Snap-Shot Assessments of Nutrient Use on Commercial Dairy Farms

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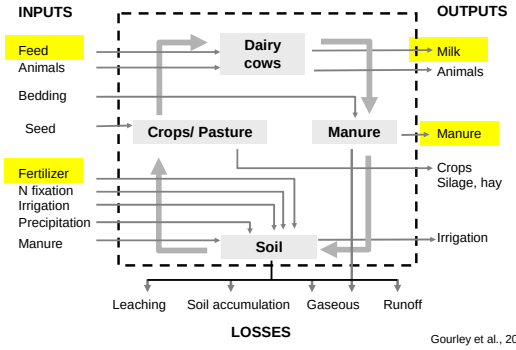
Presentation Outline

- Nutrient use on dairy farms
- General differences between confinement and grazing dairy systems

Presentation Outline

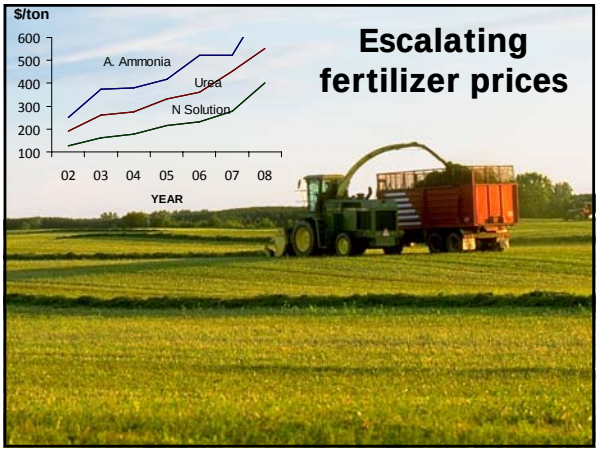
- What is a snap-shot?
- How data is collected
- Data validation
- Usefulness of the information

Nutrient use on dairy farms

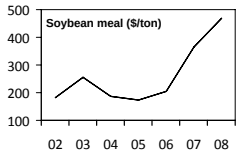


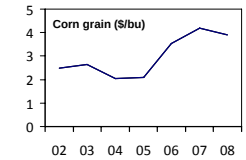
Gourley et al., 2007

Escalating fertilizer prices



Escalating feed prices

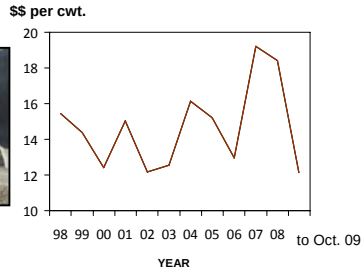




USDA-NASS, 2009

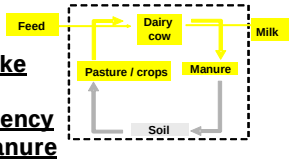
The archived presentation is available at:
http://www.extension.org/pages/Snap-Shot_Assessments_of_Nutrient_Use_on_Dairy_Farms_Webcast

Unstable and ebbing milk prices
(all milk)



USDA-NASS, 2009

Today's snap-shot focus



- Snap-shots of **feed intake** provide the basis for calculating **feed use efficiency** & nutrient excretions in **manure**
  - Manure nutrients, combined with producer information on herd and manure management, provide the basis for calculating **where, when and how manure nutrients are distributed on dairy farms**

Differences between confinement and grazing call for different snap-shots

The archived presentation is available at:
http://www.extension.org/pages/Snap-Shot_Assessments_of_Nutrient_Use_on_Dairy_Farms_Webcast

Feed on confinement dairy farms

Manure management on confinement dairy farms

Manure distribution on a 'typical' WI dairy farm

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Feed on grazing dairy farms

Effluent management

What is a snap-shot?

How data is collected

http://www.ars.usda.gov/Services/docs.htm?docid=18709

The archived presentation is available at:
http://www.extension.org/pages/Snap-Shot_Assessments_of_Nutrient_Use_on_Dairy_Farms_Webcast

Usefulness of snap-shots

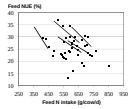
Phosphorus feeding and manure nutrient recycling on Wisconsin dairy farms. Nutr. Cycl. in Agroecosyst., 62, 277-286. 2002.

Manure collection and distribution on Wisconsin dairy farms. J. Environ. Qual. 34:2036-2044. 2005.

Validation of feed and manure management data collected on Wisconsin dairy farms. J. Dairy Sci. 9:2268-2278. 2006.

Nutrient management behavior on Wisconsin dairy farms. Agron. J. 99:211-219. 2007.

Rapid assessment of feed and manure management on dairy farms. Nutr. Cycl. Agroecosyst. 82:107-115. 2008.



Three phases of snap-shots

1) Compile information

- **Face-to-face interviews**
- **Feed, milk, manure & soil samples**
- **Farmer records**

2) Analyze & validate data

3) Discuss information with producers

Components of Face-to-Face Interviews

- **A well-scripted statement of purpose and expectations**
- **Questionnaire**
  - **Producer profile**
  - **Farm boundaries and fields**
  - **Herd structure & management**
  - **Feed practices (rations)**
  - **Crop rotations**
  - **Manure management**
  - **Nutrient management plans**

Today's examples of snap-shot assessments

Wisconsin
- Phosphorus feeding practices
- On Farmers' Ground: feed, fertilizer, manure, legumes

Australia
- Accounting for Nutrients: feed, fertilizer, manure, legumes and other (lesser) nutrient sources

China
- Feed and manure management, Shandong Province

Phosphorus feeding practices
- 98 randomly selected farms
- Single snap-shot

On Farmers' Ground
- 54 randomly selected farms
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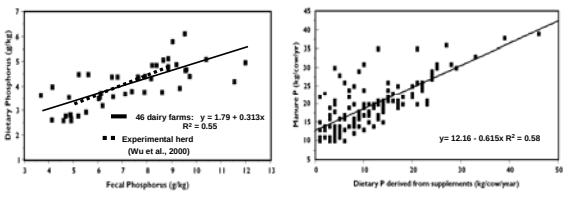
Multiple snap-shots to capture seasonal differences in nutrient management

Relationship between fecal P and dietary P



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Dietary P impacts manure P and land spreading requirement

Dietary-P	Manure-P	Spreadable Acres*	Acres Needed*
(%)	(lbs/cow/year)	(acres/cow/year)	(100 cow dairy)
0.35	42	1.6	160
0.38	47	1.8	180 (+13%)
0.48	65	2.4	240 (+57%)
0.55	78	2.9	290 (+87%)

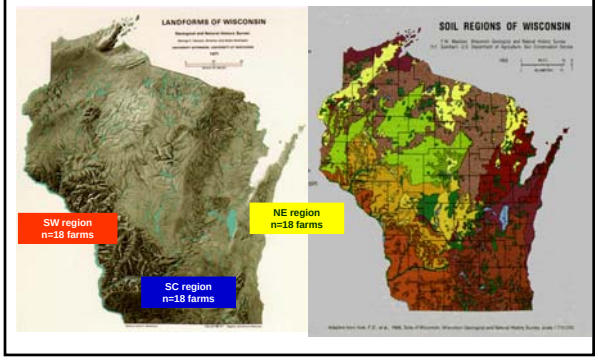
**Acres required to meet a P-based nutrient management plan. Manure application rates restricted to crop-P removal from an alfalfa, corn, soybean cropping system.*

Calculated based on 20,000 lbs milk production.

Usefulness of this snap-shot

- **85% of producers overfeed P**
- **Fecal P good indicator of diet P**
- **40% of farms have positive P balance**
- **Feeding to NRC recommendations would reduce by two-thirds the number of farms in positive P balance**

OFG: Stratified random sampling 54 confinement dairy farms in Wisconsin



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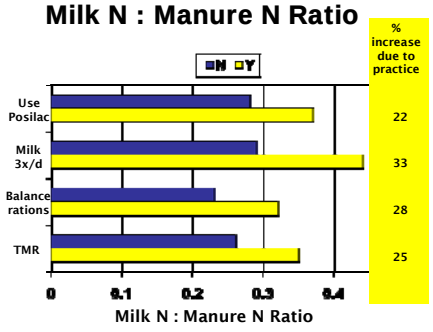
Feed Nitrogen Use Efficiencies (FNUE)

Milk N secretion (g/cow/d)
Apparent feed N intake (g/cow/d)

Feed N use efficiency (FNUE) 54 Wisconsin dairy farms

Lactating cows/farm	Milk Production (kg/cow/d)	FNUE (%)
1-29	20.0c	18.2c
30-49	27.4b	24.2b
50-99	29.7b	26.6b
100-199	33.1ab	24.3b
200+	38.7a	32.6a

Dairy management impacts on Milk N : Manure N Ratio



54 confinement dairy farms, Wisconsin

The archived presentation is available at:
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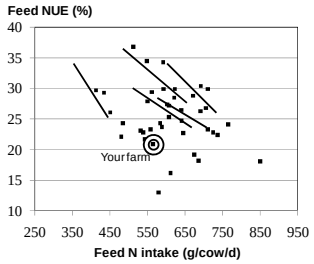
Actual vs. Potential FNUE

- Farm-to-farm comparisons
- Farm-experimental comparisons



Usefulness of this snap-shot

- Farm size, feed and milking technologies impact the relative amounts of milk and manure produced
- On many farms, actual FNUE is much lower than potential FNUE

Snap-shot of manure collection on Wisconsin dairy farms

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Regional, housing type and herd class differences in manure collection on Wisconsin dairy farms

Category	Subcategory	Mean	Min.-Max.
		% total manure N and P collected	
Region	SW	56 b‡	25-100
	SC	72 a	30-100
	NE	68 ab	33-98
		% total lactating cow manure N and P collected	
Housing type	Freestall	89 a	53-100
	Stanchion	66 b	53-100
		% total lactating cow manure N and P collected	
Herd class	<50 cows	57 c	42-82
	50-99	76 b	40-100
	100-199	95 a	82-100
	200+	100 a	100-100

Uncollected manure on 54 Wisconsin dairy farms

- **Manure deposition (kg/ha/y) range:**

340 to 5470 for N
80 to 1170 for P

Usefulness of this snap-shot

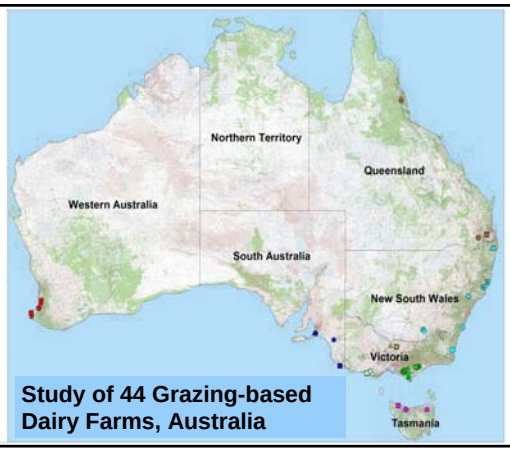
- There are geographic, farm type and farm size differences in manure collection and spreading practices.
- 'Hot spots' where manure goes uncollected should be manure management focus, particularly on small dairy farms in SW region.

The archived presentation is available at:
http://www.extension.org/pages/Snap-Shot_Assessments_of_Nutrient_Use_on_Dairy_Farms_Webcast

Accounting for Nutrients (Australia)

- 44 purposefully selected dairy farms
- 

multiple snap-shots



Study of 44 Grazing-based Dairy Farms, Australia

Face-to-Face Interviews


•Establish/confirm farm layout


•Define herd structure and management

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http://www.extension.org/pages/Snap-Shot_Assessments_of_Nutrient_Use_on_Dairy_Farms_Webcast


Feed Conversion Efficiency
(Pasture systems)

$$FCE\ (\%) = 100 * \frac{Milk\ ME}{Feed\ ME}$$

N Intake (g/cow/d) = NI_P + NI_S

- **NI_P = NI from grazed pasture**
- **NI_S = NI from supplements**


$NI_P = DMI_P \times N_P$

- DMI_P (kg/cow/d) = Dry matter intake from pasture

  DMI_P = (Cow's ME Requirement – ME of Feed Offered Manually) / Pasture ME

- N_P (g/kg) = Nutrient concentration in DMI_P determined from grab samples

A cow's ME requirement
(the sum of 4 components)

1) ME_{milk} = Milk * [(1.694 * ((0.386 * Fat %) + 0.205 * ((5.8+Protein %)-0.236))]

Parameters based on body weight (x)

2) $ME_{walking}$ = kms * (0.0037x -0.0007)

3) $ME_{grazing}$ = 0.1063x + 19.533

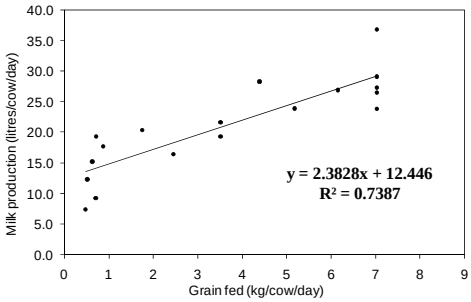
4) $ME_{maintenance}$ = 0.0915x + 8.1803

CSIRO, 2004

$NI_S = DMI_s \times N_s$

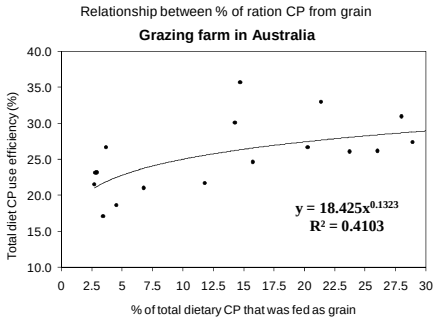
- DMI_s (kg/cow/d) = Suppl. fed, defined by producers
- N_s (g/kg) = Nutrient concentration in supplement samples

Relationship between grain fed and milk production
Grazing farm in Australia



Approximately 2.4 liters of milk obtained per kg of grain fed

Powell and Aarons, unpubl.

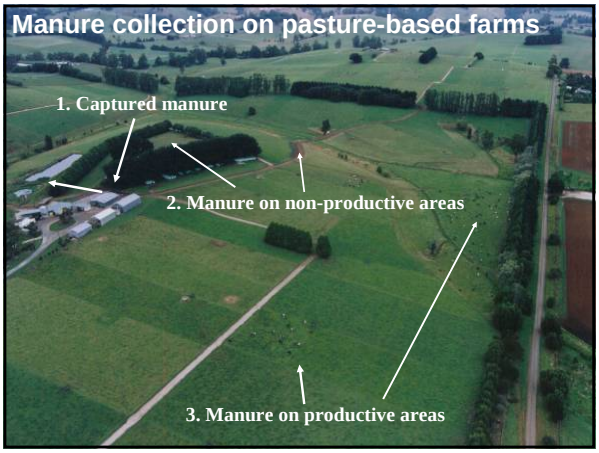


The efficiency with which grain CP was transformed into milk CP diminishes as grain CP exceeds approx. 15% of the total dietary CP intake.

Powell and Aarons, unpubl.

Snap-shot of manure collection on pasture-based dairy farms

Manure collection on pasture-based farms



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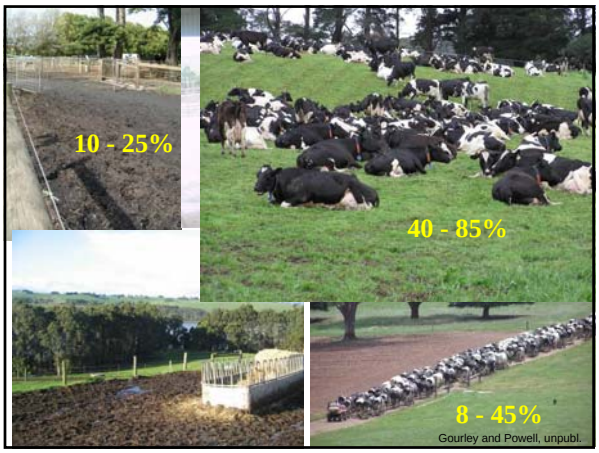


How good is snap-shot data?

- Feed nutrient consumption
- Milk production and nutrient secretion
- Manure nutrient excretion

Assess biological feasibility of the snap-shot data

Assess biological feasibility of snap-shot data

1) Cow N balance (CNB)

CNB (g N cow/d) = Feed N intake – Milk N – Manure N

2) Equilibrium feed requirement (EFR)

(the relative amount of additional, or less DMI required to achieve CNB of zero)

EFR (% of DMI) = 100*(CNB/DMN)/DMI

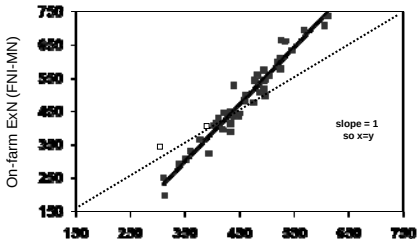
Apparent daily feed nitrogen (N) intake, outputs, cow N balance (CNB) and equilibrium feed requirement (EFR)

Location	Feed N	Milk	Manure	CNB	EFR
	g cow^{-1} d^{-1}				(%)
Shandong, Farm 1	438	98	328	+12	-2.7
Shandong, Farm 2	537	135	383	+19	-3.5
Wisconsin, forty-one farms	635 (135)[a]	152 (35)	457 (71)	+27 (59)	-2.5

[a] Mean, standard deviation in parenthesis

Comparison of literature estimates of ExN and difference between feed N intake (FNI) and milk N (MN)

Confinement dairy farms



How good is snap-shot data?

- **Manure spreading**

Compare estimates from (1) farmer information on manure collection, (2) manure spreading records

INTRODUCTION

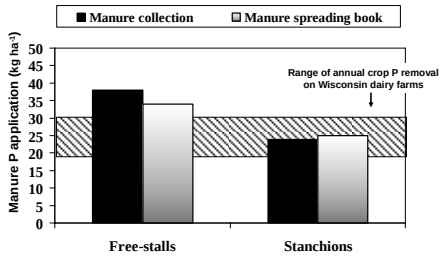
Section 1
How to use the manure spreading book

Section 2
Farm maps

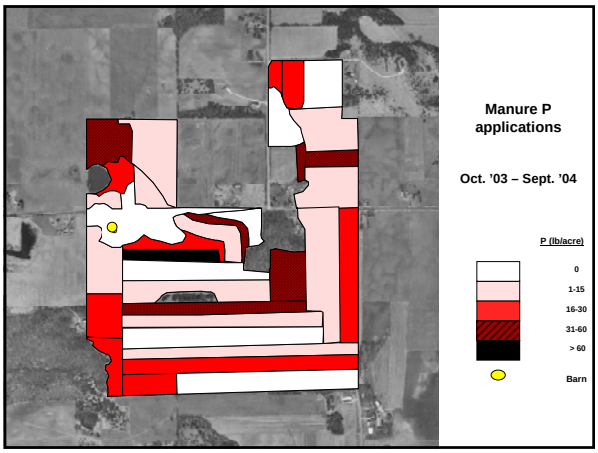
Section 3
Manure record sheets

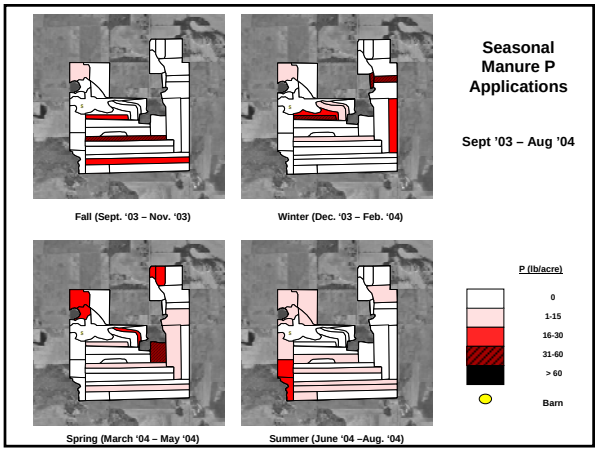
Section 4
How to sample manure

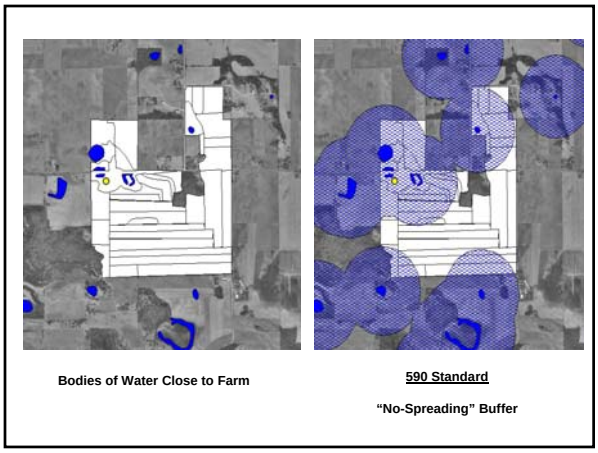
Comparison of snap-shot estimates of manure P applications to cropland



Total Manured Land:
240 acres (88%)







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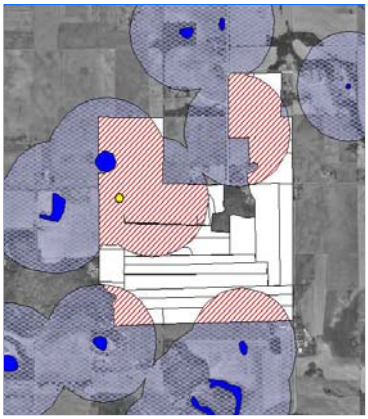
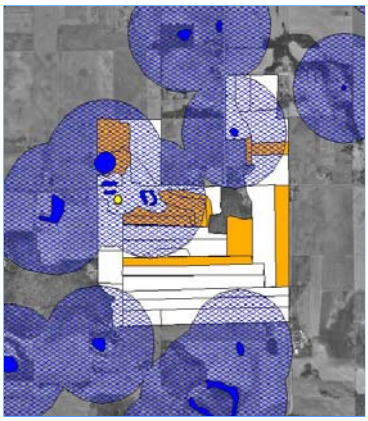


Total Land Affected by Buffer:

165 acres (60.5%)

Land manured during Winter:

59 acres



590 Standard

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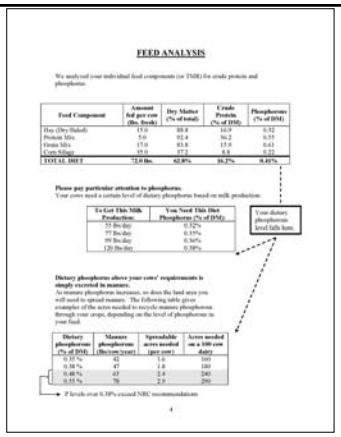
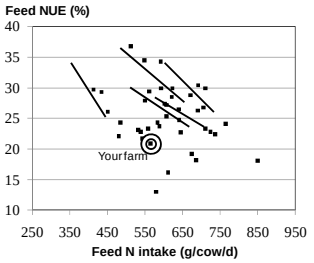
590 Standard

Winter manured land affected by buffer: 37 acres (61%)





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