

## Retaining manure nitrogen in confinement housing

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## Reasons to conserve nutrients

- Nutrients have value
- Lost nutrients can incur costs
- Nutrients contribute to odor and gaseous emissions
- Regulatory thresholds

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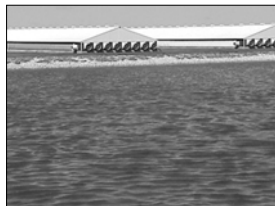
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## Confinement options

Decrease the volatilization potential

– Minimize the formation of ammonia

- From excreta
- From storage



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### Decrease the volatilization potential

- Minimize the formation of ammonia
  - From excreta
    - Fiber
    - Acidulants

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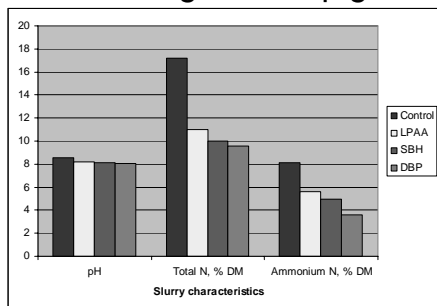
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### Feeding fiber to pigs



Shriver et al., 2003. JAS

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### Shriver et al. (2003) conclusions

- Fiber addition to the LPAA diet tended to result in a greater proportion of N excreted in the feces than in the urine.
- Slurry pH, ammonium N content, and urinary urea N excretion were reduced ( $P < 0.10$ ) in pigs fed LPAA, and
- A further reduction ( $P < 0.06$ ) in slurry ammonium N content and urinary urea N was observed with fiber addition

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### Diet acidification

- Reduces pH and causes N to remain in ammonium form rather than volatilize in ammonia form
- $\text{CaSO}_4$  in the diet reduced ammonia emissions from laying hen excreta by 40%



Wu-Haan et al., 2007 (Poult. Sci.)

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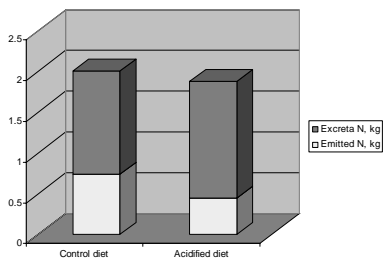
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### Acidification of hen diets



Wu-Haan et al., 2007 (Poult. Sci.)

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### Reducing nitrogen substrate available

- Excreted nitrogen can be lost as ammonia
  - Reduce nitrogen excretion
  - 10% reduction in ammonia emissions for every 1 percentage unit decrease in dietary crude protein



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### Feeding corn co-products to pigs

- 6 feeding phases (40 to 270 lbs)
- Co-products included at 5, 10, 15, 20, 25, 30% as phases progressed



Powers et al., unpublished

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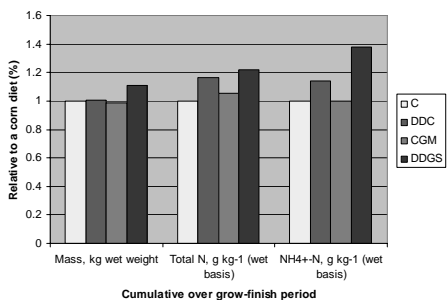
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### Swine manure characteristics following feeding of 4 diets



Powers et al., unpublished

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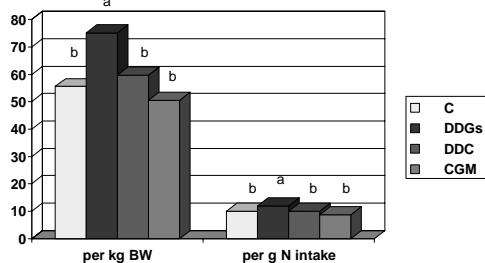
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### Ammonia emissions Daily emissions, mg



Powers et al., unpublished

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### In the dairy herd...

- Diet acidification may not be effective
  - Rumen buffering capacity
- Overfeeding N increases urinary N which is more subject to volatilization
- Tomlinson et al. (1996, Trans of ASAE) demonstrated greater urine N and less fecal N following feeding of Ca salts of LCFA.

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### Decrease the volatilization potential

- Minimize the formation of ammonia
  - From housing and storage
    - Design options
    - Management




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### Estimated losses

System	Nitrogen lost, %
<b>Solid</b>	
Daily scrape and haul	20 to 35
Manure pack	20 to 40
Open lot	40 to 55
Deep pit (poultry)	25 to 50
Litter	25 to 50
<b>Liquid</b>	
Anaerobic pit	15 to 30
Above-ground storage	10 to 30
Earth storage	20 to 40
Lagoon	70 to 85

From MWPS-18 'Livestock Waste Facilities Handbook' 2<sup>nd</sup> edition, Midwest Plan Service, Ames, IA 50011.

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### Urine-feces segregation

- In principle, urine and feces do not come in contact with each other
  - Prevents the release of ammonia from manure
  - >80% reduction in ammonia levels; corresponds to increased manure N



Photo courtesy of North Carolina State University

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### Management options

- Flushing frequency
  - Flushing increases N losses; increased scraping frequency decreases losses
  - Find compromise between cleanliness and N volatilization



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### Management options

- Oil spraying – surfactant properties
- Misting – unknown effect
- Belt houses versus high-rise houses
  - Do the total system emissions change?

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### Litter amendments

- In a study of 194 broiler houses in Delaware, Maryland, and Virginia (Sims and Luka-McCafferty, 2002), alum treatment increased total N by 5.4 pounds per ton,
  - Alum increased the litter’s fertilizer value and reduced the potential of P and heavy metal pollution.

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### Litter amendments

- Poultry Guard – reduced house ammonia concentration (Shah et al., 2007 NCSU)
- PLT – reduced house ammonia concentration (Shah et al., 2007 NCSU)
- Absorbents – mixed results (Shah et al., 2007 NCSU)
  
- Expected that reduced ammonia concentrations were accompanied by increased litter N content

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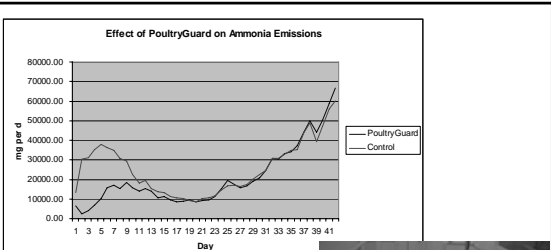
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- Turkey litter with and without PoultryGuard amendment
- 42-d broiler chicken grow-out on the litter



Powers et al. (unpublished)

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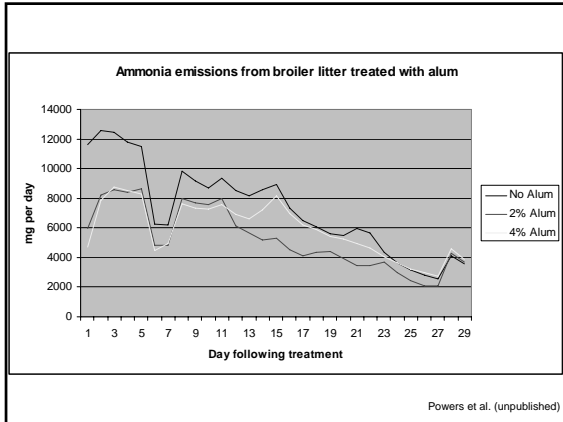
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### Summary

- Nitrogen is too valuable to lose
  - As a crop nutrient
  - As an air pollutant
- Overfeeding nutrients is not a profitable means of increasing manure nutrients
- It is worth the time to calculate the savings that can be realized by making a management and/or feeding change to conserve N and prevent volatilization

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