

Managing Nutrients in Manitoba's Livestock Industry

Alan Baron
Hog Production Industry Review
April 18, 2007

Outline

- ❑ Personal Background
- ❑ History
- ❑ Nutrient Management
 - ❑ Manure Application
 - ❑ Regulations
 - ❑ Nitrogen
 - ❑ Phosphorus
- ❑ Conclusions and Future Directions

Personal Background

- Farming Background
 - mixed grain, oilseed and potato operation
 - Livestock 3 year rotation of manure
- Personal On-Farm Experience (early 90's)
 - soil and water management issues
 - government, research and other parties
- Environmental Issues
 - Industrial Waste Water
 - Hog Industry

History

- Pork Industry in Manitoba
- Trade-offs
 - Economic Growth versus Environmental Sustainability
 - Competing Interests
 - Hog Producers versus Environmentalists
 - Government Departments
- Crossroads for Livestock Industry

Nutrient Management

Manure Application

Manure – Natural Fertilizer

Source of Essential Nutrients

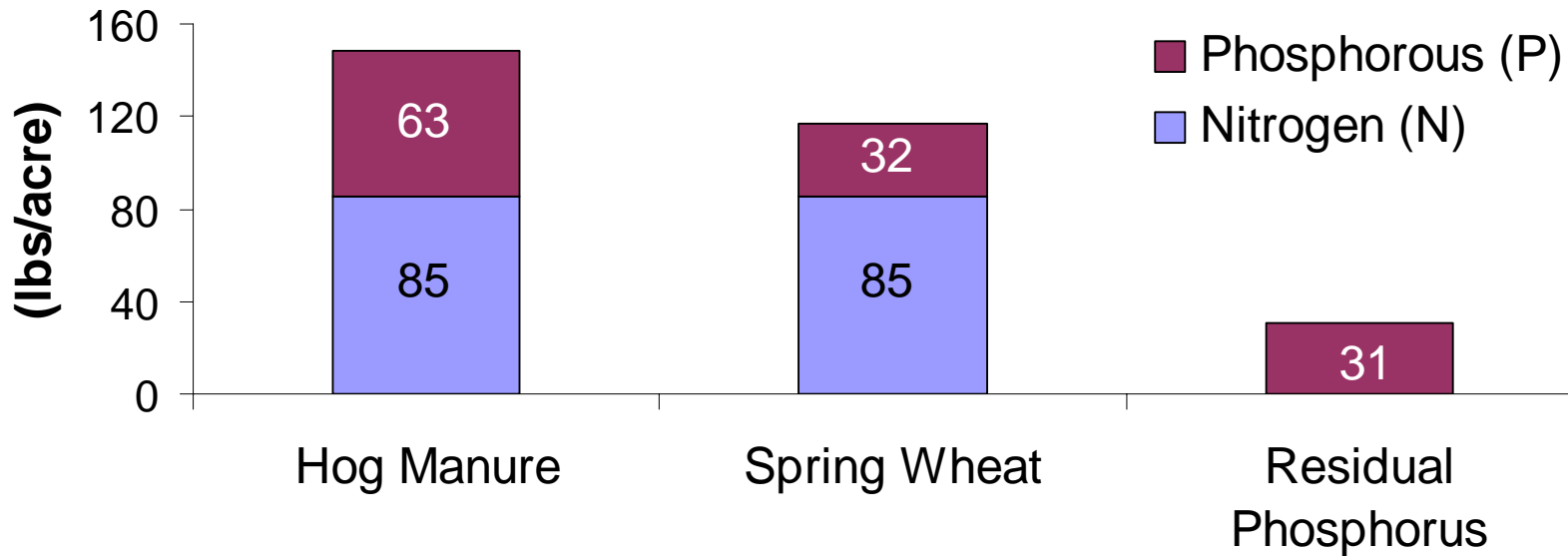
- Nitrogen (N)
- Phosphorus (P)
- Others such as potassium (K), sulphur (S), etc.

Balance of Nutrients

- Manure Content vs Crop Requirements

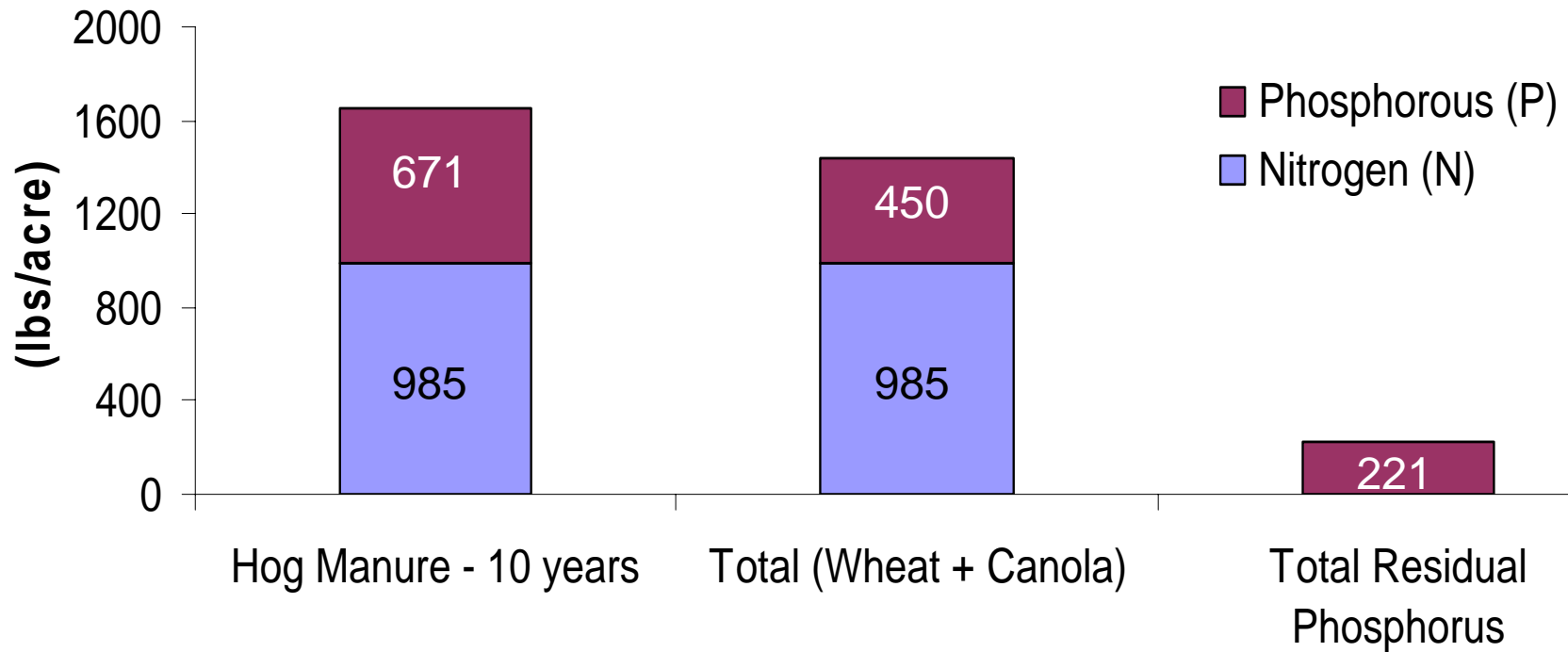
Nutrient Management Manure Application

**Residual Phosphorus - 1 Year of Hog Manure Application
Spring Wheat (40 bu/ac)**



Nutrient Management Manure Application

Residual Phosphorus - 10 year Wheat/Canola Rotation



Nutrient Management

Manure Application

1994 – Guidelines for Manitoba Hog Producers

- Land Base Requirement

- What is an animal unit (AU)?
- manure generating 73 kg or 160 lbs nitrogen (N)

TABLE 18: LAND BASE REQUIRED FOR MANURE APPLICATION, ACRES

STEP 1:	Number of Livestock	_____	(A)
	Animal Unit Factor (Table 17)	_____	(B)
	Total Animal Units (A x B)	_____	(C)
STEP 2	Storage and Application Factor (Table 15)	_____	(D)
STEP 3	Soil and Crop Nitrogen Utilization Factor (Table 16)	_____	(E)
STEP 4	Days in Feeding Location	_____	(F)
STEP 5	Acres Required for Feeding Location (C x D x E x F / 365)	_____	

Nutrient Management

Manure Application (N-based)

- **1994** – maximum application rates recommended:
 - Medium to heavy soils 90 lb/acre
 - Light soils 70 lb/acre
- **1997** – max application rates increased:
 - Medium to heavy soils Max 140 lb N / acre (top 4 ft)
 - Light soils Max 90 lb N / acre (top 4 ft)
 - Alfalfa Max 275 lb N / acre (top 4 ft)
- **1998** (Regulation no 42/98)
 - Same rates as 1997, but reduced soil sampling depth to top 2 ft
- **2004** – max application rates based on *soil classes*
 - *i.e. Soil Class 1,2,3 (“capable of sustained production of common field crops) – allowed 140 lb N/acre in top 2 ft x 2, or 280 lb/N/acre during growing season*

Nutrient Management

Manure Application (P)

- **Different terms / units of measurement**
 - ppm, P (elemental Phosphorous), & P_2O_5 (phosphate)
 - “Soil Test P” is measured using the “Olsen method”
- **Multiple terms cause confusion**
 - Ensure calculations and rates are “*comparing apples to apples*”
 - i.e. $10 \text{ ppm} = 20 \text{ P} = 46 \text{ P}_2\text{O}_5$

Nutrient Management

P Agronomics vs Manure Application Regulations

AGRONOMIC RECOMMENDATIONS FOR P

Soil Test P**Rating**

20+ ppm

Very high

0 to 10 P₂O₅ / acre for cereals, max 25 P₂O₅ for legume

MANURE MANAGEMENT RECOMMENDATIONS FOR P (effective Jan, 2006)

Soil Test P**Rating**

<60 ppm

low risk

no limit based on P content

60 - 119 ppm

medium risk

2 x crop removal rate of P is allowed

120 - 180 ppm

high risk

1 x crop removal rate of P is allowed

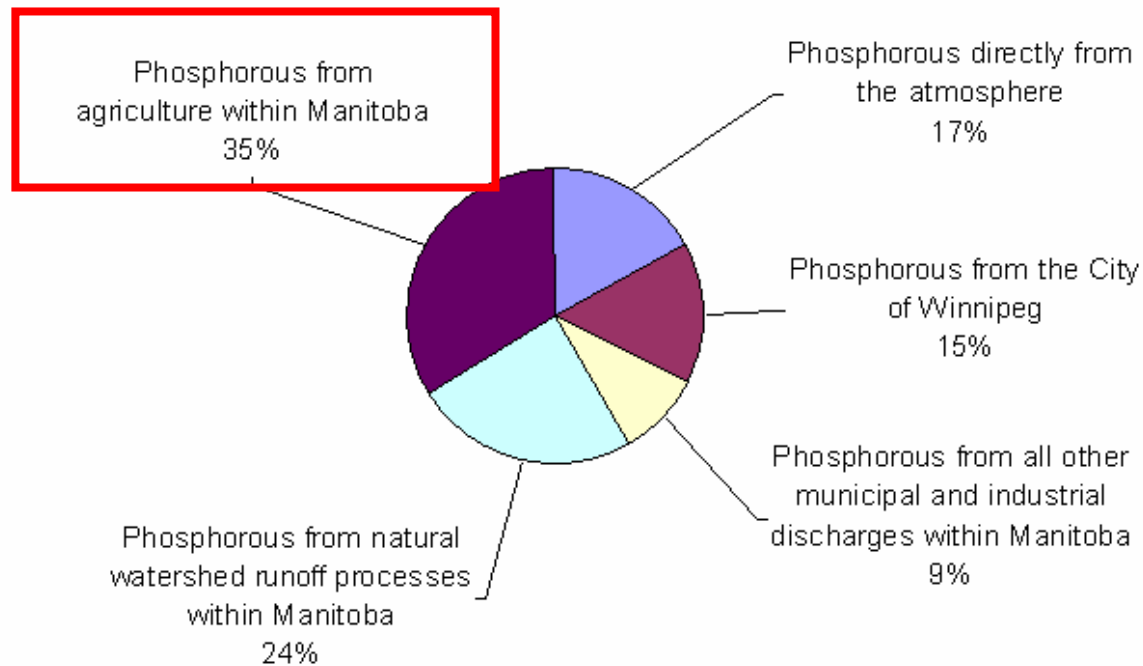
Crossroads for Manitoba's Hog Industry

1. In summary, changes to regulations have allowed for increasing amounts of residual nitrogen (N)
2. However, the phosphorus (P) content of manure has recently become a major concern
3. Has the push for economic growth via Manitoba's hog industry compromised the environment, and at what cost?
4. Can we restore balance between economic growth and environmental sustainability?

Nutrient Management

Dealing with the Phosphorus Content of Manure

Manitoba Sources of Phosphorous to Lake Winnipeg (tonnes/yr)
Source: Lake Winnipeg Stewardship Board - Interim Report, January 2005



Nutrient Management

Dealing with the Phosphorus Content of Manure

- In certain scenarios, managing manure based on nitrogen (N) content has resulted in elevated levels of soil phosphorus (P)
- Managing manure as a fertilizer, taking into consideration the P utilization of crops, is a more sustainable practice

“By strict regulation, manure can only be applied to the land as fertilizer.”

i.e. Applied manure application rates should not exceed crop removal rates

SOURCE: (The Truth Matters, MPC Advertisement, June 2002)

Nutrient Management

Dealing with the Phosphorus Content of Manure

Appendix Table 12. Phosphorus recommendations for field crops based on soil test levels and placement.

Soil phosphorus (sodium bicarbonate P test)			FERTILIZER PHOSPHATE (P ₂ O ₅) RECOMMENDED lb/ac															
			Cereal		Corn Sunflower		Canola Mustard		Buckwheat Faba beans		Flax		Peas Field beans Lentils		Legume forages		Perennial grass forages	
ppm	lb/ac	Rating	S ¹	Sb ²	B ³	S ¹	B ³	S ¹	B ³	S ¹	B ³	S ¹	B ³	S ¹	seeding PPH ⁴	Est stand BT ⁵	seeding PPH ⁴	Est stand BT ⁵
0	0	VL	40	40	40	20	40	20	40	0	40	20	75	55	45	30		
	5	VL	40	40	40	20	40	20	40	0	40	20	75	55	45	30		
5	10	L	40	40	40	20	40	20	40	0	40	15	75	55	45	30		
	15	L	35	35	35	20	35	20	35	0	35	15	65	50	35	25		
10	20	M	30	30	30	20	30	20	30	0	30	10	60	40	30	20		
	25	M	20	20	20	20	20	20	20	0	20	10	50	35	20	15		
15	30	H	15	15	15	0	15	20	15	0	15	0	45	30	15	10		
	35	H	10	10	10	0	10	20	10	0	10	0	35	25	5	5		
20	40	VH	10	10	10	0	10	20	10	0	10	0	30	20	0	0		
20+	40+	VH+	10	10	10	0	10	20	10	0	10	0	25	20	0	0		

20+ ppm
= very high

S¹ – seed placed rates

Sb² – side banded rates for row crops

B³ – banded away from the seed

PPH⁴ – for forages phosphorus is applied most effectively by banding 1 inch to the side and below the seed. If phosphate cannot be banded, then broadcast and preplant incorporate.

BT⁵ – broadcast for established stands of forages

Est stand = established stands of forages

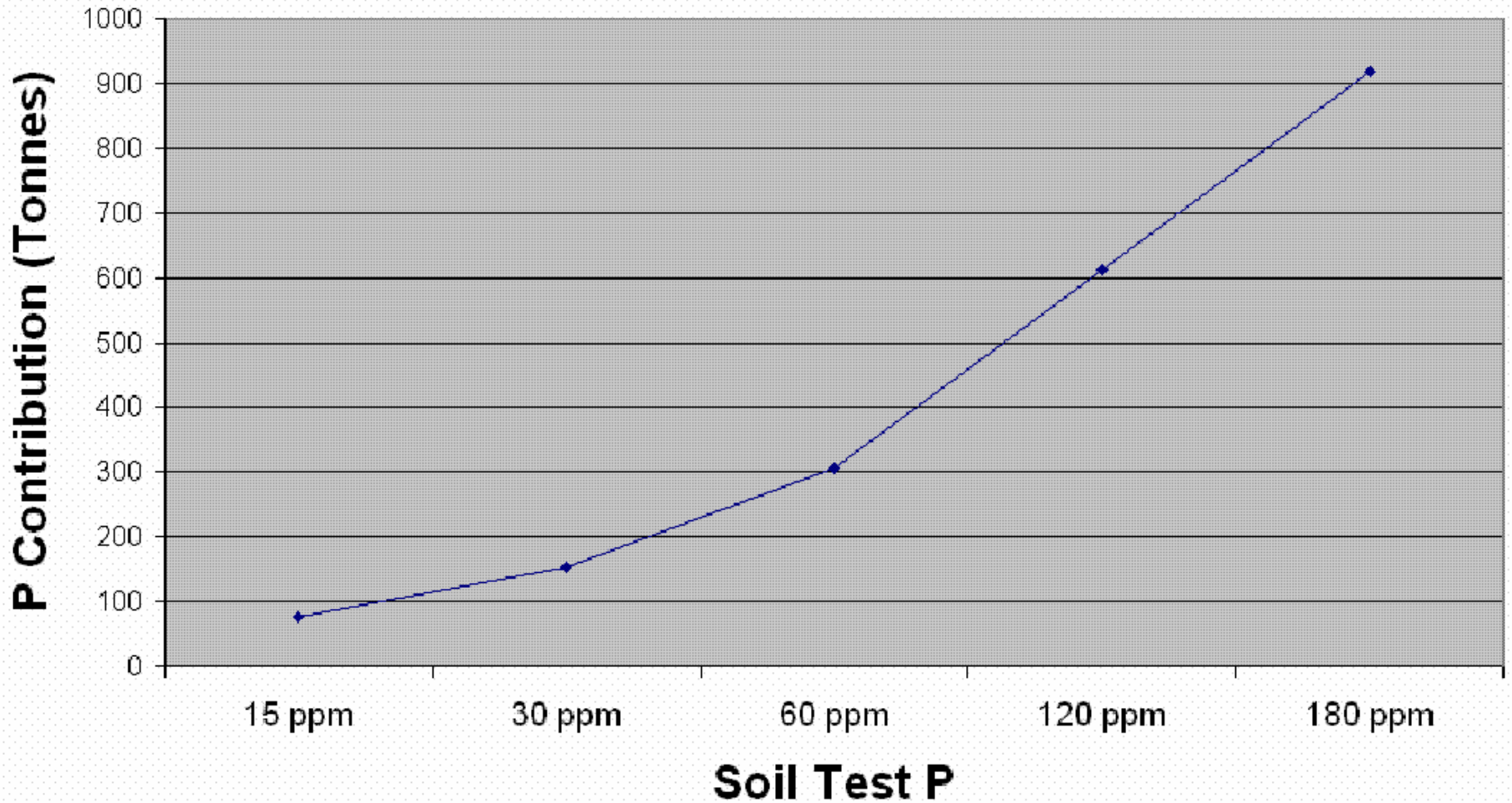
Source: Manitoba Fertilizer Recommendation Guidelines Based on Soil Tests:

[Http://www.gov.mb.ca/agriculture/soilwater/soilfert/fbd02s16.html#12](http://www.gov.mb.ca/agriculture/soilwater/soilfert/fbd02s16.html#12)

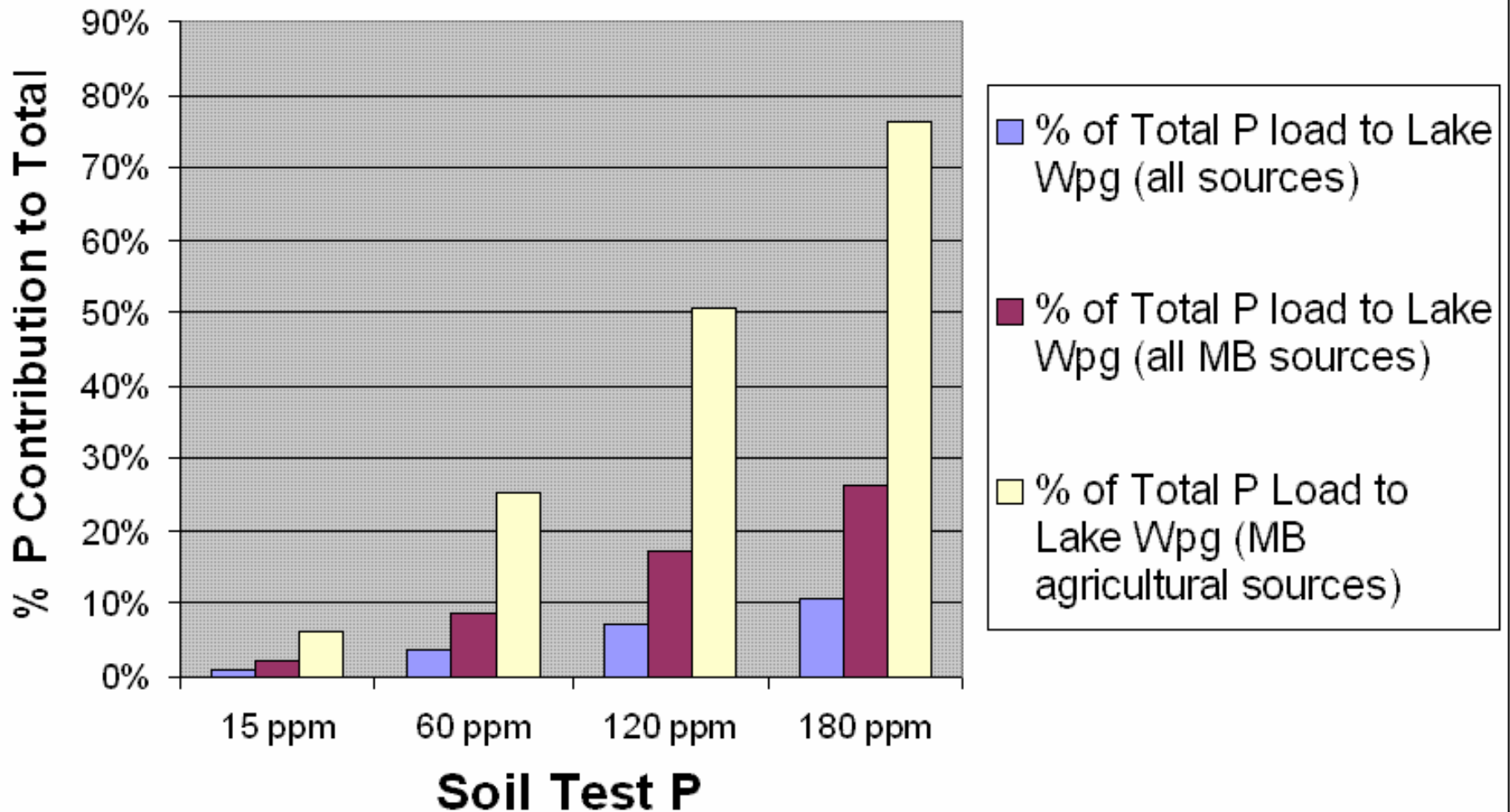
Impact of “Soil Test P” on Phosphorous Loading Risk to Lake Winnipeg

- High soil test P values are common in fields fertilized with hog manure
- As soil test P increases, the risk of phosphorous loading to surface water increases at the same rate.
- This relationship can be illustrated by using phosphorous source data presented by the Lake Winnipeg Stewardship Board – Interim Report, January 2005.
- It is possible to isolate the average level of P loading per acre based on different starting soil test P values...

Soil Test P and P Contribution to Lake Winnipeg, Manitob Hog Industry, Revised Data



Soil Test P and P Contributions to Lake Winnipeg, Manitoba Hog Industry



2006 Hog Industry Facts & Assumptions

(As stated by MPC in a presentation posted on their website “The Hog Industry in Manitoba”)

Category	N	P
Tonnes Excreted (2006)	29,847	10,995
Estimated Average Crop Removal Rate	99.5 kg/ha/yr	15 kg/ha/yr
Crop land area required to recycle nutrients excreted	300,000	744,000

- MPC requires 2.44 times more land area, or an additional 444,000 ha, to sustainably manage phosphorous
 - inputs cannot exceed crop removal rates
 - science-based crop removal calculations ignored until now.

SUMMARY

- 1) MB Hog Industry – Unsustainable Manure Management
 - 10-15 years
 - N-based application rates lead to P accumulation

- 2) Lake Winnipeg – Phosphorus Loading
 - P-loading will increase under current management practices

- 3) Environment versus Economics
 - **Land base to manage nutrients (N and P) in a sustainable agronomic manner**
 - **Pressure from Hog Industry to compromise**
 - Economics of manure management - the “waste bucket” approach
 - Environmental stewardship and the protection of MB water

Effectiveness of MB Manure Management Regulations

- Regulations - incentives used to motivate compliance
 - rewards, penalties, monitoring and enforcement
- Saying that MB regulations are amongst the most strict in the world...**DOES NOT MAKE THEM SUSTAINABLE!**
- Low level fines and deterrents facilitate pollution
 - More often than not, farm economics dictate producer's behaviour
 - commitment to environmental stewardship
- **From 1998/99 to 2005/06, MB Livestock Manure & Mortalities Management Regulation reported:**
 - **115 prosecutions and 398 warnings**
 - **Only \$129,579 in fines collected**

Livestock Manure & Mortalities Management Regulation

Summary Enforcement Activities 1998/99 to 2005/06

Fiscal Year	Prosecutions	Warnings	Orders	Fines (\$)
1998-99	12	32	7	11,862.
1999-00	9	35	10	8,496.
2000-01	16	49	22	8,067.
2001-02	16	53	34	11,903.
2002-03	15	59	21	20,280.
2003-04	19	54	57	23,076.
2004-05	16	63	45	36,960.
2005-06	12	53	35	8,935.
TOTALS	115	398	231	129,579.

Average fine per violation:

= \$129,579 Total fines collected / 115 prosecutions = \$1,127 per prosecution

http://www.gov.mb.ca/conservation/envprograms/livestock/pdf/livestock_enforcement_activities_1998_99_to_2005_06.pdf

Conclusions

- 1. Manitoba's hog industry needs to operate in an environmentally sustainable manner**
- 2. Current manure management regulations do not represent a sustainable benchmark.**
- 3. For science-based manure management regulations, MB's hog industry must not condone application rates that exceed the crop removal rate of N, P, and other nutrients.**
- 4. Ineffective monitoring and enforcement of manure application regulations has contributed to current problems in MB's hog industry**

FUTURE DIRECTIONS

- Nutrient Thresholds must be based on:
 - ability of crops to use nutrients
 - consider residual nutrients applied in previous years
 - NOT holding capacity of soil
- Conduct field testing and publicize results on an ongoing basis
 - acquire funding to assess and monitor P transport risks throughout the province
 - ensure accountability of regulators and producers

FUTURE DIRECTIONS

- **Land base**
 - **Hog industry requires 2.44 times the area currently used**
 - **stop P accumulation of MB soils**
 - **prevent P loading of MB water resources.**
- **Lesson learned - take things slow**
 - **ambitious growth contributed to the current situation**
 - **ignored the science of P recycling rates; crop recycling of P**
- **Maintain a proactive approach**