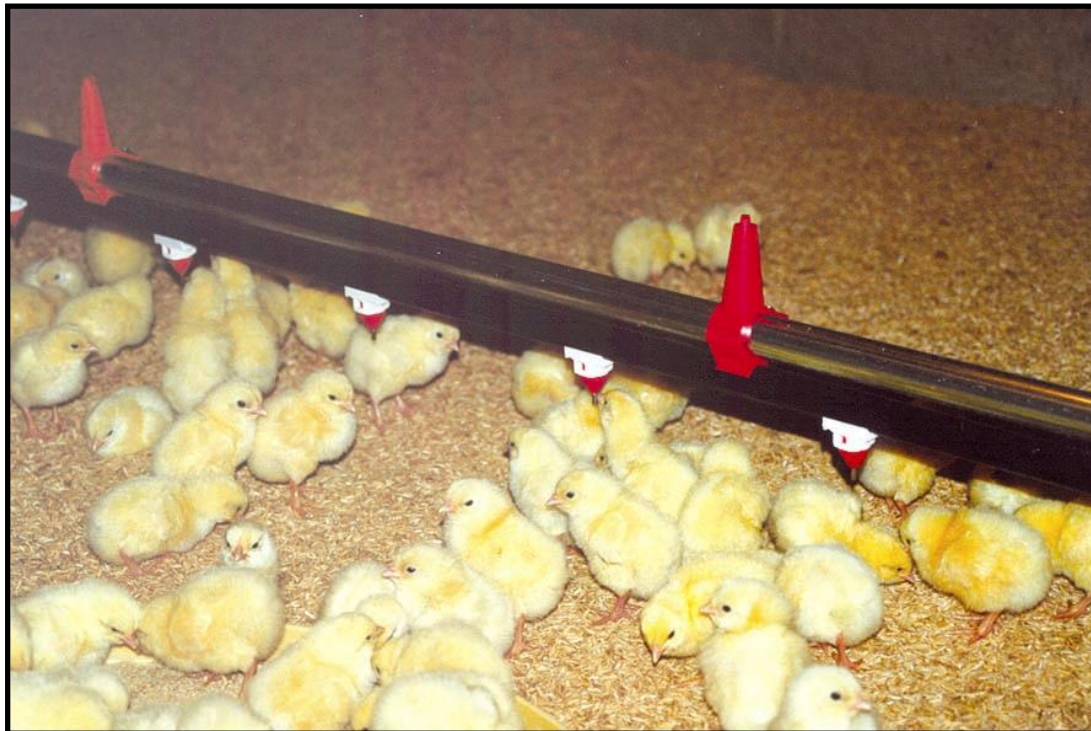


# Long Term Studies of Nitrogen Mass Balance in Broiler Production

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# Introduction

- **Broiler litter is commonly reused for several flocks**
- **“Caked” litter is removed and disposed of between flocks**



# Introduction

- **“Top-dressing” often used to extend useful life of litter**
  - ◆ Spread thin layer of new litter over old litter without performing complete clean-out
  - ◆ Drier, clean material reduces caking of litter
  - ◆ Cheaper and faster than complete clean-out



# Introduction

- **Need current data regarding ammonia emission rates from broiler rearing facilities**
  - ◆ Most recent work done in Europe
  - ◆ Not applicable to US production
  - ◆ Most work done in US based on air sampling of commercial facilities
  - ◆ Few nitrogen mass balance studies performed with broilers

# Literature Review

- **Measurement of ammonia emission rates in Texas broiler houses**
  - ◆ Redwine et al., 2002
  - ◆ Observed that emission rates:
    - Varied greatly
    - Increased with the age of birds
  - ◆ Summer: 59 to 2105 g/h (3 to 111 lb/d)
  - ◆ Winter: 38 to 1893 g/h (2 to 100 lb/d)

# Literature Review

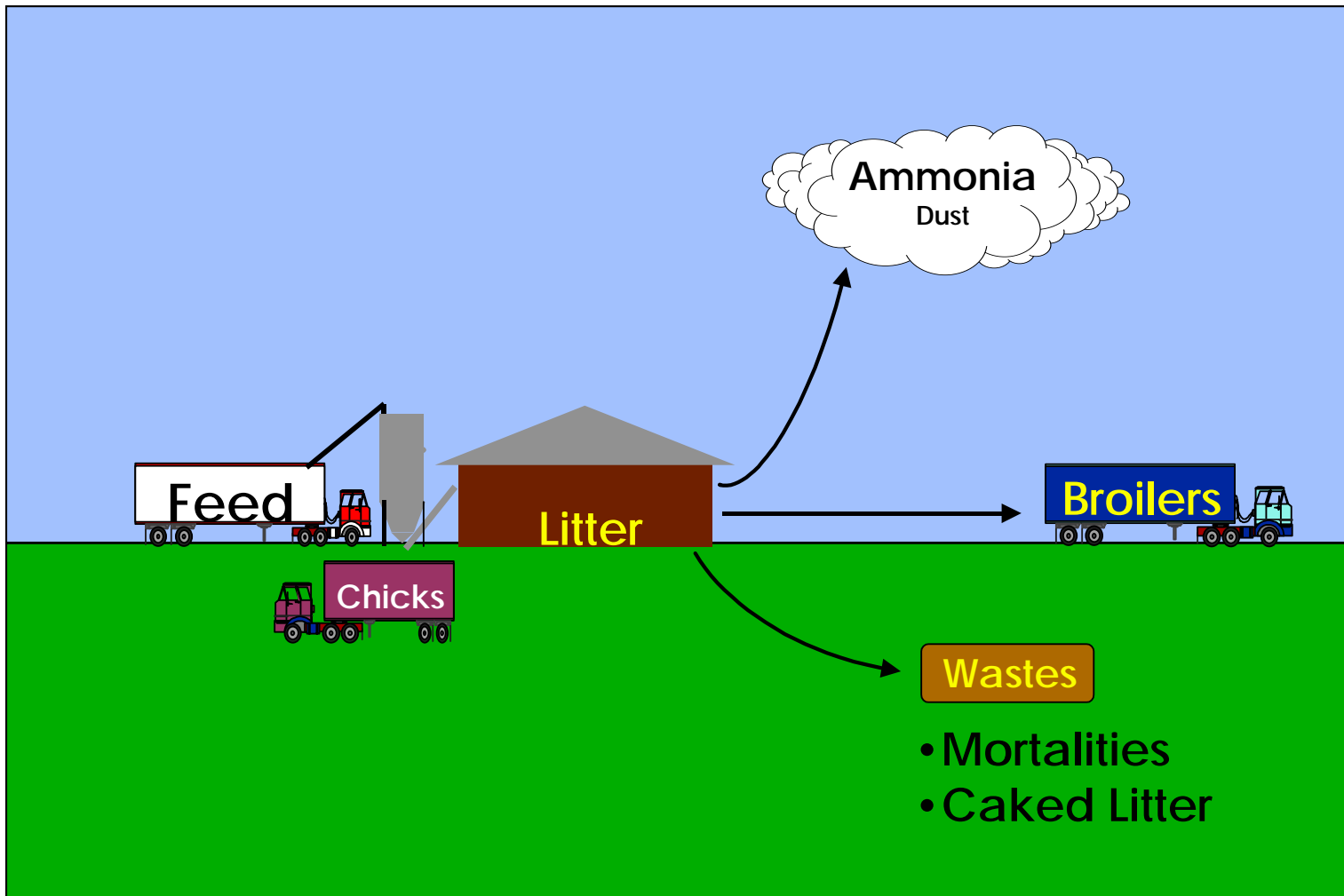
- Published NH<sub>3</sub> Emission Rates:

	g NH <sub>3</sub> /h-AU
◆ Wathes et al., 1997 -	9.2
◆ Amon et al., 1997 -	0.6 – 8.1
◆ Koerkamp et al., 1998 -	2.2 – 8.3
◆ Demers et al., 1999 -	5.4

# Objectives

- ◆ Perform an accurate nitrogen mass balance of a broiler rearing facility to measure nitrogen lost as ammonia and dust
- ◆ Compare untreated vs. “top-dressed” recycled litter impacts on nitrogen balance.

# Nutrient Flow in Broiler Production



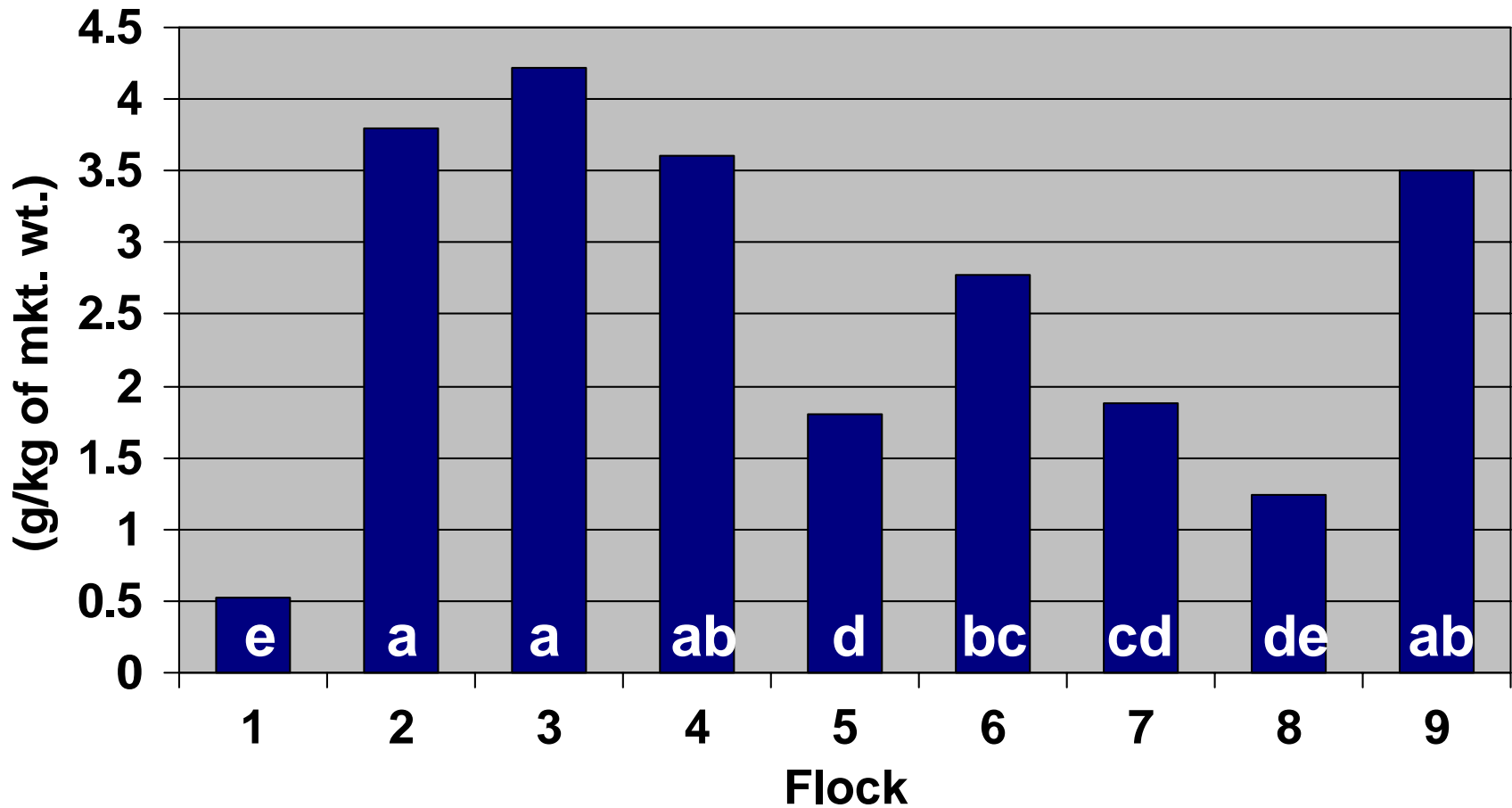
# Experimental Design

- **Replicate commercial conditions:**
  - ◆ Obtain all chicks and feeds from a commercial poultry integrator
  - ◆ Flocks 1-9 = 504 broilers per flock
  - ◆ Flocks 10-18 = 840 birds per flock  
(420/treatment)
  - ◆ Grow-out period of 41-42 days (6 weeks)

# Experimental Design

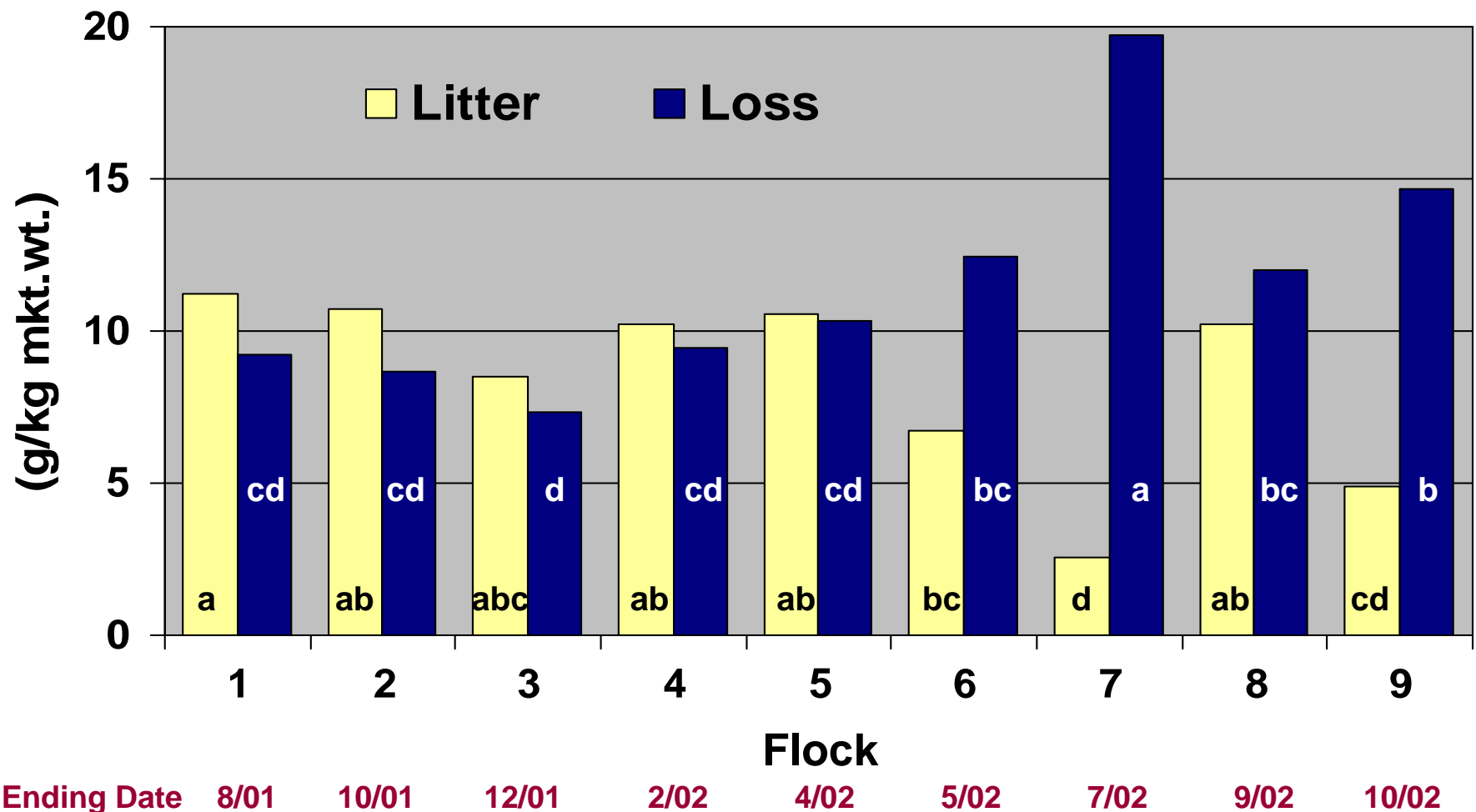
- **Replicate commercial conditions:**
  - ◆ Litter recycled from flock to flock
  - ◆ Remove caked litter between flocks
  - ◆ Nipple drinkers
  - ◆ Environmentally controlled with cooling pads
  - ◆ Commercial stocking densities
    - 0.75 ft<sup>2</sup>/bird (697 cm<sup>2</sup>)

# Nitrogen Removed with Caked Litter

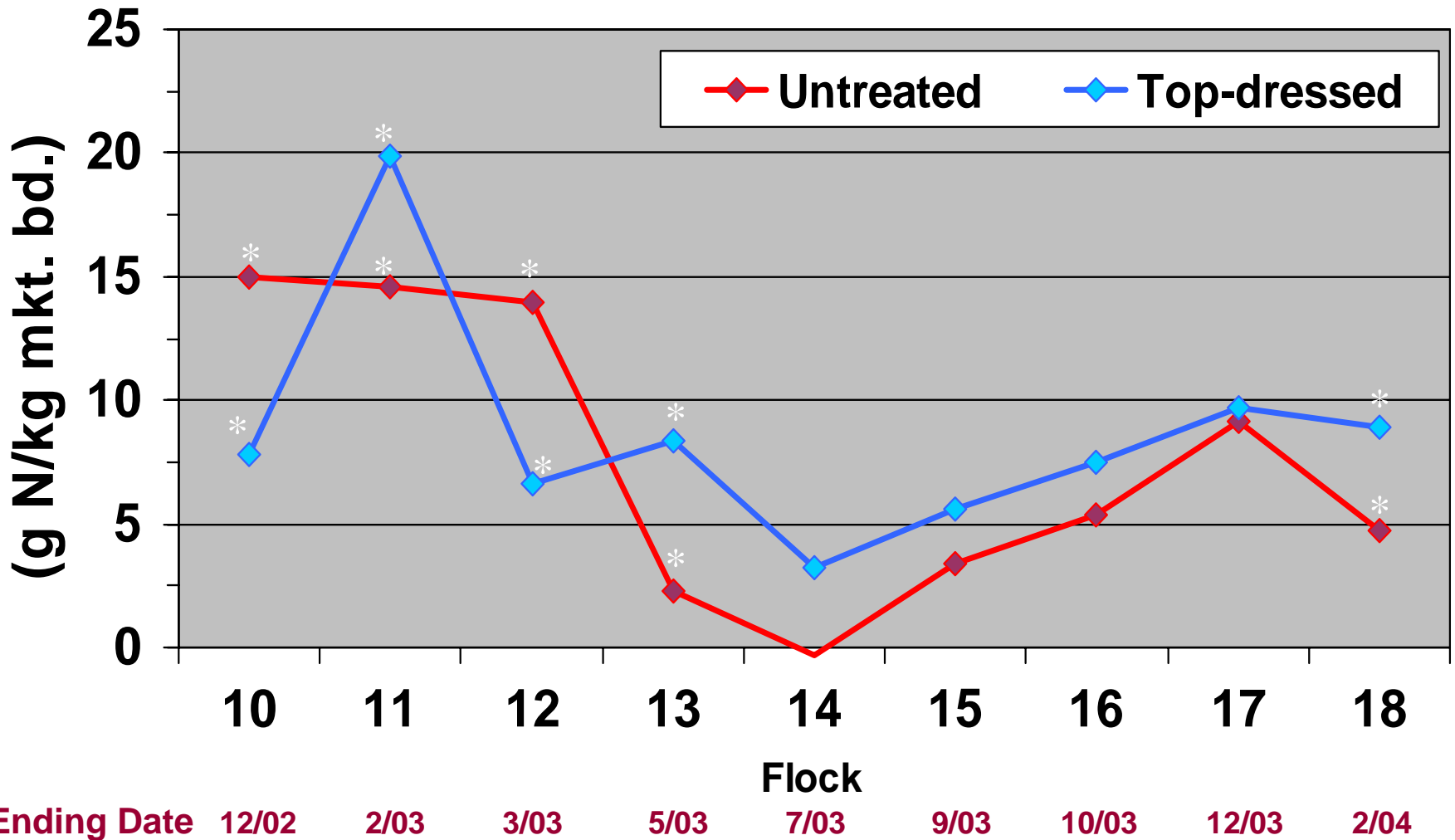


Ending Date 8/01 10/01 12/01 2/02 4/02 5/02 7/02 9/02 10/02

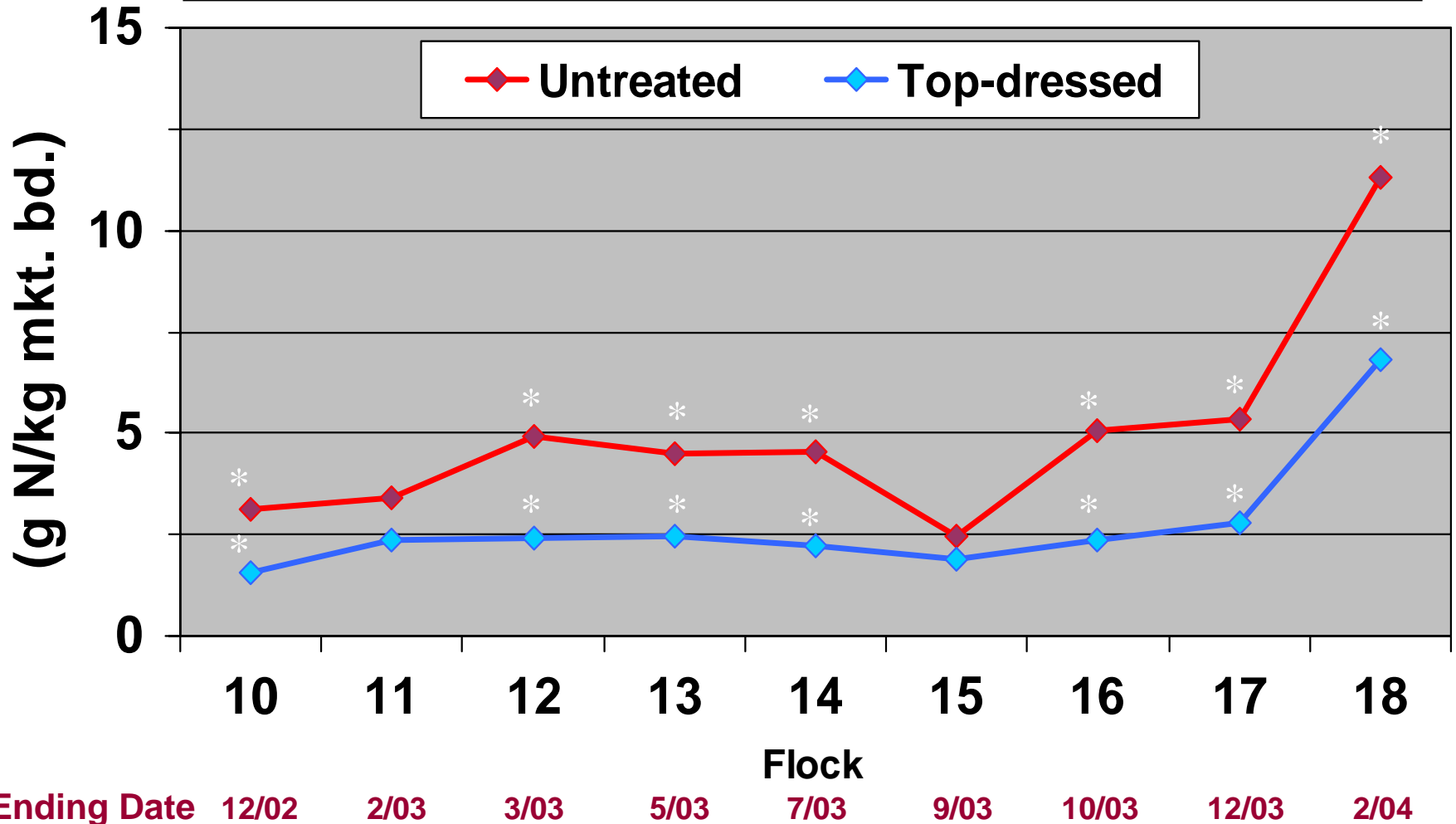
# Nitrogen Retained in Litter and Lost in Dust and Ammonia



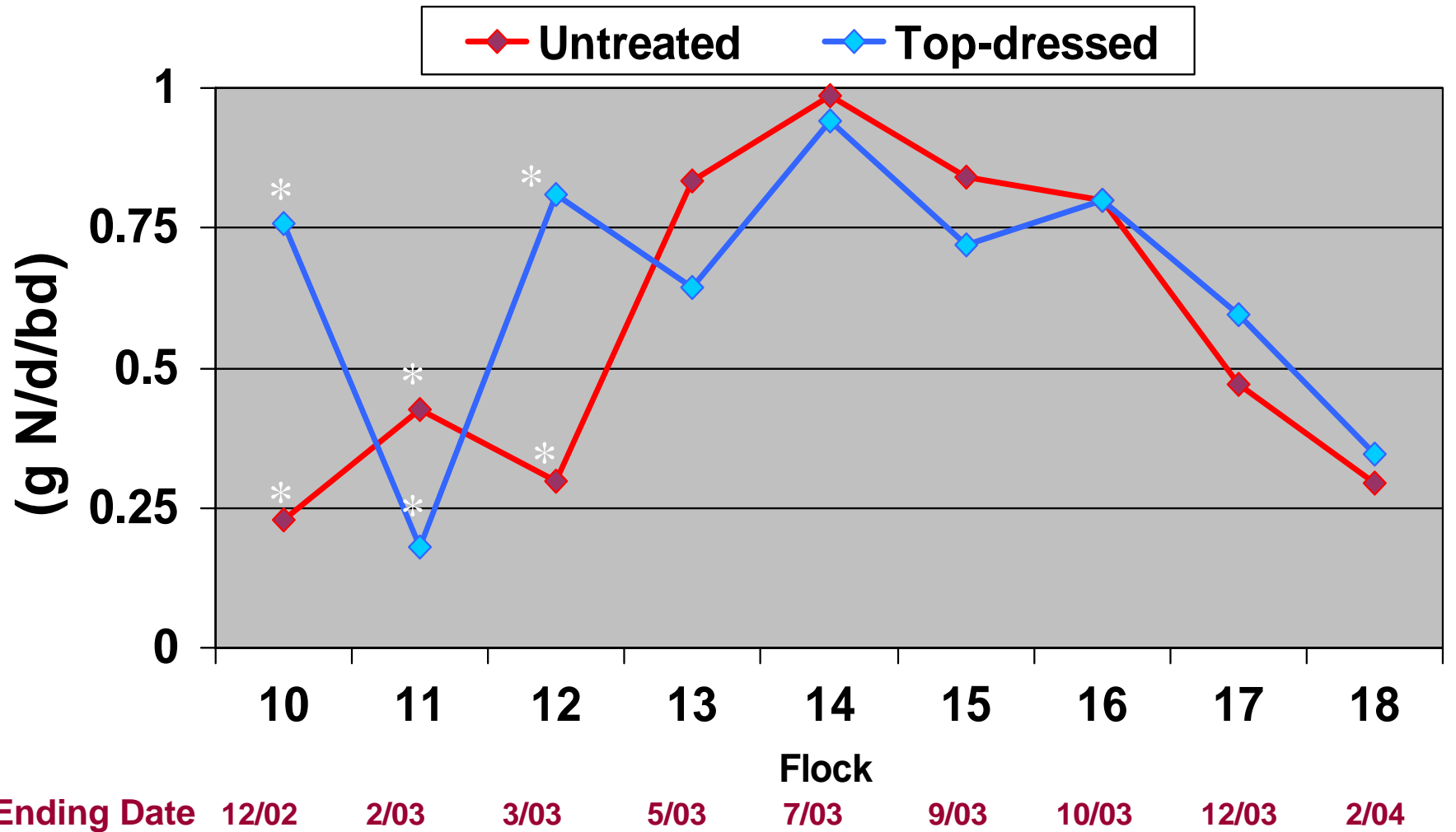
# Nitrogen Retained in Litter



# Nitrogen Removed in Caked Litter



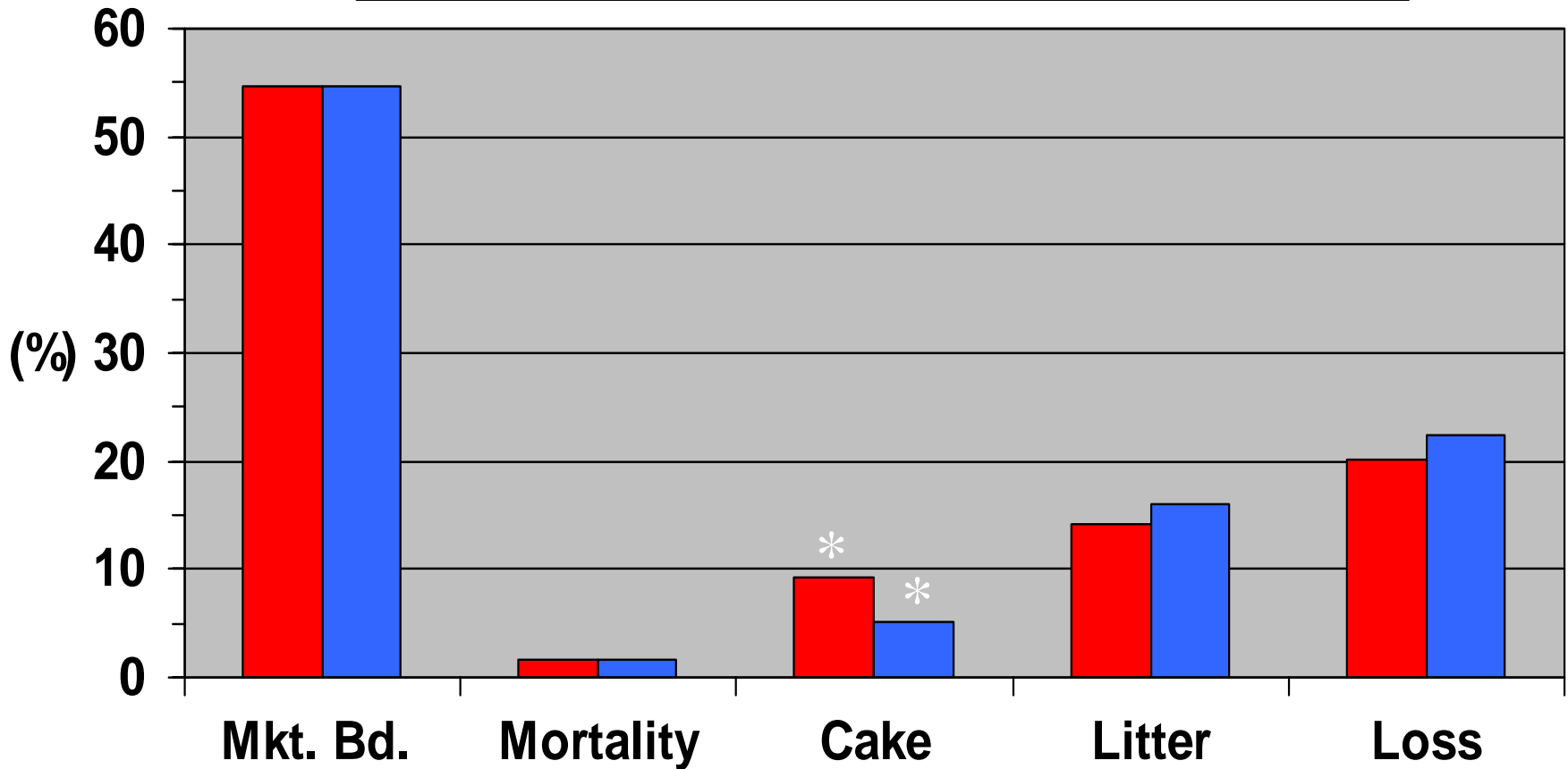
# Nitrogen Lost as Ammonia and Dust



# Nitrogen Partitioning Flocks 10-18

■ Untreated

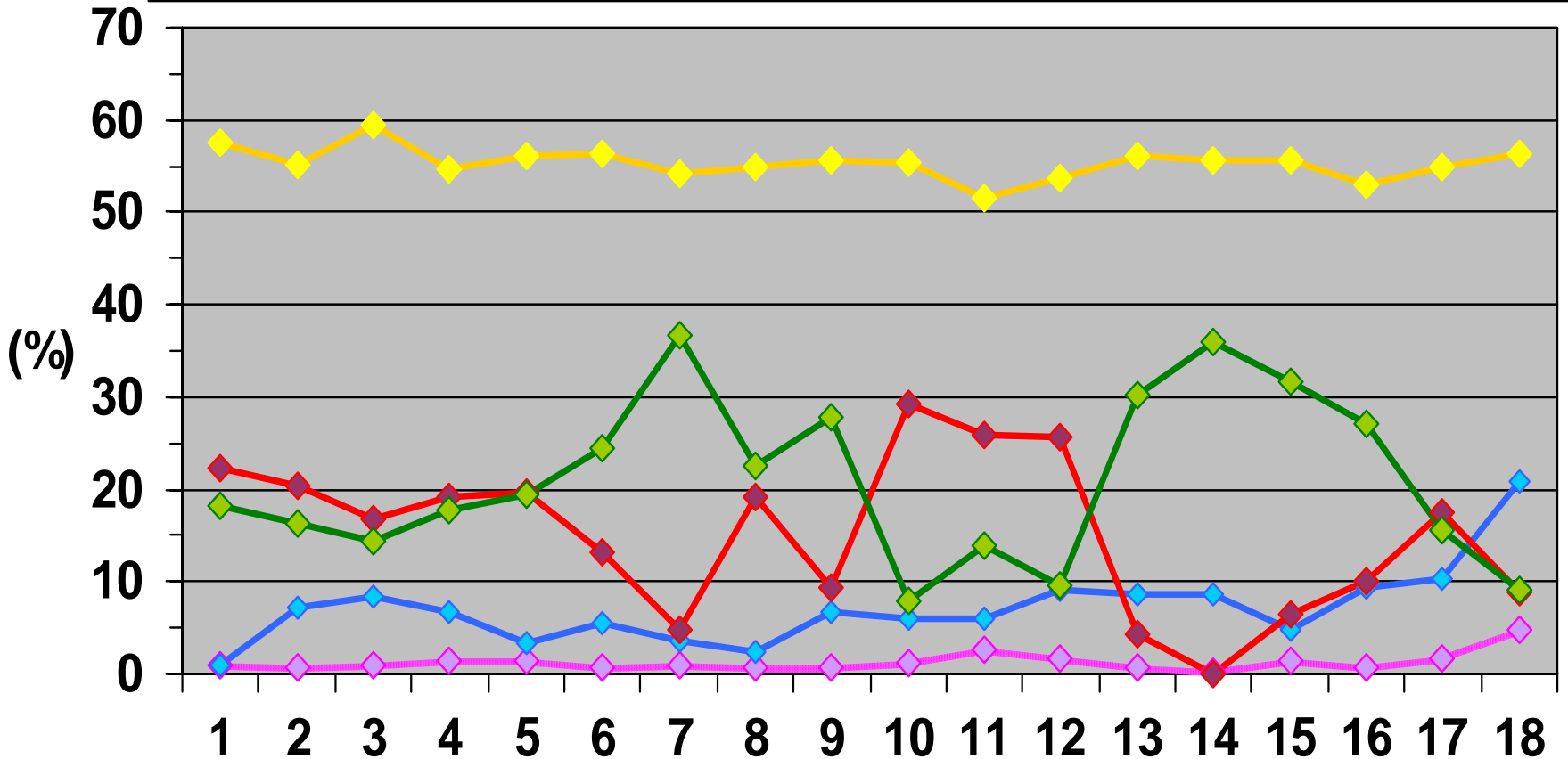
■ Top-dressed



# Nitrogen Partitioning Flocks 1-18

## (Untreated Litter)

◆ Mkt. Birds   
 ◆ Mortality   
 ◆ Cake   
 ◆ Litter   
 ◆ Loss



10/01

7/02

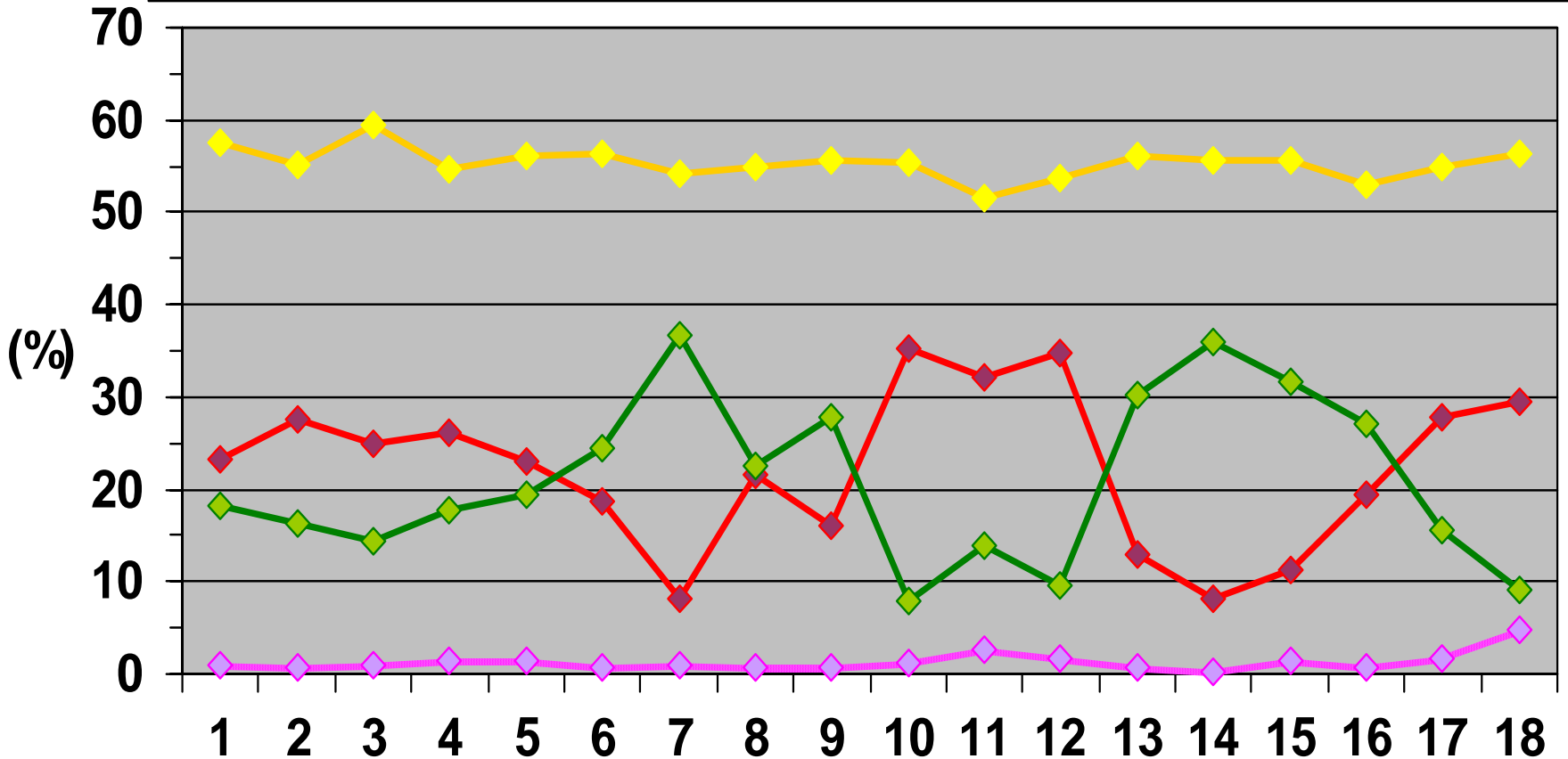
12/02

7/03

2/04

# Nitrogen Partitioning Flocks 1-18 (Untreated Litter)

Mkt. Birds   Mortality   All Litter   Loss



10/01

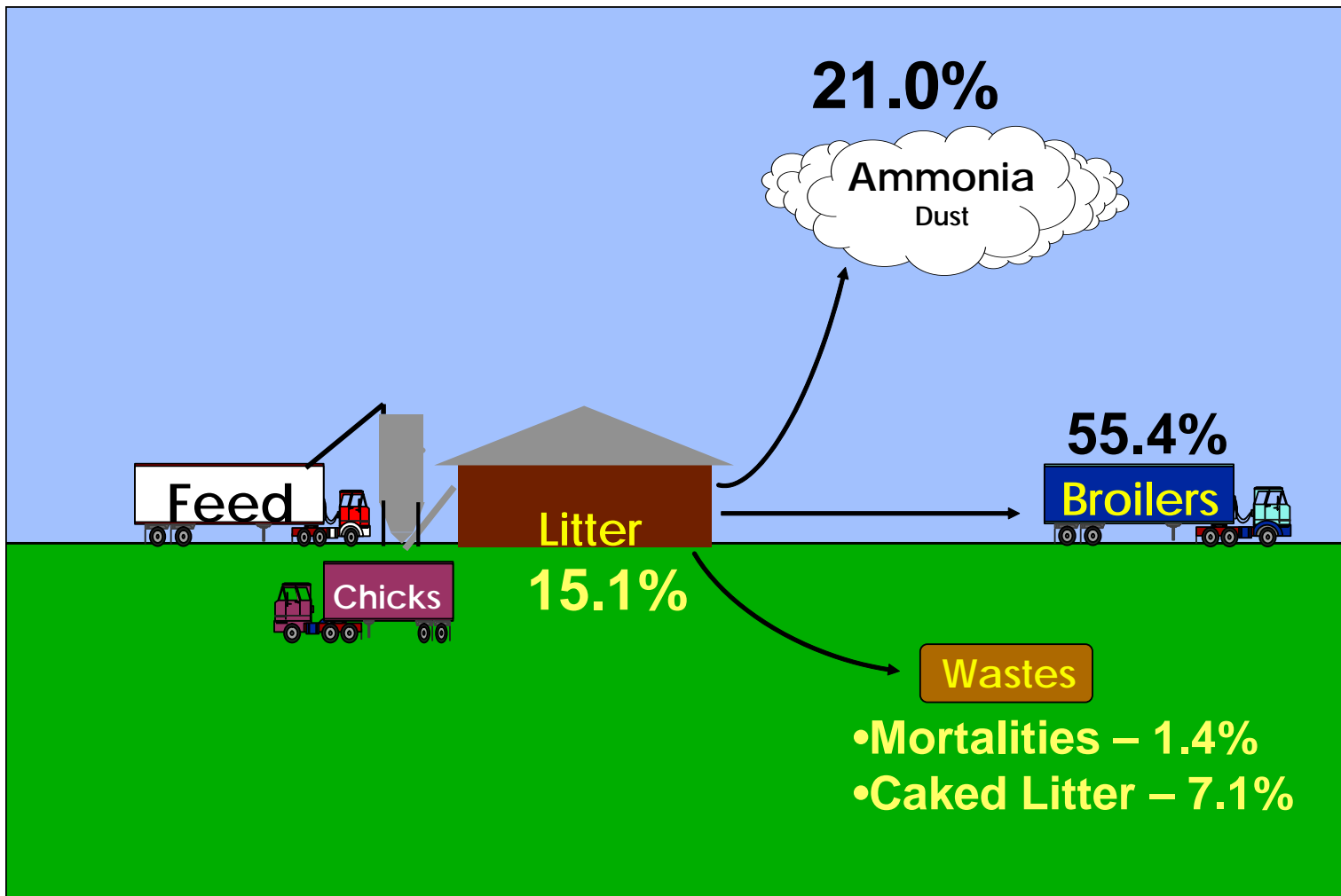
7/02

12/02

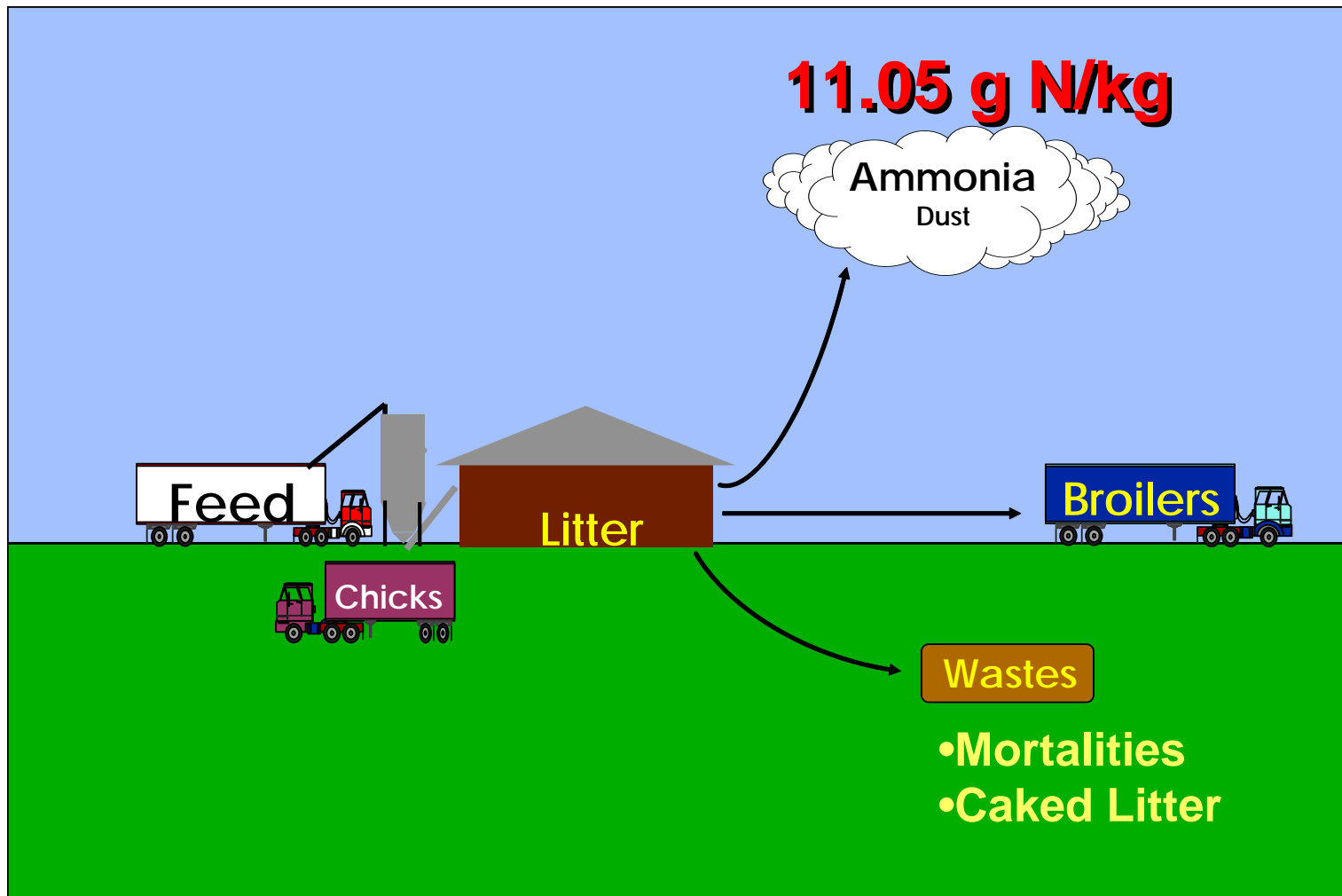
7/03

2/04

# Nitrogen Partitioning in Broiler Production Flocks 1-18



# Nitrogen Emission in Broiler Production Flocks 1-18



# Application of Data

- **Example Farm: broiler producer using recycled rice hull litter**
  - ◆ 4 house farm
  - ◆ 25,000 birds/house
  - ◆ 4.8 – 5.0 lb (2.2 kg) bird at market age
  - ◆ 6 week grow-out period
  - ◆ 18 flocks on same litter

# Application of Data

**Broilers produced per flock = 100,000**

**Weight of broilers = 100,000 x 2.2 = 220,000 kg**

**N loss = 220,000 kg x 11.05 g N/kg bd = 2431 kg/flock**

**Daily N loss = 2431 kg / 42 days = 57.9 kg/d**

**127.6 lb/d for the farm**

**31.9 lb/d for each house**

# Conclusions

- ◆ **Seasonal effects nitrogen mass balance**
- ◆ **Nitrogen absorbed by litter and nitrogen lost is inversely related**

# Conclusions

- **Top-dressing can be a useful method to extend useful life of recycled litter**
- **Top-dressing could negatively impact overall nitrogen mass balance**
  - ◆ Did NOT increase N retention in litter consistently
  - ◆ 2% more N loss over 9 flocks

# Literature Review

- **Measurement of ammonia emission rates in Texas broiler houses**
  - ◆ Redwine et al., 2002
    - ◆ Summer: 59 to 2105 g/h (3 to 111 lb/d)
    - ◆ Winter: 38 to 1893 g/h (2 to 100 lb/d)
  - ◆ Present study = 31.9 lb/d