3/18/12

Level: Step 1: Fertilizer Costs if Using No Manure
 (Enter Year Data in the Cells Formatted in RED)

Enter the Following Values.		Help in Calculating Nutrient Costs	
		Nutrient	Costs per lb.
1	Nitrogen (lb)	50.38	
2	Phosphate (P ₂ O ₅)	50.01	
3	Potash (K ₂ O)	50.00	

Nutrients Needed per Acre		
Do not include starter fertilizer amounts as manure will not replace starter.		
4	Nitrogen (lb)	110 lbs/acre
5	Phosphate (P ₂ O ₅)	50 lbs/acre
6	Potash (K ₂ O)	70 lbs/acre
		(N - P ₂ O ₅ - K ₂ O)
Required Nutrients (from above)		110 - 50 - 70
Total Cost of N, P ₂ O ₅ , and K ₂ O		\$114.53

7	Cost of Purchased Micro nutrients per Acre	50.00	/acre
8	Net Fert. Application Cost (avoided when Manure Covers Need)	50.00	/acre
9	Net Fert. Application Cost (avoided)	55.00	/acre
10	Total Cost for Applied Commercial Fertilizer	\$125.53	/acre

Go to step 2 Help Display More Scenarios

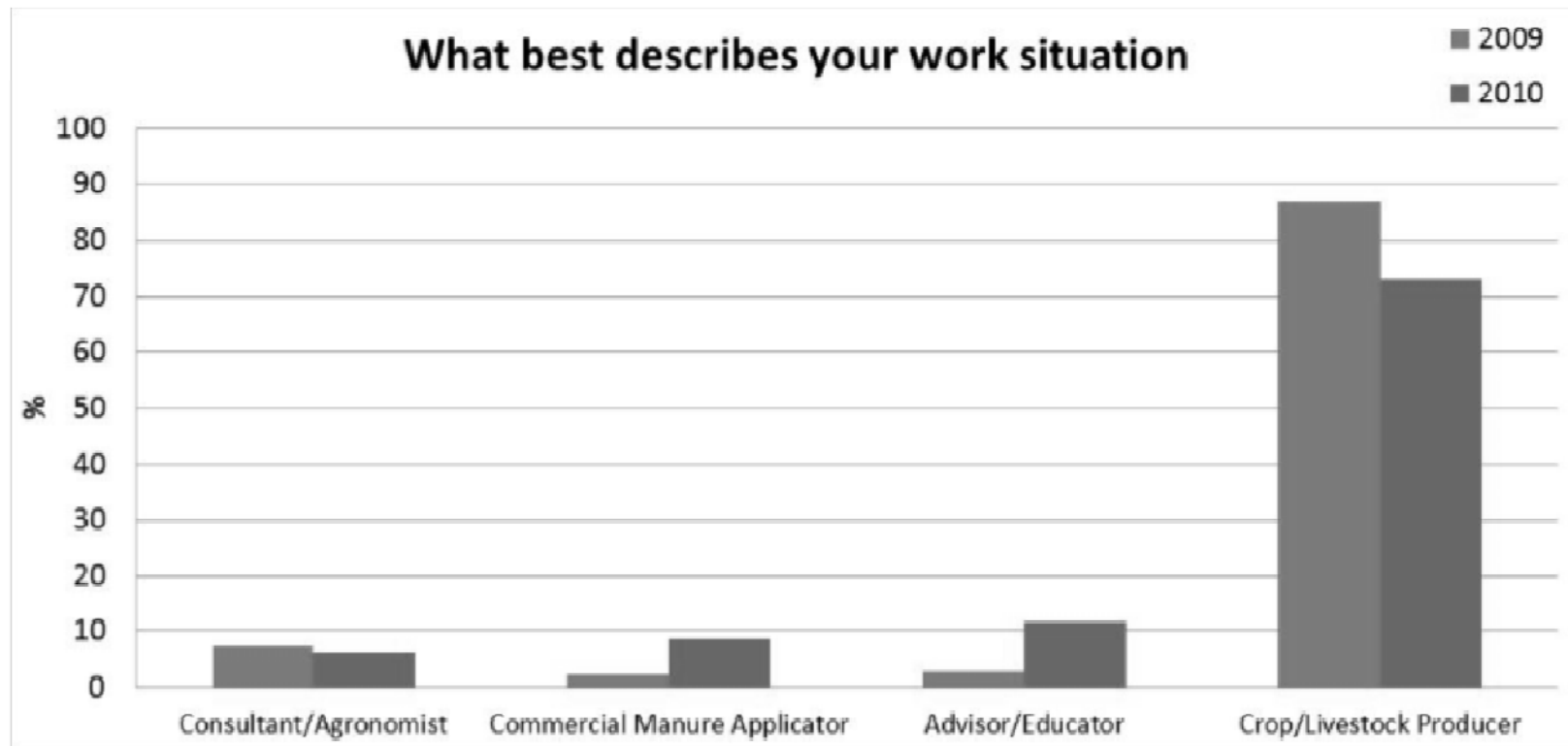
Manurwksst screenshot

WORKSHOP METHODOLOGY

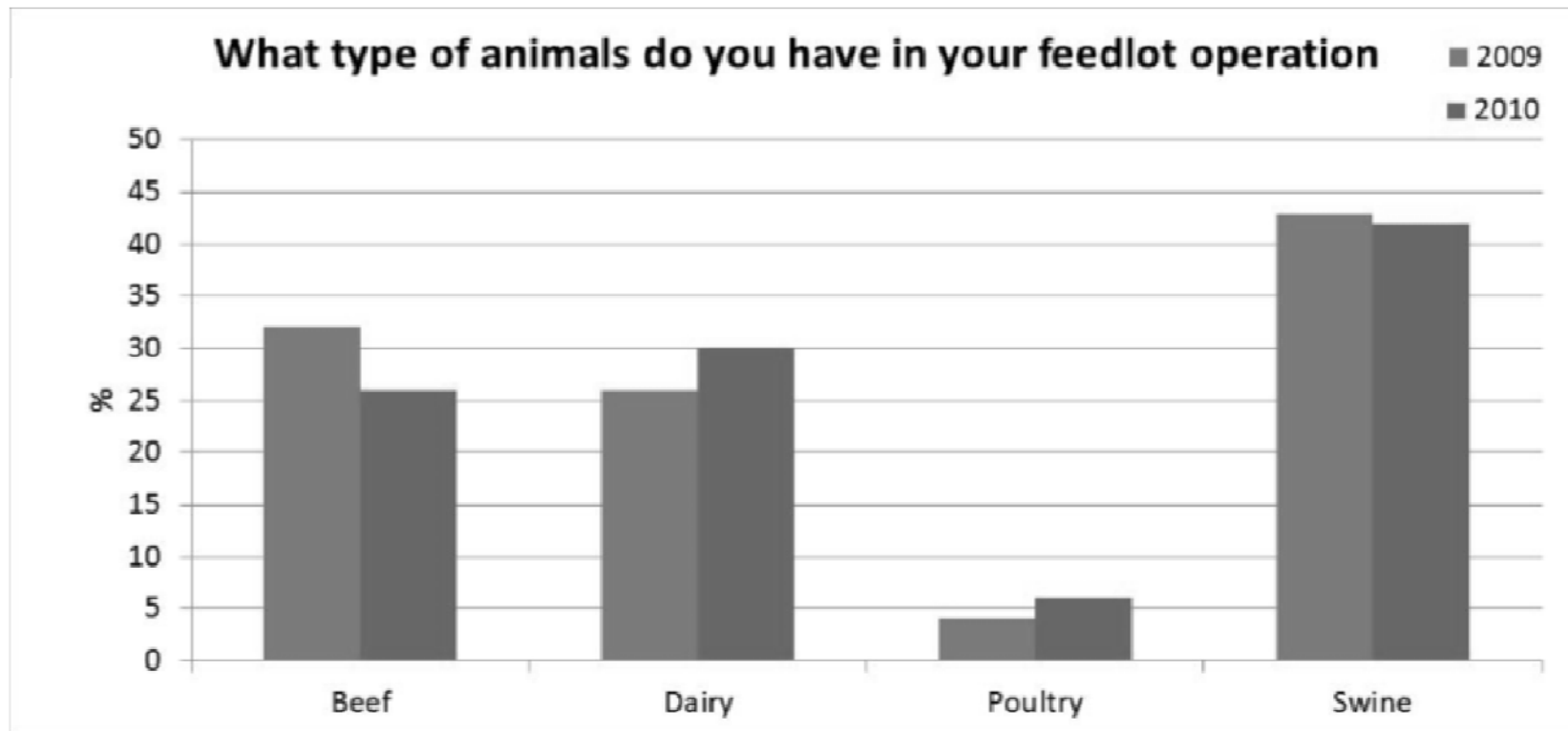
- Producers are asked to bring the following information about their operations:
 - Fertilizer type, prices and applications costs
 - Amount of nutrients to be applied to a given crop (inc. micronutrients).
 - Manure information: Specie, type (liquid/solid), volume produced by the operation, acres available for manure application, soil tests, application method, manure chemical analysis, application costs.



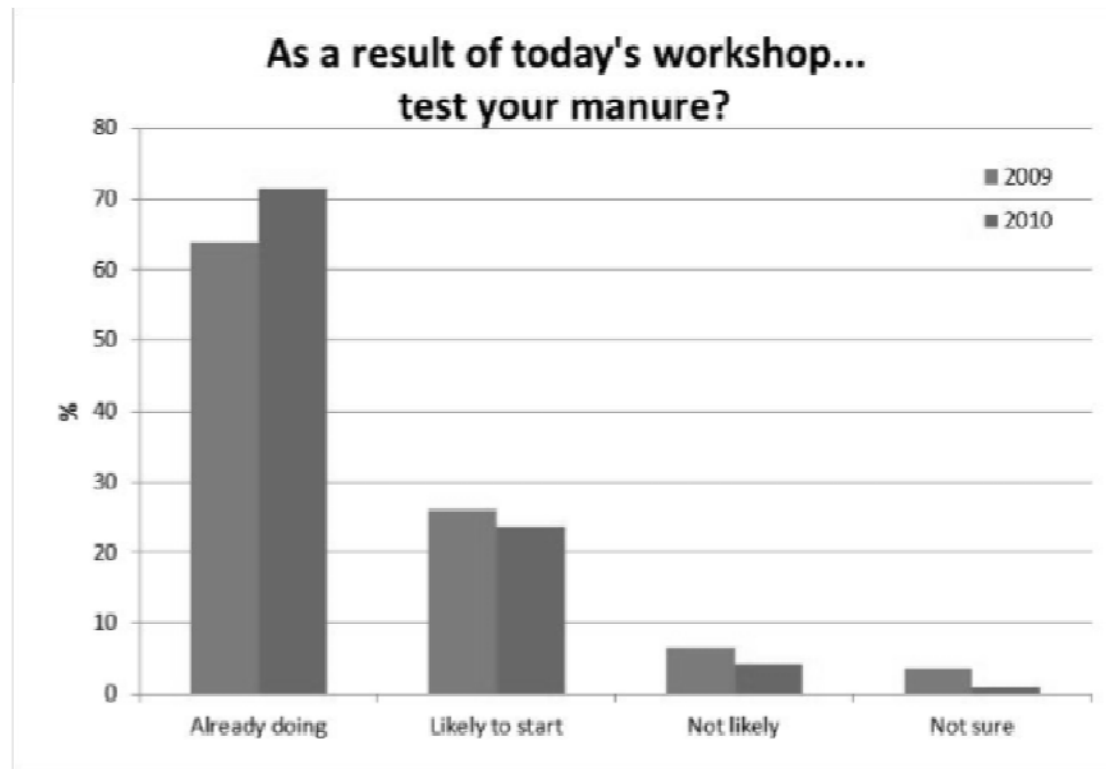
PRE – WORKSHOP SURVEY



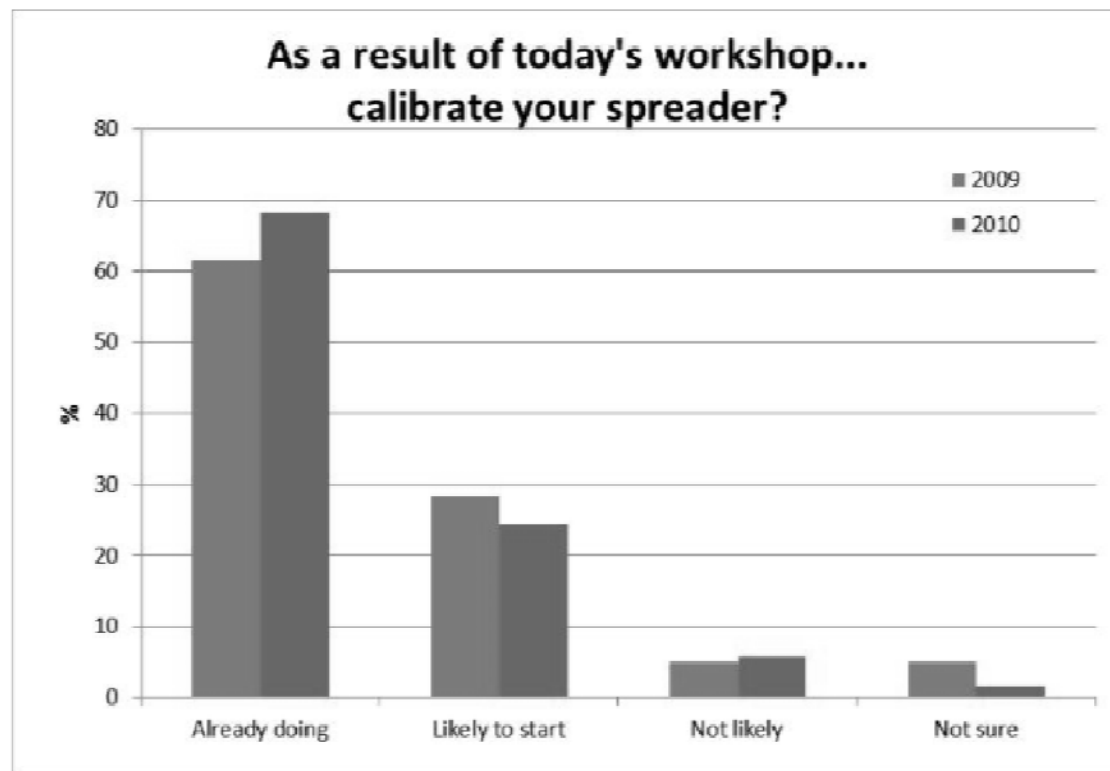
PRE – WORKSHOP SURVEY



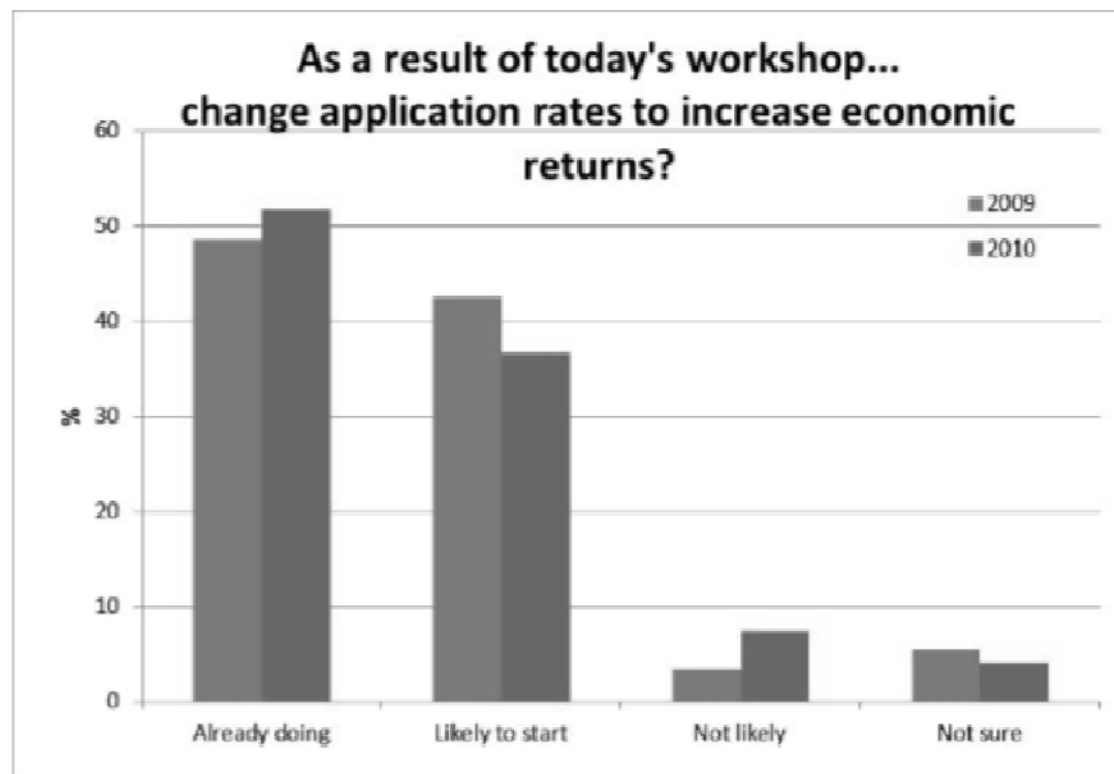
POST – WORKSHOP SURVEY



Post – Workshop Survey



Post – Workshop Survey



Post – Workshop Survey



Post – Workshop Survey



POST – SEASON SURVEY

- In late 2010, a survey of producers who had previously attended the value of manure workshops was carried out to determine rates of adoption of best management manure practices. The survey and reminders were sent to those that provided email addresses (187) with 58 responses. Results from these respondents are as follows:
 - 62% are producers, 9% consultants/agronomist, 5% commercial applicators, and 25% advisors/educators.
 - 67% are using the Manure Economics Worksheet presented in the workshops.
 - 77% are keeping field-based records of manure applications, and 17% are likely to begin.

Post – Season Survey

Practice	Had previously implemented %	Started Implementing %	Planning to Implement %	No Plans to Implement %
Annual manure testing	78	17	3	2
Spreader calibration	55	14	14	17
Credit manure nutrients fully	60	16	14	10
Inject or immediately incorporate manure	91	3	3	2
Change manure application rates to increase economic returns	60	14	14	12
Rotate applications among fields to increase economic returns	72	16	7	5

Producers were asked, based on their use of the spreadsheet on their farms, how much economic improvement in manure return per acre they achieved:

None	28%
\$1 - \$5/acre	26%
\$5 - \$10	22%
\$10 - \$15	16%
\$15 - \$25	7%
>\$25	2%





Download spreadsheet at:
<http://z.umn.edu/manureworth>

Thank you.

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