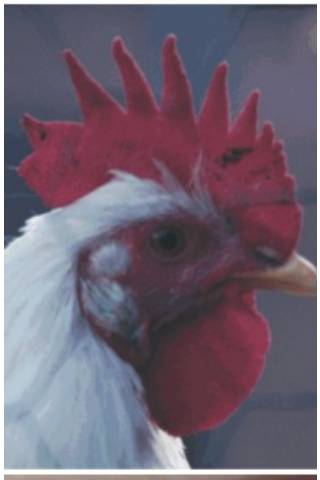





# Livestock and Poultry Agriculture: The Environment and Nutrient Management Issue

IMC

Resource Materials Contained Within Support A "Whole Farm Nutrient Management Strategy" to Manure and Nutrient Management.

## Introduction

Livestock and poultry agriculture has changed from small flocks and herds to large scale intensive production. This intensive production meets consumer demand for an inexpensive and safe food supply; however, intensification of livestock and poultry numbers and increasing urbanization have resulted in considerable attention to potentially odorous emissions produced from livestock and poultry production sites. In recent years, attention has also shifted to their impact on the environment and their effects on water, soil, and air quality as well as the rural-urban interface.

Livestock and poultry production results in the conversion of feeds into valuable products such as meat, milk, eggs and wool as well as into unavoidable and less desirable manure products (table 1). Livestock and poultry manure is excreted in solid, liquid, and gaseous forms. In the past, the term manure was used to describe livestock and poultry excreta that was predominantly used as fertilizer and soil conditioner, however with geographic concentrations of livestock production land availability has become a challenge. The volume of manure generated today may be a major obstacle to future development of the livestock and poultry industries if the impact on the environment is not properly managed and controlled. There is legislative activity to restrict agricultural practices and impose penalties for exceeding land application limits in an effort to control agricultural impacts. In the future, sound nutrient management practices such as "Whole-Farm Nutrient Management" will be mandated to manage both nutrient inputs (feed) and outputs (manure) to minimize the environmental impact of livestock and poultry agriculture.

Table 1. Livestock and poultry manure production in the United States (tons dry matter x 1,000)

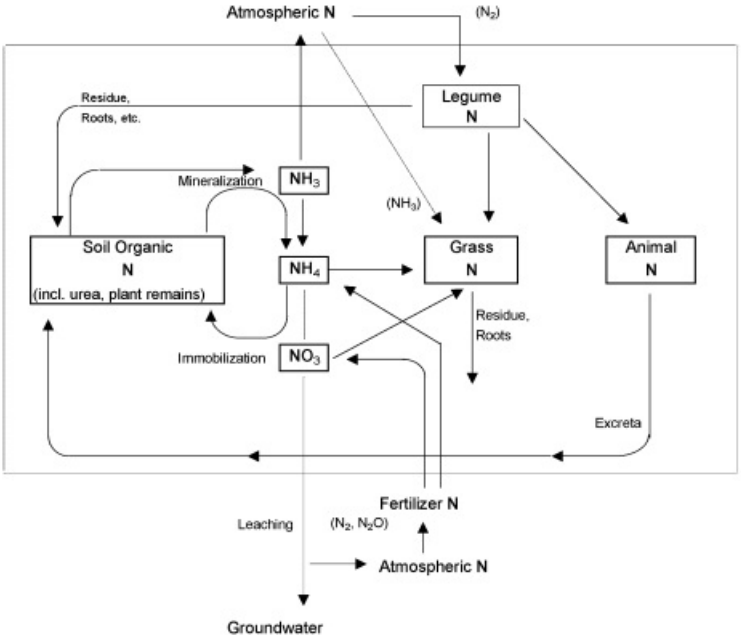
| Class of animal | Total production | Estimated collectible |
|---|---|---|
| Beef cattle (range) | 46,678 | 1,699 |
| Feeder cattle | 18,364 | 17,998 |
| Dairy cattle | 26,738 | 23,626 |
| Swine | 8,496 | 8,325 |
| Sheep | 2,996 | 1,603 |
| Layers | 3,038 | 2,978 |
| Turkeys | 1,250 | 1,225 |
| Broilers | 4,168 | 4,084 |
| Total | 111,728 | 61,538 |

*Midwest Plan Service, 1985*

## Effect of Nitrogen on the Environment

In livestock and poultry manure, nitrogen (N) is a primary agent of concern to the environment. For example, manure degradation can be a major source of nitrogen oxides ($NO_x$), which contribute to accumulation of greenhouse gases. Volatilization of ammonia ($NH_3$) causes "acid rain" which acidifies soils and woodlands. Its been reported that in western Europe animal sources are responsible for 50% of the acid precipitation. Emissions of nitrous oxide ($N_2O$) during the nitrification-denitrification cycle can contribute to ozone depletion. Furthermore, land application of excessive quantities of nitrogen is subject to surface run-off and leaching that may contaminate ground or surface waters. Nitrate leaching is considered a major concern on livestock farms today. Nitrogen conversion in manure can also be a source of odors. Under confined livestock applications nitrogen end products (ammonia) become a health hazard affecting the performance, morbidity and mortality of the animals and poultry we feed. Besides the atmospheric and environmental consequences from nitrogen losses in livestock waste, large quantities of nitrogen, which could be used as fertilizer for crop production, are lost. (Figure 1)

Figure 1. The Nitrogen Cycle




Effect of Phosphorus on the Environment

Phosphorus is a key mineral for optimum livestock and poultry production presently targeted in legislation nationally and in various states. Excess phosphorus in manure, in contrast to nitrogen, does not leach through the soil into the groundwater. Phosphorus is not toxic and would not be a problem except phosphorus is the nutrient that limits biological activity in most of our clear water lakes and streams. Nitrogen and potash generally occur naturally in the environment in sufficient quantities to support algae and plant growth in water bodies. Insufficient phosphorus in most inland water bodies keeps the clear water lakes and streams from being congested with plant growth. Levels of phosphorus exceeding critical values for aquatic plant growth can lead to the acceleration of eutrophication, the natural aging process of a lake that is characterized by excessive biological activity.

Consequences of accelerated eutrophication include degradation of recreational benefits and drinking water quality, which in turn can increase treatment costs. Advanced eutrophication can also reduce aquatic wildlife populations and species diversity by lowering dissolved oxygen and increasing the biological oxygen demand (BOD). Eutrophication from excessive phosphorus has not generally been considered a public health issue derived from agricultural runoff, as has nitrates or pathogenic bacteria. However, there are reports of toxic algae blooms and Pfiesteria microbes that can flourish with increases in available nutrients, which is causing researchers to focus more attention on the isolated events that have occurred in other states.

The manure is spread on fields to take advantage of the nutrient value and organic matter. Crops most readily respond to nitrogen, so growers have historically applied enough manure to meet crop nitrogen needs. This results often times in the over application of phosphorus. Repeated application of manure based on nitrogen needs causes phosphorus to accumulate in the soil. In some cases, 10 years of repeated applications has caused very high soil test phosphorus levels, particularly on pasture-lands where crops have not been removed. In the past, this build-up has not been a cause for concern. Phosphorus is a naturally occurring nutrient and, even at high levels, is not detrimental to crop production. It is also relatively stable once attached to soil particles. Phosphorus was once thought to have significant movement off fields only if soil was moved by erosion.

For land with high soil test phosphorus levels, it is now known that appreciable amounts of soluble phosphorus can exist in the runoff water from these areas and can significantly impact water quality in nearby streams and lakes. Looking at the top one inch of the soil profile, recent research has shown that the concentration of phosphorus in runoff increases as the soil test phosphorus increases beyond the soil holding capacity.