

Managing ammonia emissions to conserve the fertilizer N value of dairy manure

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**How much of the total nitrogen (N)
excreted in manure
on a “typical” Wisconsin dairy farm
is recycled through crops**

????

10 to 40 %

? What happens to manure N ?

(% of excreted N)

- Lost as ammonia (20-40)
- Taken up by plants (20-40)
- Lost as nitrate (10-20)
- Denitrification (3-5)
- Immobilized by soil microorganisms (?)

**Manure N use inefficiencies are inevitable.
But we can do much better!**

What we know

Manure N recycling is influenced by:

- Dairy diets
- Herd management
- Manure handling, storage and land application
- Weather, soils



What we know

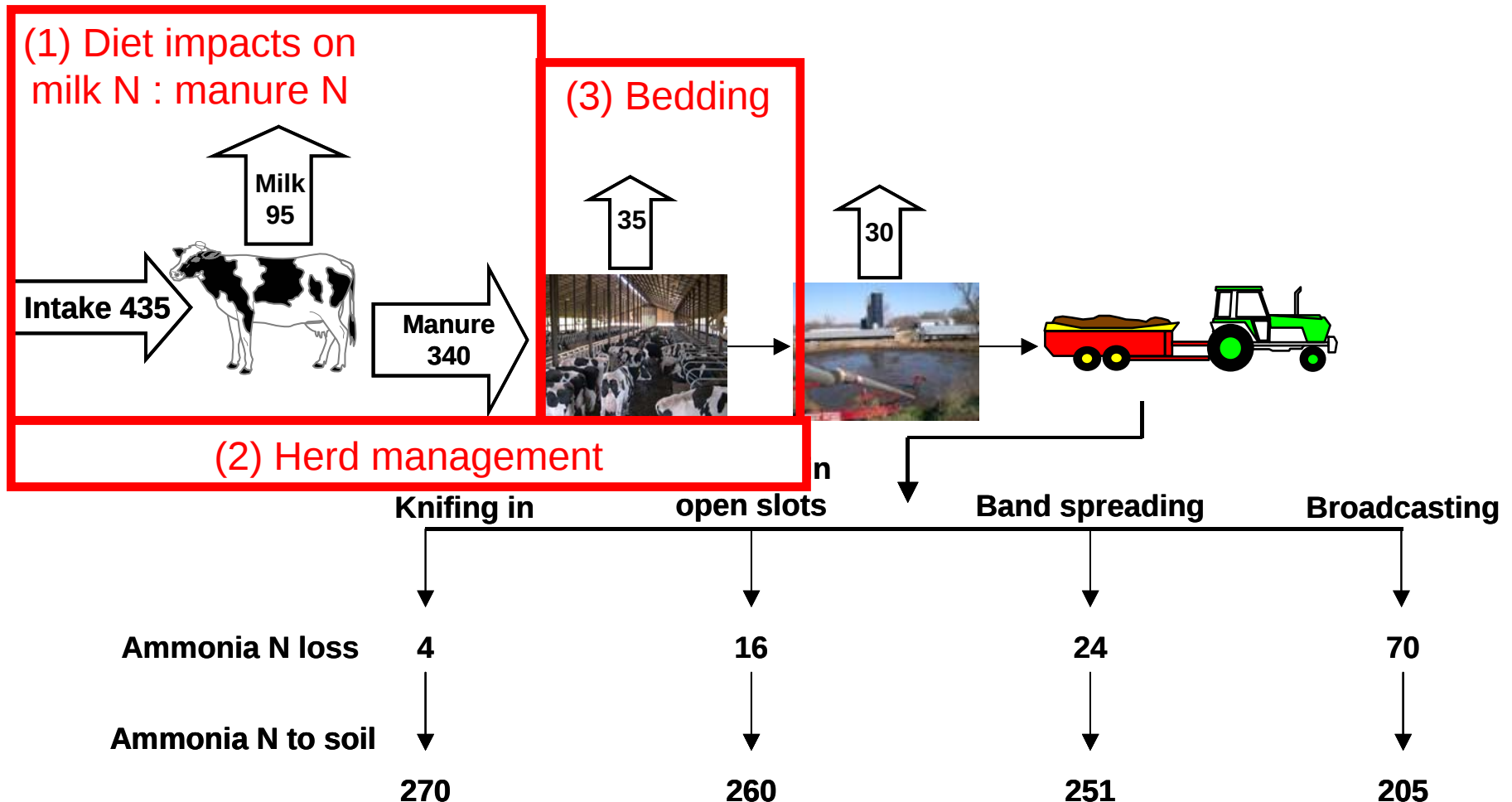
- **Because ammonia is a gas, losses are inevitable.**
- **Ammonia production and loss occur almost immediately in the barn and continue through manure storage and land application.**
- **This loss of nitrogen can greatly reduce the fertilizer value of manure.**

What we know

- **But ammonia nitrogen loss can be reduced, and the fertilizer value of manure can be maintained through management.**

Nitrogen flow (lbs/cow/year)

Typical confinement dairy operation in Wisconsin



Diet studies

Rationale – Diets designed to put more crude protein into milk will influence:

- total manure N excreted
- relative manure N proportions in urine vs. feces
- changes in other urinary/fecal constituents

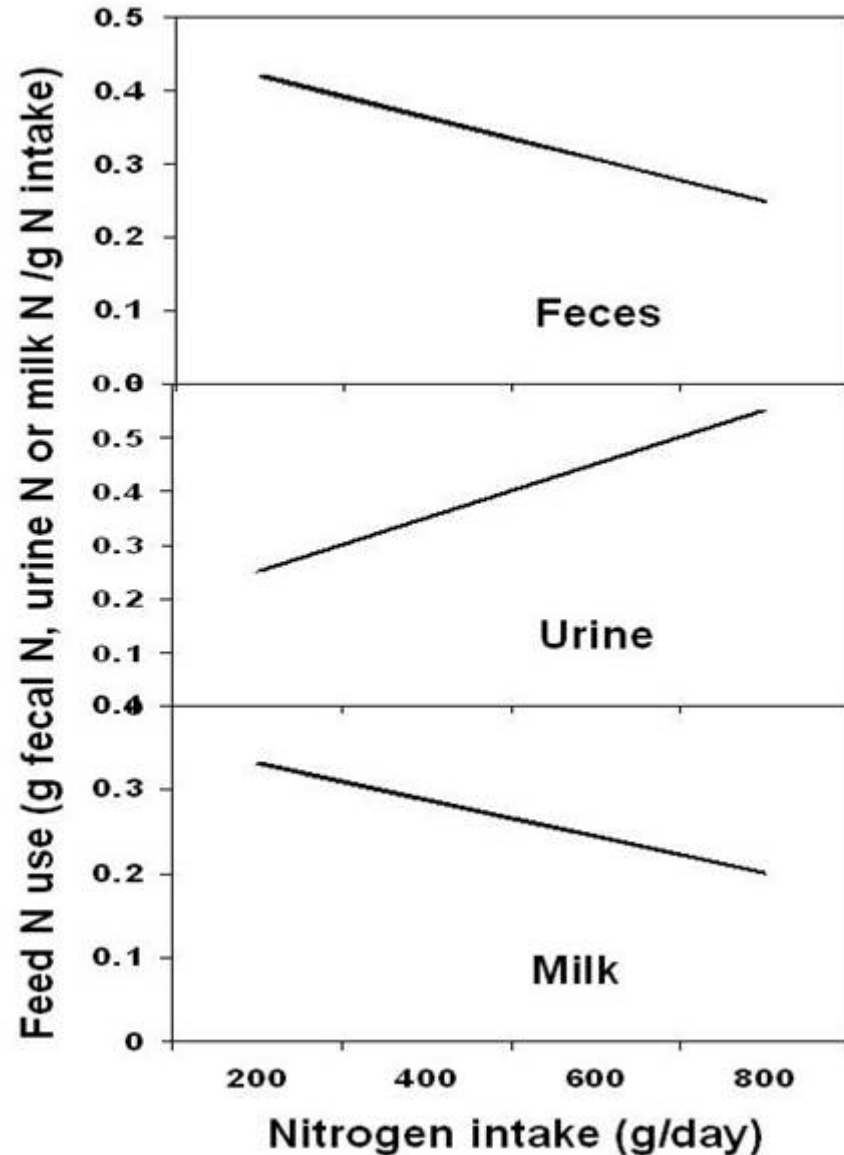
Our research is evaluating the impact of these changes on ammonia emissions from the barn floor and following manure application to land.

Impact of dairy diets

Crude protein fed
in excess of
requirements

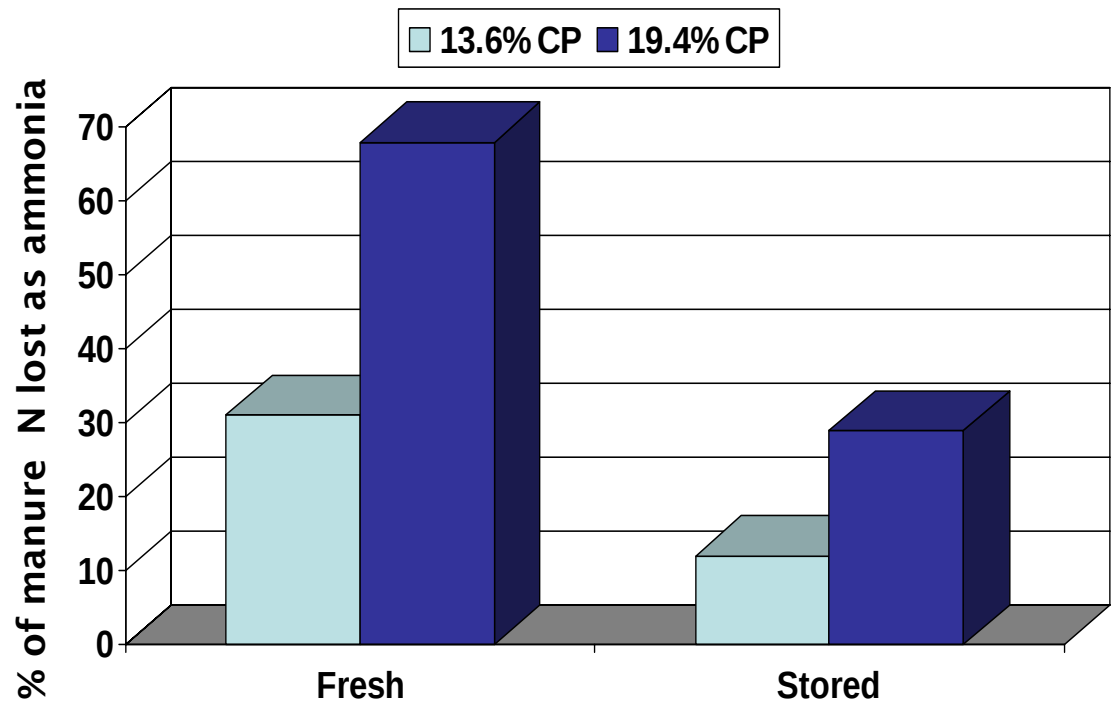
- Decreases
Milk N
Fecal N
- Increases
Urinary N

As urine N ↑ Ammonia N ↑



Impact of dairy diets

Excess dietary CP impacts ammonia emissions after manure application to soil



Herd management impacts

- Manure N capture and recycling

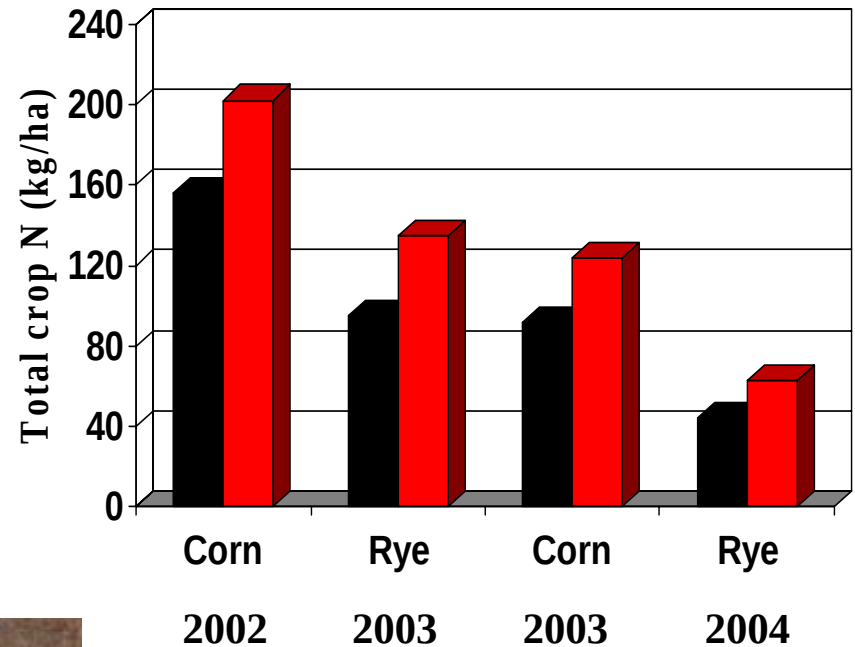


Herd management impacts



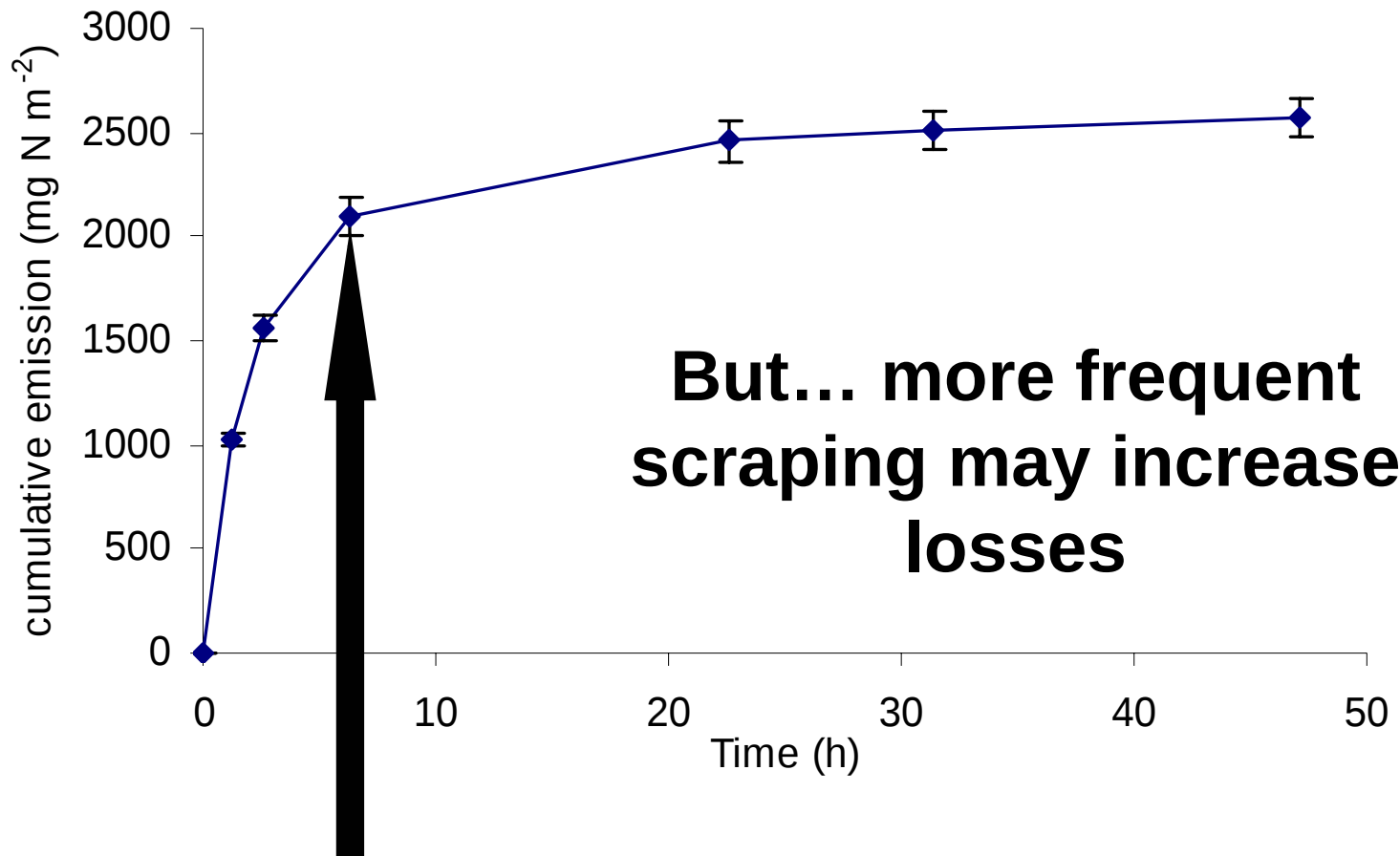
A three-year field study

■ Barn manure ■ Corraling



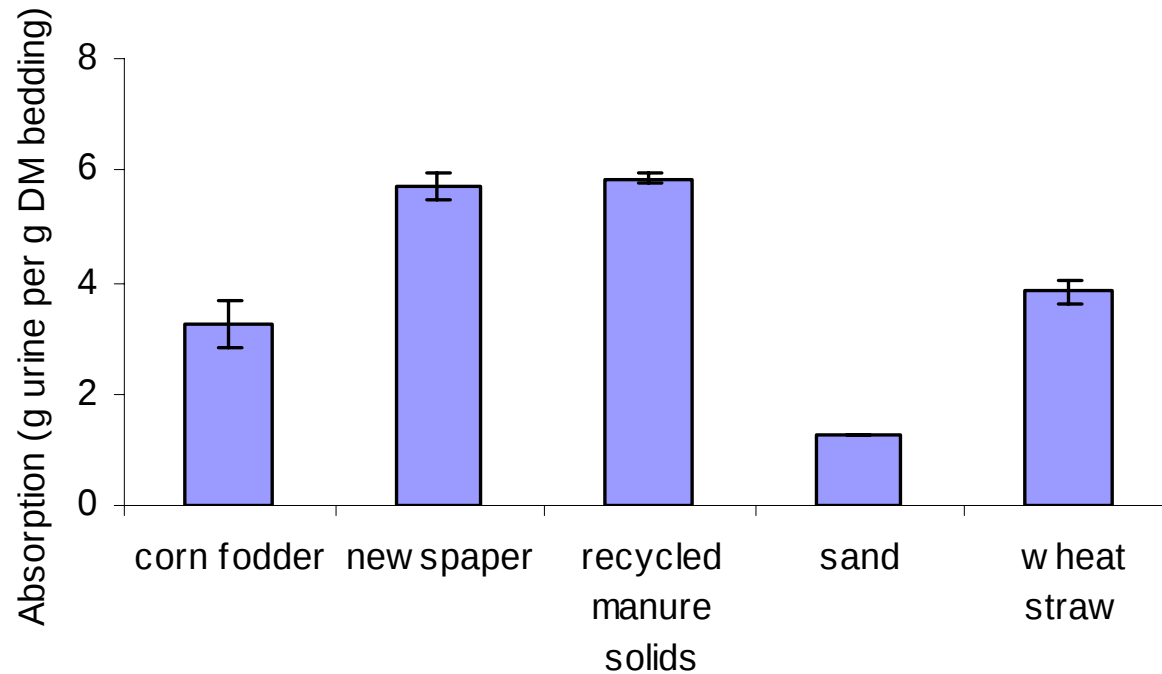
Potential in-barn ammonia losses

Most ammonia loss occurs within 4-6 hours after

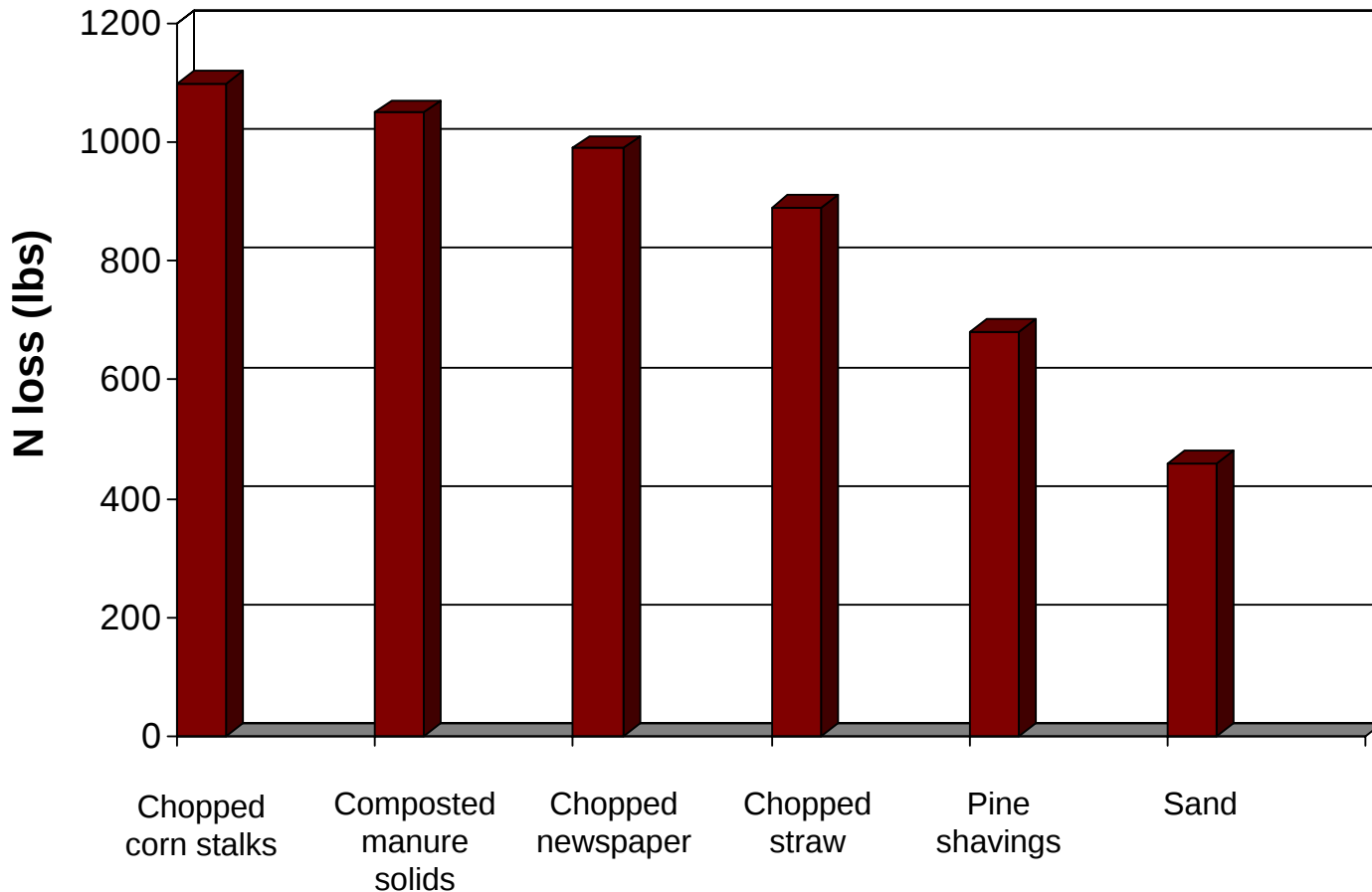


Bedding types

Different bedding types absorb different amounts of urine.

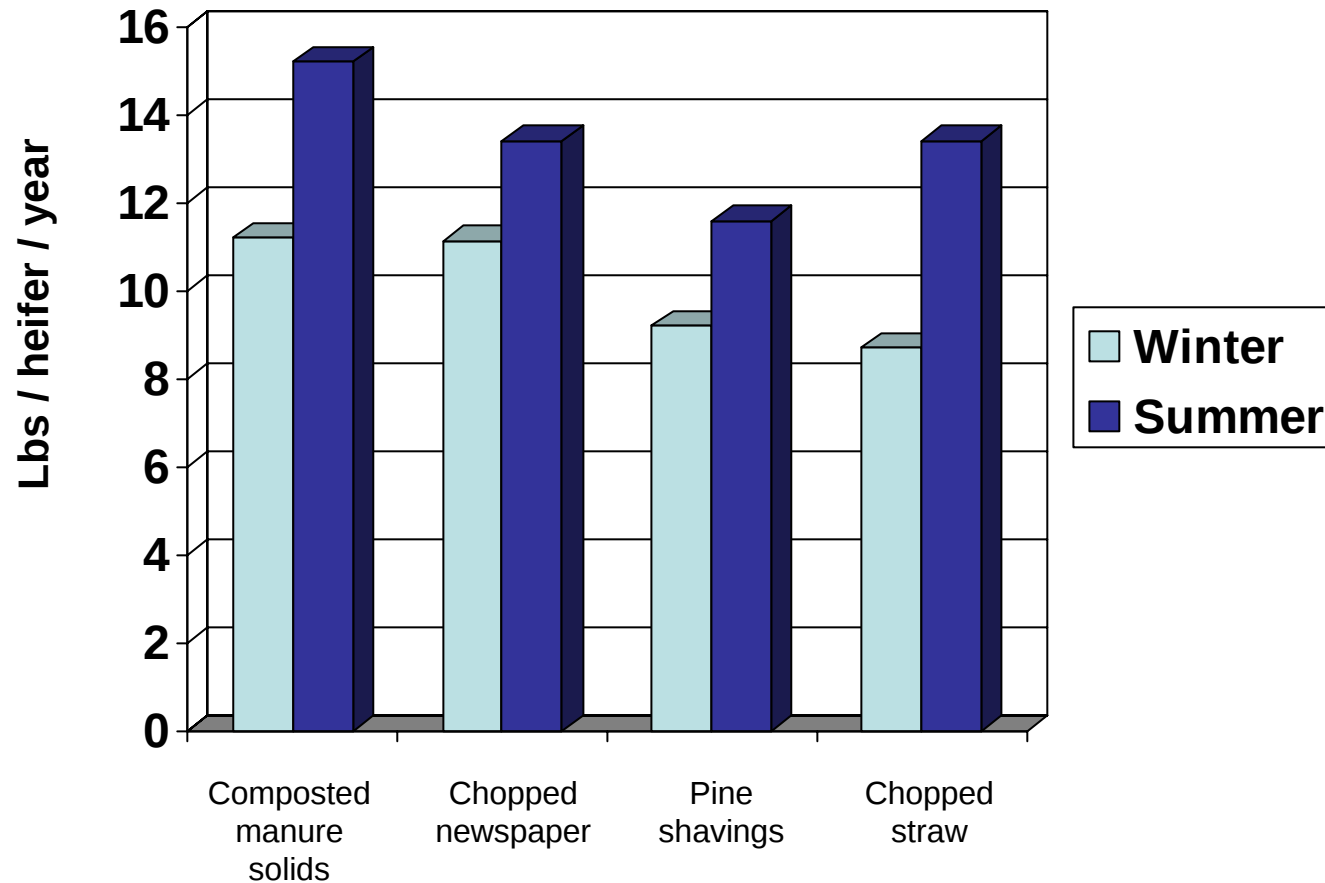


Annual loss of ammonia nitrogen From 100 heifers, different beddings



Those that absorb the most urine also have high losses (wicking effect)

Ammonia N loss from dairy heifers in tie-stalls using different beddings



Summer emissions are 20-55% greater during summer than winter

???

How much of total
manure N *is*
recycled through
crops on a dairy
farm?

10 to 40 %

How much of total
manure N *can be*
recycled through
crops on a dairy
farm?

40 to 60%

Summary

Impact of improved management on reductions in ammonia emission

Management practice	Mechanism for decrease ammonia loss	Decrease in ammonia loss (%)
Remove excess and/or feed balanced dietary protein	Decrease N output in urine	10 to 15
Cover manure storage	Decrease ammonia escape	20 to 30
Incorporate or inject manure	Reduce ammonia production and loss	30 to 50

Implementation of these management practices has the potential to reduce ammonia N loss from about 115 to 30-40 lbs/cow/yr, a 65-70% reduction.

This means that an additional 70-80 lbs. N per cow would be available annually for application to field crops.

At a fertilizer N value of \$0.34/lb N, this can mean annual savings of

\$2300 to \$2700 per 100 dairy cows

On fertilizer costs

Questions?

