



**Netherlands East African  
Dairy Partnership**

**Improving manure management**

**Module 3.**

**Options for manure management in intensive  
small-scale dairy systems**

# Learning objectives of Module 3

1. Understand meaning of integrated manure management and its criteria
2. Know which options for integrated manure management are feasible for small-scale intensive dairy systems

# Integrated manure management



# Integrated manure management for small-scale intensive dairy systems

- Manure management is management of the whole manure “chain”: integrated manure management

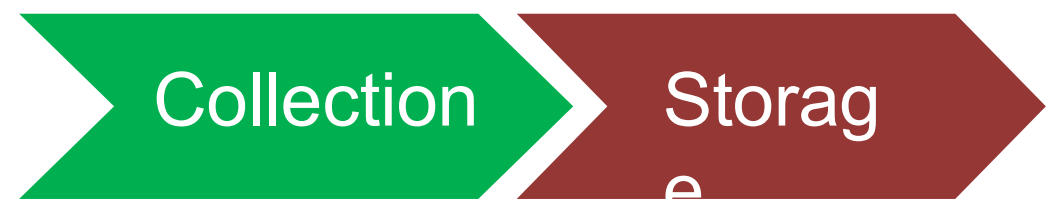


- Options for improving manure management should:
  - take into account collection, storage, eventual treatment and application and/or use of the manure
  - focus on reducing loss of nutrients and negative environmental effects
  - consider the feasibility and economy of the options.

# Options for integrated manure management



# Options for improved manure management



## Key points for improvement of collection and storage:

- **Type of barn:** tied barn, loose housing system, deep litter system
- **Type of floor:** earthen floor, sandy or concrete floor of walking area
- **Roofing of the barn/shed:** partial roofing or complete roof
- **Frequency** of manure removal, collection



# Options for improved collection



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## Areas of manure production



**Barn**

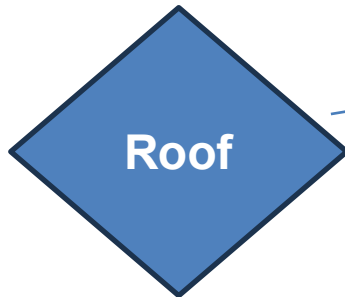
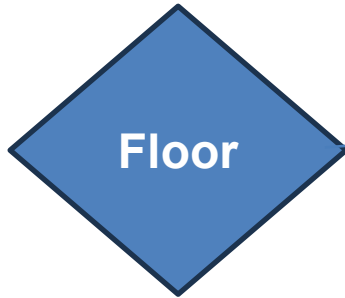


**Feedlot**



**Confinement**

## Areas of improvements



## Improvements

- Solid floors
- Increasing the slope of the walking floor
- Using gutters to drain the urine

- Roofing the confinements, including the walking area

Improved collection practice should:

- Ease manure collection
- Reduce losses via spills, leaching/drainage

## Practices of improvements



- Regular manure collection
- Separation of manure liquid and solid fractions



# Separate collection of liquids and solids



**Reduces loss of nutrients**  
(less ammonia volatilization)

**Requirements:** Investments in separate storages and extra labour (collection)

**Methods:**

- 1. Separate collection at time of excretion**
- 2. Partial separate collection of liquids and solids in barn:**
  - Draining of liquids on sloping floor to a liquid storage
  - Collection of solids from the floor



# Options for improved storage (1)

Good storage of manure will reduce nutrient losses and reduce bad smell

## Options for effective storage of slurries and liquids:

- Closed, concrete walled pits or tanks



Slurry concrete pit



Urine concrete pit



Manure solids storage



# Options for improved storage (2)

Use of protective covers on manure heaps and piles will reduce nutrient losses

## Options for protective covers on heaps and piles:

- (Semi)-permanent covers: plastic covers (cheap)
- Permanent cover: roofed shed (relatively high investment)
- Temporary covers: banana leaves, straw (short lived)



# Options for improved manure management



## Treatment

### Reasons for treatment of manure :

- Production of a valuable product, e.g. biogas or compost
- Improvement handling (reduction of volume, moisture)
- Reduction of nutrient losses
- Reduction of risk human infections (e.g. killing of pathogens) and/or weed seeds

### Options:

Biodigestion, drying (dehydration), physical separation, composting and refining

# Options for manure treatment (1): biodigestion

- **Anaerobic digestion process in biodigester:** breaking down of manure (organic matter)
- **Production of energy:** biogas (methane) and digestate (bioslurry)
- **Bioslurry:** organic fertilizer has low dry matter content, less organic matter and higher mineral N content than original manure



## Options for manure treatment (2): air drying (dehydration)

### **Air drying:**

- Evaporation of moisture to improve volume and handling
- Most applicable for moist manures: slurry and bioslurry

### **Advantages:**

- End product is easy to handle and transport
- Reduction of odour

### **Disadvantages:**

- Risk of drainage of nutrients during drying
- Losses of mineral N (volatilization)
- Difficult during rainy season

## Options for treatment (3): mechanical separation

### **Mechanical separation**

- Mechanical treatment of slurries with manure separator into a liquid and a solid fraction
- The solid fraction: a stackable organic fertilizer, easy to store and to transport (e.g. for sale)
- Liquid fraction: fertilizer for crops and in fish farming
- Liquid fraction contains more N and solid fraction more P

**Disadvantage:** relative high investment (separator)

- Suitable for larger farms with surplus of manure

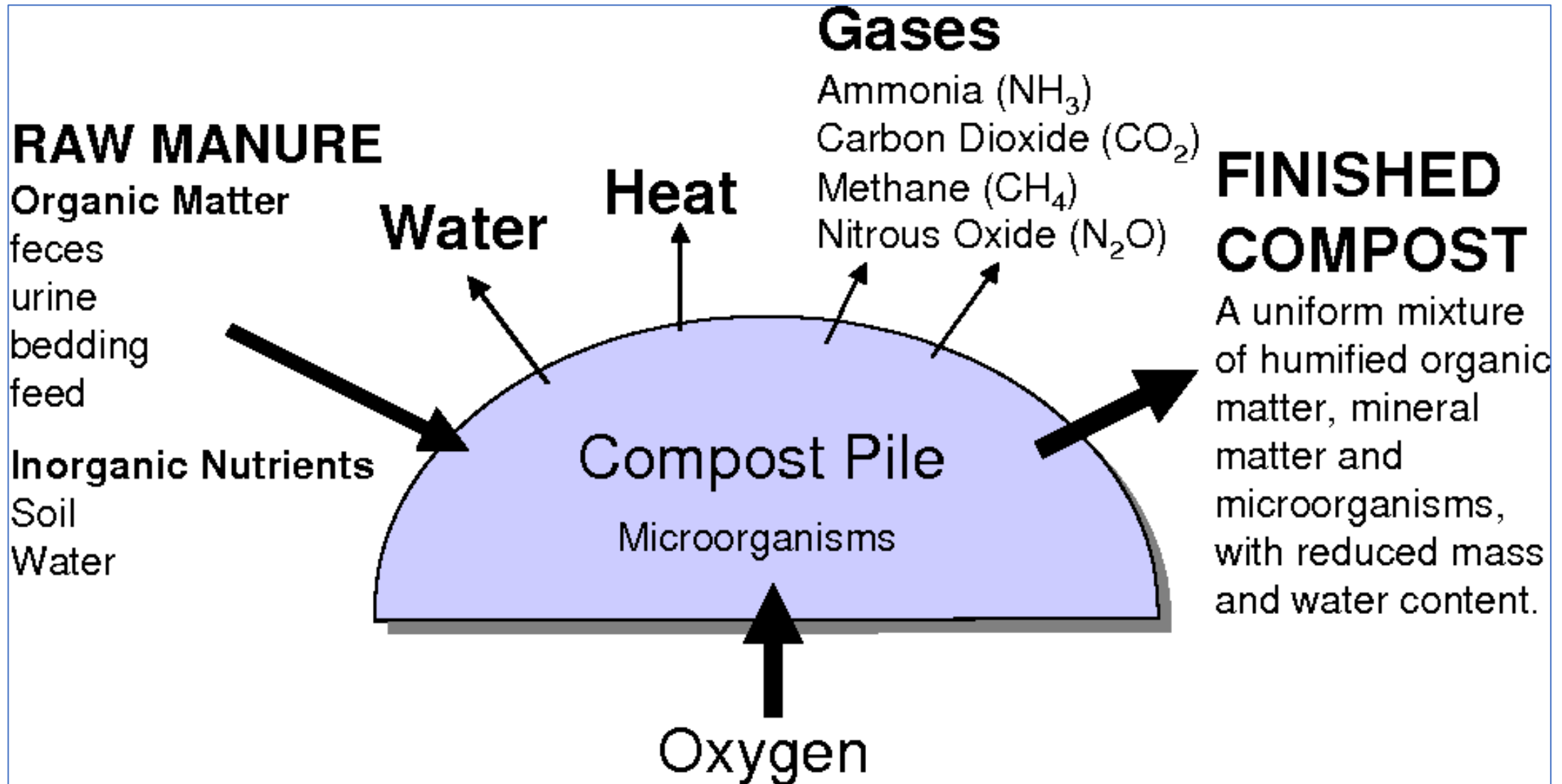


# Options for manure treatment (4): composting

## Aerobic composting:

- Natural process of decomposition by microorganisms:
  - suitable reduction of volume and moisture
  - Suits all farm situations (large, small) and all types of manure
- End product:
  - stable (moisture content, nutrients), easy to handle
  - free of pathogens and viable weeds (aerobic composting)
- **Requirements:** Availability and addition of other organic materials (green, dry)
- **Disadvantages:**
  - Labour intensive
  - Nutrient losses (C,N) can be high

# Composting process





# Options for improved manure management

## Application

- If possible, take sample of manure for lab analysis to determine nutrient content
- Apply manure based on nutrient content and according to crop needs to avoid overfertilization
- If separate collection of liquids and solids, allocation could be the following:
  - ✓ Regular application of liquids (during weeding) on forage crops
  - ✓ Application of solids on land (during cultivation) for food crops/cash crops
- Incorporation of manure-slurry into the soil (mixing) at or directly after application:
  - Reduction volatilization of ammonia (N)
  - Better utilization of nutrients by the crop
- Distribute manure evenly over the land or crop

# Options for improved manure management: Summary

Options	Nutrient losses	Fertilizer value	Extra labour	Investment	Effect on environment	Expected profitability
Baseline: uncovered heap, no roofing walking area barn	---	---	0	0	---	+ -
Heap covered with plastic sheet	--	--	+	+	--	++
Roofing and closed storage	++	++	+	++	++	+
Direct separation liquid solids, closed storage	+++	+++	+++	++	+++	+ - ?
Partial separation liquid solids, closed storage	++	++	++	++	++	+ - ?

# Options for improved manure management: Summary

Options	Nutrient losses	Fertilizer value	Labour	Investment	Effect on the environment	Expected profitability
Mechanized separation Slurry	++	++	+	+++	++	?
Composting slurry/manure	+ -	+	+++	++	+	?
Drying dung/ solid fraction	+ -	+	++	+	+	+
Vermi culture	?	+	++	++	++	?