Feed and Animal Management Practices to Minimize Nutrient Waste

Minimizing Livestock Waste Production

Animals Produce Waste! A lot of Waste!

Table 11-1. Manure and nutrients produced by 100,000 commercial laying hens annually and nutrients removed by corn grain at 150 bushels per acre.

Manure Nutrients, lbs[a]		Nutrients, lbs/acre[b]	Nutrients Removed by Corn Grain[c]	Nutrients in Manure/Nutrients Removed by Corn
Total N	53,650	328	130	2.5X
P_2O_5	79,120	483	57	8.5X
K_2O	44,630	272	42	6.5X

[a] 100,000 hens produce 2,776,860 lbs, or 1,388 tons of manure annually. Source: Patterson and Lorenz 1996.
[b] 164 acres of arable land to apply manure
[c] Martin et al. 1975.

Livestock Waste – a few concepts

- The quantity of nutrients excreted by animals is affected by :
  - amount of dietary nutrients consumed,
  - efficiency with which they are utilized by the animal

Table 11-4. Partitioning of feed N in commercial poultry.

	Percent				
Poultry	Feed	Manure or Litter	Carcass	Eggs	Atmosphere
Laying hens	100	25.01	0.84	34.07	40.01
Pullets	100	43.20	25.30	— —	31.50
Turkeys	100	28.00	46.00	— —	26.00
Broilers	100	30.56	51.08	— —	18.36

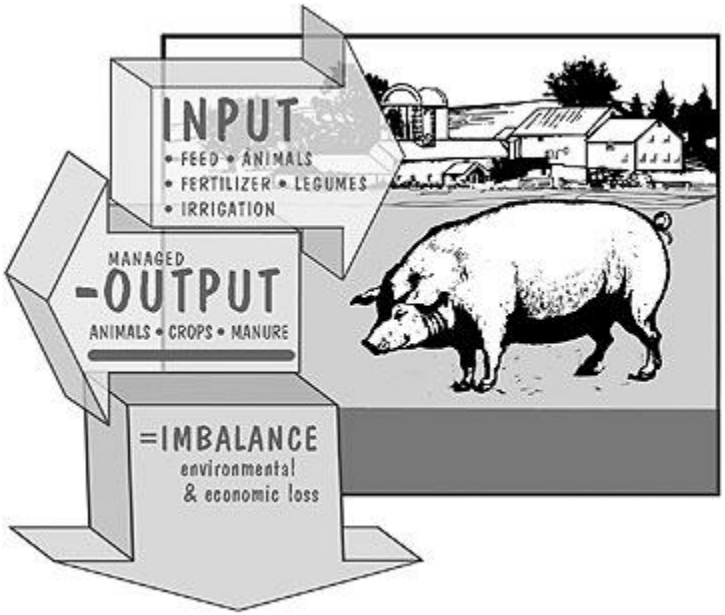
Sources: Patterson and Lorenz 1996; Patterson and Lorenz 1997; Patterson et al. 1998; and Patterson et al., unpublished data.

Livestock Waste – a few concepts

- To reduce the amount of nutrients excreted
  - Decrease the amount that is consumed
  - Increase the efficiency of utilization of the dietary nutrients

Livestock Waste – a few concepts

- The existing challenge is to formulate rations for high production levels while simultaneously minimizing the environmental impact of excessive nutrients in the manure



Minimizing Livestock Waste Production-Benefits

- Less waste
  - = less cost
  - = lower environmental impact
  - = higher production efficiency (for a given level of production)

Minimizing Livestock Waste Production-Strategies

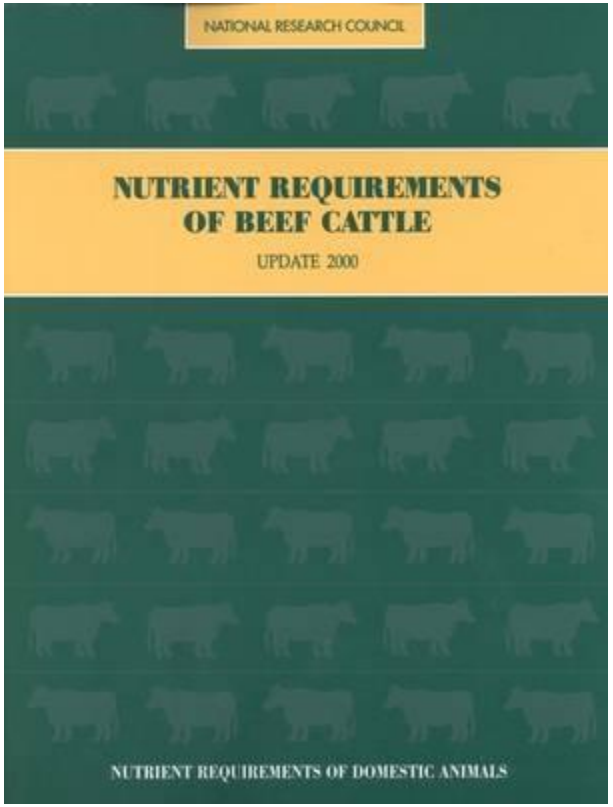
- Two Approaches:
  - Nutritional Manipulation
  - Manipulating the Animal and Environment

Nutritional Manipulation-General

- The amount and composition of manure is primarily influenced by the original composition of the diet
  - Decrease nutrient excretion by optimizing nutrient availability and proportion in the diet

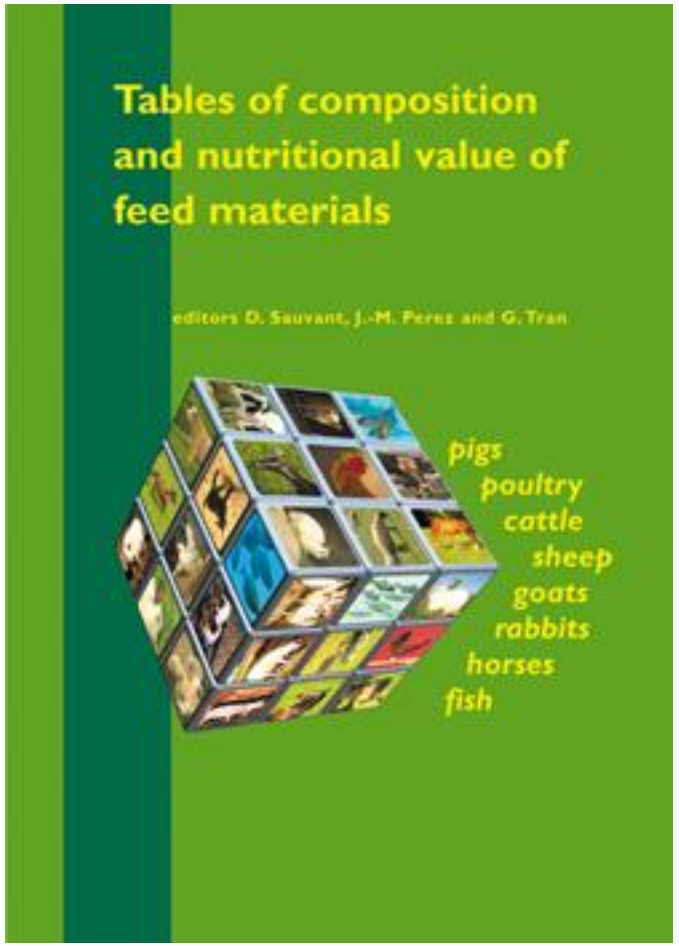
Nutritional Manipulation-General

- Know the nutritional requirements of your animals



Nutritional Manipulation-General

- Know the nutritional composition of your feed stuffs

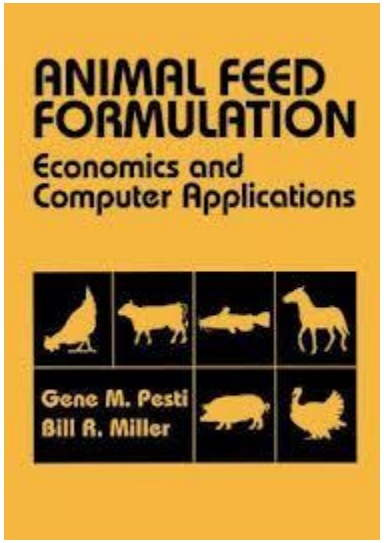


Nutritional Manipulation-General

- Feeding characteristics of feedstuff varies
  - Composition, Digestibility and utilization
    - Type of feed
    - Year to year -and batch to batch variation
- Conduct Routine Feed Analyses
  - New forages
  - New batches
  - By-product feeds

Nutritional Manipulation-General

- Formulate diets to closely match requirements
  - Minimize feeding nutrients in excess
  - Often done as a "safety factor" to minimize poor performance because of potential variation in feed sources and cattle performance



Nutritional Manipulation-General

- Consult with Nutritionist !!!

CONSIDERATIONS FOR BEEF CATTLE

Nutritional Manipulation-Beef Cattle

- Balance diets for Protein/Nitrogen
  - Balance diets based on Metabolizable Protein (MP) rather than crude protein (CP)
    - MP better reflects the needs of the animals
    - Using CP can result in feeding of excess N and increase N excretion

Nutritional Manipulation-Beef Cattle

- Balance for Protein/Nitrogen
  - Can reduce N excretion by as much as 25 percent.

Nutritional Manipulation-Beef Cattle

- Balance diets for Phosphorus
  - P levels can vary significantly, particularly in by-products
  - Fermentation by-products used as energy or protein sources can increase P excretion
  - P may be routinely added to mineral mixes for cattle, BUT
  - Ingredients in basal diets can have adequate or even exceed P requirements

Nutritional Manipulation-Beef Cattle

- Balance for Phosphorus
  - P excretion can be reduced by 20 to 30 percent by eliminating supplemental P the diet.
  - Forage-based diets, may need to add minimum supplemental P

Nutritional Manipulation-Beef Cattle

- Phase feeding and Grouping Strategies
  - Group cattle of common age, sex and size
  - Less variation within groups allows the use of diets that come closer to actual requirements
  - Can reduce N and P excretion by 5 to 10 percent

Nutritional Manipulation-Beef Cattle

Table 3 Potential for feed management to impact nutrients in beef cattle manure [1]

Strategy	Nitrogen reduction (%)	Phosphorus reduction (%)
Minimize dietary nutrient excesses	0–25	0–30
Protein manipulation	0–25	n/a [2]
Growth promotants	5	5
Phase feeding	5–10	5–10

1 Table adapted from Federation of Animal Science Societies (FASS) publication, *Dietary Adjustments to Minimize Nutrient Excretion from Livestock and Poultry*, January 2001.
2 Not applicable.

NON-NUTRITIONAL STRATEGIES TO REDUCE VOLUME AND NUTRIENT CONCENTRATION IN WASTE/MANURE

Non-Nutritional Strategies to Reduce Waste

- General Concepts
  - The less animals to feed per given level of production (increasing productivity)
    - Less feed
    - Lower cost
    - Less waste/manure

Non-Nutritional Strategies to Reduce Waste

- General Concepts
  - Increasing productivity
    - Growth rates / Feed conversion
    - Health / animal housing an environment
    - Genetics and Breeding
    - Reproduction
    - Culling

Non-Nutritional Strategies to Reduce Waste

- Reduce stress
  - Minimizing stress is an all inclusive goal to reduce P excretions
    - Housing
    - Health
    - Nutrition
    - Genetics

Non-Nutritional Strategies to Reduce Waste

- Reduce environmental stress
  - High environmental temperatures =increase water consumption = increases the rate of intestinal passage and increase excretion

Non-Nutritional Strategies to Reduce Waste

- Strategic Culling
  - Non-productive animals eat generate waste but does not produce aproduct –Environment fixed cost or Maintenance cost

Non-Nutritional Strategies to Reduce Waste

- Strategic Culling
  - Cull animals prior to periods where there is likely to have the greatest impact on the environment
    - Winter (winter feeding)
    - Droughts
    - Low forage availability (reduce overgrazing)

Non-Nutritional Strategies to Reduce Waste

- Strategic Culling
  - Cull animals that are:
    - Unhealthy
    - Open/non-pregnant
    - Wasting /Low producing
      - Low productivity/unit waste
      - Lower nutrient utilization, and,
      - Increase nutrient excretion

Non-Nutritional Strategies to Reduce Waste

- Other Considerations-Feed storage
  - Poor feed storage can lead to direct lost of nutrients to the environment – adds to waste
    - Rainfall on uncovered feed
    - Silage leachate

Non-Nutritional Strategies to Reduce Waste

- Other Considerations- Feed bunk management
  - Adjust intake to better meet nutritional requirements of animals
  - Minimize feed-bunk spillage
  - Re-feed spills rather than scrape and add to waste

Hay Management

- Hay wastage can vary from 6 to 60%
  - Contribute to total waste
  - Hay feeding sites accumulate hay and animal waste
  - Facilitates infestation with flies

Hay Management

- **Practices to minimize impact**
  - Move feeding sites numerous times during the season,
  - Composting sites to kill any harmful bacteria
  - Burning sites at the end of the season.

Hay Management

- **Practices to minimize impact**
  - Locate round bale feeding sites at least 100 feet away from riparian areas
  - Limit feeding time- 3 hours/day no impact on performance
  - Cone-type feeder

	Feeder Type			
Item	CONE	SHEET	RING	POLY
Waste, % bale wt	5.3a	13.0b	20.5c	21.0c
Total waste, lb*	63.6a	156b	246c	252c
Cost of waste/bale	$ 3.71	$ 9.10	$ 14.35	$ 14.70
Cost of wasted hay per month	$111.30	$ 273.00	$ 430.50	$ 441.00
Cost of wasted hay per season*	$667.80	$1,638.00	$2,583.00	$ 2,646.00

[abc] Means within a row with uncommon superscripts differ (P<0.05)
* Assuming $70 per 1,200 lb bale, feeding 180 bales per season

Modified Cone Ring

Water Source Management

- Cattle given access to streams, ponds and rivers can lead to:
- Environmental impacts
  - Degradation of waterways
  - Damage banks of ponds, streams, creeks and rivers,
  - Increased erosion and the deposition of sediment in downstream waters
  - Nutrient enrichment of waterways

Water Source Management

- Cattle given access to streams, ponds and rivers can lead to:
- Herd Health Problems
  - Spread of water-borne diseases
  - Foot rot
  - Mastitis
  - Leg injuries

Water Source Management

- Practices to minimize impact of grazing
  - Restrict access to water ways
  - Develop “of-stream” water sources
  - Rotational grazing
  - Manage fenced stream
  - Control growth on banks using high-intensity, low-frequency grazing

Water Source Management

- Time of Grazing
  - Grazing in summer months
    - Increases grazing within 110ft and proportion of animals located in streams
    - Increases the amount of bare ground around streams
    - Increases the amount of manure covered ground around streams

Animals should not be allowed direct access to

Animals should not be allowed direct access to surface waters.

Water Source Management

- Restricting Access to Waterways in continuous stocked pastures reduce:
  - The proportion of animal observed in streams
  - The proportion of animals observed within 110ft of stream

Water Source Management

- Restricting Stream Access on continuously grazed pastures
  - Keeps the Proportion of animals located within 110ft of pasture stream below 2%
  - Reduces the amount of bare-ground on stream banks and within 110ft of the stream bank
  - Reduces the amount of fecal covered-ground on stream banks and within 110ft of the stream bank
  - Particularly during summer months

Water Source Management

- Rotational Grazing also reduces:
  - The proportion of animal observed in streams
  - The proportion of animals observed within 110ft of stream

Pasture rotation provides adequate cover to prevent runoff to surface waters.

STREAM BANK EROSION

Continuous Stocking,
Restricted Stream Access

Rotational
Stocking

Continuous Stocking,
Unrestricted Stream Access

Water Source Management

- Provision of of-stream water sources:
  - Reduces the proportion of animals found in streams and within 110ft of the stream during summer months on pastures with unrestricted stream access:
  - SIMPLY PROVIDING AN OFF-STREAM WATER SOURCE CAN REDUCE IMPAIRMENT OF WATER SOURCES

Self watering systems protect surface water from direct access by animals.

EFFECTS OF GRAZING MANAGEMENT AND OFF-STREAM WATER ON P EXCRETION IN OR WITHIN 110 FEET OF A PASTURE STREAM

Grazing System	Off-Stream Water	P Excretion, g·cow^{-1}·d^{-1}		
		Total	In Stream	110 Foot Zone
Continuous Unrestricted[b]	-	50.9	1.6	8.4
Continuous Restricted[b]	-	51.4	0.2	1.9
Continuous Unrestricted[b]	+	50.9	0.8	5.2
Continuous Restricted[b]	+	51.4	0.1	0.6
Rotational[c]	+	43.9	--	2.5

[a]Pregnant fall-calving cows receiving no P supplementation.

[b]Calculated with proportion of time using GPS collars.

[c]Calculated with proportion of days in riparian paddock.

THANK YOU!