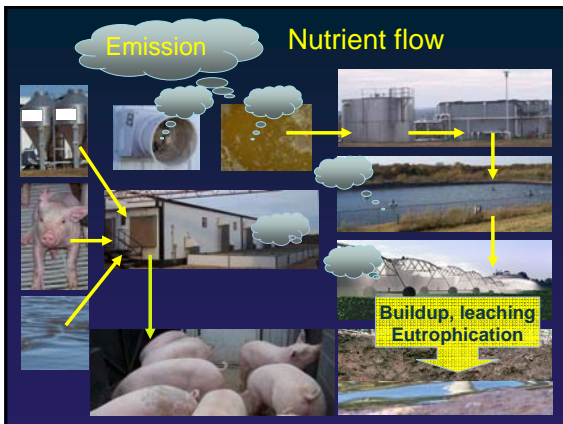
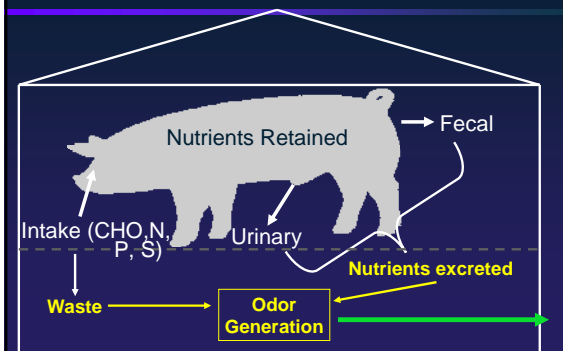


Feeding strategies to reduce air emissions - Swine

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Nutrient excretion = gas emission



Estimated nutrient excretion of finishing pigs

| Mineral | Retention, % <small>(Kornegay and Harper, 1997)</small> | Estimated excretion, % |
|---------|--|------------------------|
| N | 40 - 50 | 60 - 50 |
| P | 20 - 45 | 80 - 55 |
| K | 10 - 20 | 90 - 80 |
| Fe | 5 - 35 | 95 - 65 |
| Zn | 10 - 20 | 90 - 80 |
| Cu | 10 - 20 | 90 - 80 |

Origins of Odor emissions

| Odorant | Origin |
|---------------------------------|----------------------|
| Ammonia | Urea, protein intake |
| VFA's | Fiber, protein/AA |
| Phenol, cresol, indole, skatole | Aromatic AA |
| Sulfur compounds | Sulfur-containing AA |

Strategies to reduce Nutrient Excretion

| Strategy | Reduction |
|---------------------------|-----------------------------|
| Pelleting | 5% for N and P |
| Reduce Feed waste | 1.5% for every 1% reduction |
| Matching Nutrient Req't's | 6 to 15% for all nutrients |
| Formulation | 10% for N and P |

Each of these strategies may have an effect on gas emissions and odor

Specific strategies to reduce Ammonia Emissions

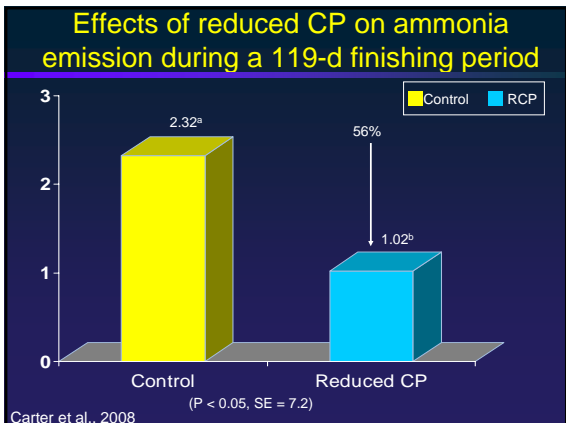
1. Reduce dietary crude protein with AA additions

- o A 1 percentage unit decrease in dietary CP decreases N excretion by ~10%
- o Results in a decrease in ammonium N in slurry
- o Decrease slurry pH
- o Each of these responses lead to a reduction in aerial ammonia concentration or emission

Specific strategies to reduce Ammonia Emissions

| CP reduction | Decrease in ammonia |
|---------------|-------------------------------|
| 19 to 13% | 47 to 59% (Hobbs et al, 1996) |
| 16 to 12% | 79% (Turner et al., 1996) |
| 16.7 to 12.2% | 40% (Kendall et al., 1998) |
| 14.2 to 10.6% | 50 – 60% (Hill et al., 2001) |
| 15 to 9% | 80% (Otto et al., 2003) |
| 18 to 14.2% | 52% (Velthof et al., 2005) |
| 17.6 to 13.8% | 57% (Panetta et al., 2006) |
| 15 to 12% | 30% (Le et al, 2008a) |

Most studies performed with individual pigs, short-term, and simulated manure pits



Specific strategies to reduce Ammonia Emissions

2. Addition of fermentable CHO

- o Addition of soybean hulls, wheat midds, sugar beet pulp
- o Increase bacterial protein in feces, decrease urea in urine
- o Decrease pH of slurry
- o Increase VFA concentrations of manure
- o Decrease ammonia concentration or emissions

Specific strategies to reduce Ammonia Emissions

| Fiber addition | Decrease in ammonia |
|---------------------------------|---|
| 30% sugar beet pulp | 47% (Cahn et al, 1998b) |
| Soybean hulls | 17 to 36% (Cahn et al., 1998c) |
| 10% Soybean Hulls | 20% (Decamp et al., 2001) |
| Potato starch/sugar beet pectin | Each 100g increase in fiber, ammonia emission decreased by 29.4% (Le et al., 2008b) |
| 15% Soybean hulls | 19% (Carter et al., 2008) |

Specific strategies to reduce Ammonia Emissions

3. Addition of acidifying agents, urease inhibitors

- o Addition of Ca salts, adipic acid, yucca
- o Canh et al (1998a) reported 30 to 50% decrease in ammonia emissions with addition of Ca salts
- o Van Kempen (2001) reported a 25% decrease in ammonia emission with 1% dietary adipic acid
- o Responses to yucca addition have been variable

Specific strategies to reduce Hydrogen Sulfide Emissions

1. Reduce sulfur content of diet
 - o Manipulate sulfur-containing amino acid content of diet
 - o Reduced protein, AA-supplemented diets
 - o Responses have been variable, some reports of a decrease while other reports of no change
 - o Change source of trace mineral inclusion
 - o Replace sulfate forms with other forms (inorganic or organic)
2. Inclusion of fermentable carbohydrates
 - o Decrease in H₂S concentrations have been reported

Specific strategies to reduce Odor Emissions

1. Reduce dietary crude protein with AA additions
 - o Inconsistent responses
 - Le et al. (2008a) 15 vs 12% CP
No effect on odor strength or offensiveness
 - Le et al. (2008b) 18 vs 12% CP
No effect on odor strength or offensiveness
 - o Numerous other reports found no effect of protein level in the diet on odor strength or offensiveness
 - o However, other studies report decrease in odor with CP reduction

Effects of dietary ingredients on Emissions

Protein sources
Feather meal and fish meal increased odor (van Kempen and van Heughten, 2003)

DDGS
No effect on odor with up to 10% inclusion (Gralapp et al., 2002)

Potential for increased NH₃ and H₂S emissions

More research needed for specific feed ingredients

Summary

Diet can impact emissions of specific odorants

1. Low CP, AA supplemented diets
 - Decrease ammonia concentration or emissions
 - Possibly decrease hydrogen sulfide
2. Addition of fermentable CHO
 - Decrease ammonia concentration or emissions
 - Possibly decrease hydrogen sulfide
 - Possibly an additive effect with reduced CP, AA-supplemented diets
3. Feed additives
 - Inconsistent responses
 - More research needed

However, more research is needed to clarify the effects of diet on overall odor strength and offensiveness

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