How Much Land Will Be Needed for Manure Disposal in a Changing Regulatory Climate?

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- Historically applied manure to meet crop N needs

- Issues
  - N to P ratio
  - Soil P build-up
  - P and water quality
  - Field P variation

Available nutrient content from dairy manure

	N (surface/incorporated)	P_2O_5	K_2O
Solid *(lb/ton)*	3 / 4	3	8
Liquid *(lb/1,000 gal)*	8 / 10	8	21

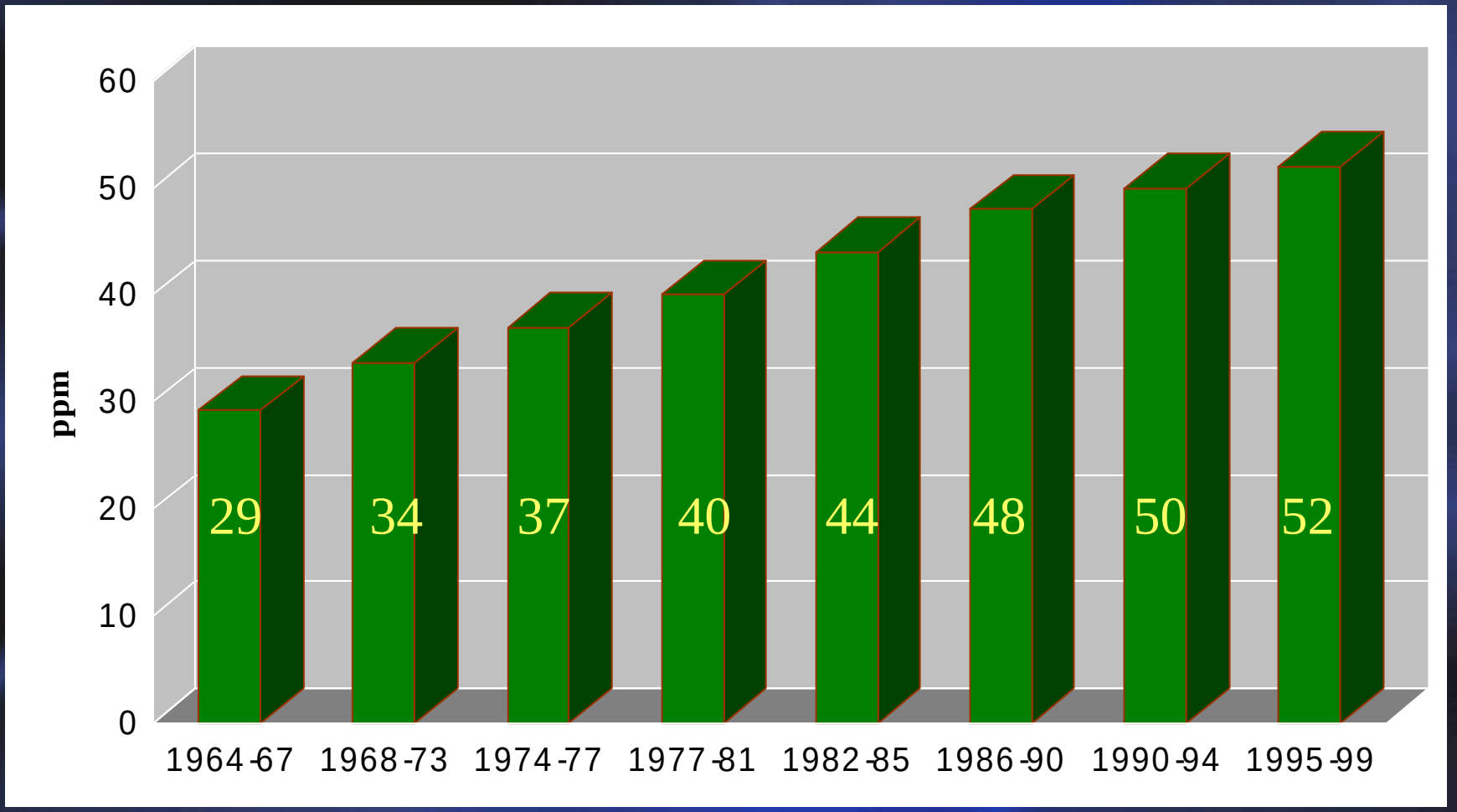
Recommended crop nutrient applications for corn grain at optimum soil test levels.

	N	P_2O_5	K_2O
	- - - - - - - - - - lb/a/yr - - - - - - - - -		
Corn (@ 200 bu/a)	160	75	55
Corn (@ 160 bu/a)	160	60	45
Corn (@ 120 bu/a)	160	45	35

Comparing Crop Removal With Manure Nutrient Content

- Corn utilizes approximately three times more nitrogen than phosphorus.
- Manure supplies N & P_2O_5 at approximately a 1:1ratio.
- Result = Soil test phosphorus levels increase if applying manure to meet crop nitrogen needs.

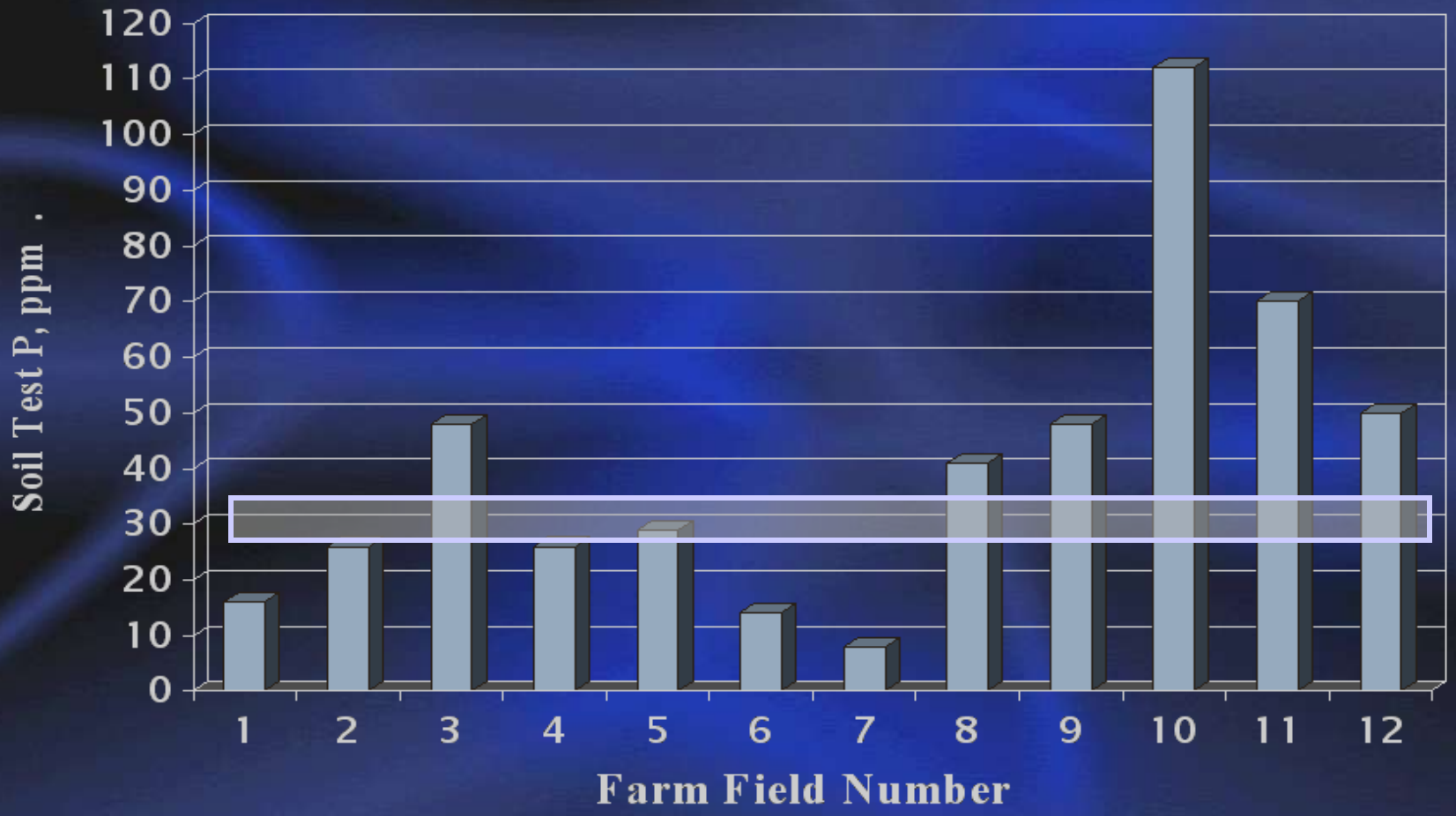
Average Soil Test P in Wisconsin



P and Water Quality: Why the concern?

- No plant toxicity
- Held in soil
- Accumulates slowly
- Does not leach

Soil Test Phosphorus Variability from a Wisconsin Dairy Farm



Regulations increasing P emphasis:

- New NRCS Nutrient Management Standard 590 applies if accept federal cost share

- DNR Nonpoint Performance Standard
  * Waters impaired by P (303d list)
  * Outstanding and exceptional resource waters

Features of P-based nutrient management

Using soil test P criteria

- N-based management when soil test is < 50 ppm
- Soil test 50-100 ppm, P additions limited to crop removal or less over 4 year rotation
- Soil test > 100 ppm, limit P to less than crop removal

Using P Index criteria

- Rates individual fields to predict risk of P loss
- Considers erosion, P levels, cover, fertilizer/manure practices

Other 590 restrictions that affect needed land base:

- Cannot spread in concentrated flow channels or buffers
- No winter spreading near lake (1000 ft), stream (300 ft) or groundwater conduit (200 ft)
- No winter spreading on slopes > 9% or 12% with RRP
- Winter application limited to P for current crop, not exceeding 7000 gal/a liquid manure

Land needs per cow:

1. 1400 lb cow produces about 10,000 gal diluted manure/yr

2. Average analysis of available nutrients (10 - 8 - 21)

3. Raising corn at 160 bu/a (160 - 60 - 45)

N-based land need for 100 cow herd:

- 100 cows x 10,000 gal/yr
  = 1,000,000 gal/yr
- 1,000,000 gal x 10 lb N/1000 gal
  = 10,000 lb N/yr
- 10,000 lb N/yr ÷ 160 lb N/a
  = 62.5 a/yr

P-based land need for 100 cow herd:

- 1,000,000 gal/yr x 8 lb P_2O_5/1000 gal
  = 8,000 lb P_2O_5 /yr

- 8000 lb P_2O_5 ÷ 60 lb P_2O_5 /a
  = 133.3 a/yr

Dairy Dietary P Management

Milk Production	Dietary P Level
(lbs/day)	(%)
55	0.32
77	0.35
99	0.36
120	0.38

Adapted from *Nutrient Requirements for Dairy Cattle*, Seventh Revised Edition,
National Academy Press Washington, D.C., January 2001

Dairy Dietary P Management – Implications of a High-P Diet

Dietary-P Acres (%)	Manure-P (lbs/cow/year)	Spreadable Acres* (acres/cow/year)	Increase In (%)
0.35	42	1.6	--
0.38	47	1.8	13
0.48	65	2.4	57
0.55	78	2.9	87

Farmers may need to manage dietary P intake in order to reduce manure-P.

* ***Acres required to meet a P-based nutrient management plan. Manure application rates restricted to crop-P removal from an alfalfa, corn, soybean cropping system.***

Source: Powell et al., 2001.

Dairy dietary-P intake effects on soluble P losses in runoff from fields manured at 25 tons/acre.

Runoff Event	Dietary-P Intake (%)	Runoff-P Concentration (ppm)	Runoff-P Load (g/ha)
June	0.32	0.30	7
	0.48	2.84	79
October	0.32	0.21	10
	0.48	0.89	37

Source: Ebeling et al., 2002.

P Best Management Practices

- Balance P inputs and removals
- Check and limit P in animal diets
  - 0.40% P adequate for dairy
- Minimum P in starter
  - 15-20 lb P_2O_5/a
- Incorporate manure & fertilizer?
- Time applications to minimize runoff
  - Fall or winter apply to tilled fields
  - Spring apply to NT fields

BMP's continued

- Apply manure P on lowest fields first
- Allow soil P to build on low risk areas
- Avoid applications if soil test P >100-150 ppm
- Use conservation practices
- Cover/buffers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