

MANURE MANAGEMENT AND ENVIRONMENTAL PLANNING



BASICS

OVERVIEW

- Animal manure includes: urine, manure, and various bodily secretions (those from the nose, vagina, and mammary glands). Management of manure encompasses its production, collection, storage, treatment, transfer, and utilization. Environmental planning includes manure management as well as nutrient and odor management.
- The total number of cattle in the United States has decreased from over 100 million head in 1994 to 88.5 million head in 2014. The same trend was seen in Europe, whose cattle population declined by 62 million head over the same time period. This decrease in cattle population in developed countries is largely a result of increased productivity and intensive management through confinement systems. Since the land base for nutrient disposal and the animal centers are often separated, manure must be collected for distribution and plans developed for appropriate allocation of nutrients.
- A formal manure management plan can guide decisions about nutrient tracking and crop nutrient use and identify current and future requirements for livestock manure management to protect water and air quality.
- Producers and veterinarians are integral in addressing emerging air quality issues (such as ammonia and methane emissions), nutrient loading of the water supply, antibiotic transfer through microorganisms, and general human health concerns due to emissions from ruminant agriculture. Policy making through a comprehensive understanding of farm and animal management as well as manure management is an important first step.
- As urban development has come closer to livestock operations, there has been increasing public concern about the environmental impact on public health. Beyond health impacts, the public also lists odor, dust, and flies as the top three nuisances related to agriculture. Careful site selection, educated management decisions, appropriate facility design, and positive local public relations are the most effective means of avoiding public conflict.
- Management requirements are different for point (farmstead) and non-point (field-applied) sources of pollutants from ruminant operations.

MANURE MANAGEMENT

Site Selection

Facility site selection is integral to the success of a manure management plan. The following should be considered:

- Avoid lands adjacent to residential development, commercial facilities, recreational use areas, waterways and other non-agricultural lands
- Wind direction probability plans for warm season direction of flow should be evaluated. This is imperative to control smells and insects from the public venue.
- Use tree barriers and hedgerows to diminish air movements

- If possible, locate facilities near the center of the property
- Avoid environmentally sensitive areas, such as streams, drainage canals, lakes, and wetlands.
- Farm facilities should be constructed on high ground to allow wastewater management options.

Manure Storage

- Manure needs to be evaluated in two contexts:
 - Nutrient conservation for maximum fertilization
 - Nutrient reduction for ease of management
- Settling and holding basins prior to lagoons should be designed for the separation of solids from liquid discharge. This aids in manure handling (i.e. hauling lighter manure solids to fields further from the farm center rather than heavy liquid manure)
- Anaerobic lagoons, storage basins, and holding ponds help reduce nutrient loading. Lagoons can reduce odor levels, reduce nutrient application, decrease the effect on ground water, and allow producer time management for the scheduling of land application.

Manure Application

- Equipment
 - Surface broadcasting of liquid or solid manure using tanker or box spreader
 - Incorporation of liquid manure
 - Chisel, disk, and high pressure injection can reduce ammonia losses by 40-100%
 - Irrigation systems
 - All manure equipment must be calibrated to ensure uniform application rates.
- Timing
 - Apply nutrients as near to the period of plant uptake as possible
 - Smaller and more frequent applications will increase nutrient uptake efficiency
 - Avoid application to bare land by planting cover crops. This will decrease ground water pollution and soil erosion.
- Application Rates
 - Annual soil and manure lagoon testing allows for correct allocation of nutrients
 - Phosphorus readily binds to organic material and minerals within the soil whereas Nitrogen is more susceptible to leaching based on high solubility in groundwater. These, along with other biochemical differences between nutrients, are taken into account when determining application rates on various crops.
- Other Considerations
 - Cost/benefit
 - Time requirements to haul manure
 - Legal acreage requirements for application needs
 - Soil compaction
 - Odor considerations
 - Scheduling custom applicators

MANURE AND DISEASE

Feedstuffs are important in introducing disease agents through fecal contamination. Do not use manure handling equipment to deliver feed to livestock. High-pressure washers are important in the cleaning of manure handling equipment.

Manure Application and Disease

- Application of manure and lagoon water to growing forages can cause contamination of animal feeds (especially pastures and hay fields).
- Limiting manure application time periods to well before harvest reduces the transmission of *Salmonella* spp., *E. coli*, and Johne's disease.
- Composting manure can help reduce pathogen loading.
- Many bacteria can survive for 1 year in manure packs.
- Ensure the application of manure on crop fields, not hay fields.
- Manure from trucks of unknown status should be avoided.
- Manure from exhibitions/show bedding should not be spread on hay or pasture fields.

Bovine Diseases: Manure

BVD, coccidiosis, cryptosporidiosis, *Giardia* spp., *E. coli*, *Salmonella* spp., *Campylobacter* spp., Johne's disease, *Listeria* spp.

Bovine Diseases: Water

BVD, cryptosporidiosis, *Giardia* spp., *E. coli*, *Salmonella* spp., *Campylobacter* spp., Johne's disease

Bovine Diseases: Pasture/Forages

Coccidiosis, cryptosporidiosis, *Giardia* spp., *E. coli*, *Salmonella* spp., *Campylobacter* spp., Johne's disease

ENVIRONMENTAL PLANNING

In the United States, environmental planning for livestock operations has been regulated since 1970. These regulations are continually changing along with each unique livestock industry. The main goal is to decrease non-point source pollution to waterways, meaning pollution that enters via any route other than direct-discharge. Other goals include improving crop productivity through appropriate nutrient budgeting, protecting air quality, and maintaining or improving the physical, chemical, and biological condition of the soil.

Nutrient balancing is performed by evaluating nutrient flow at the herd, crop, and whole farm level. Nitrogen and phosphorus are the main nutrients evaluated in nutrient management planning. Accurate plans rely on the availability of detailed farm records (i.e. reproductive, milk production, herd numbers, acreage per crop, manure and fertilizer usage, etc.). When records are not complete, calculations are performed to estimate values such as heifer growth rates, manure production, etc.

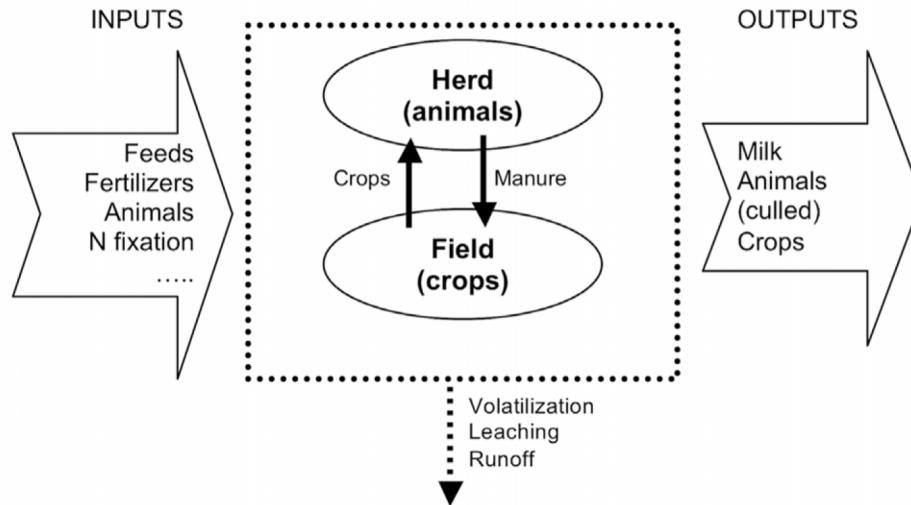


Figure 1. A schematic illustration of nutrients (nitrogen and phosphorus) flowing through a dairy farm as inputs and production outputs, nutrients cycling within farm between herd and field management components, and pathways for potential environmental losses.

Manure management plans and environmental plans including nutrient and odor management plans are generally regulated by government organizations and prepared and implemented by either public officials or private consultants. Veterinarians can play an integral role in planning facilities as well as controlling nutrient flows. This can be done by decreasing excess nutrient inputs by targeted ration formulation and increasing nutrient use efficiency through improved growth rates, reproductive performance, and production.



MISCELLANEOUS

SEE ALSO

- Manure Microbiology and Zoonosis (www.fiveminutevet.com/ruminant)
- Cleaning and Disinfection (www.fiveminutevet.com/ruminant)

ABBREVIATION

- BVD = bovine viral diarrhea

Suggested Reading

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