

MANURE MANAGEMENT STRATEGIES/TECHNOLOGIES

Prepared by

Jeffery Lorimor, Iowa State University
Charles Fulhage, University of Missouri
Ruihong Zhang, University of California-Davis
Ted Funk, University of Illinois
Ron Sheffield, North Carolina State University
D. Craig Sheppard, University of Georgia
G. Larry Newton, University of Georgia

Reviewed by

John Sweeten, Texas A & M University
Phil Westerman, North Carolina State University

A number of manure management strategies are used for both open lot and confinement facilities in the United States. The primary control strategies for open lots are solids removal using settling basins and containment followed by land application of the liquids. These management strategies are dictated by federal law for large open lots. Smaller lots may or may not capture and land apply the runoff liquid. Both large and small lot operators must haul and distribute manure solids on the land. The development of solid manure spreaders that apply uniform rates is a major research need.

Confinement facilities rely primarily, but not exclusively, on liquid handling systems.

Two general categories of liquid systems are pits, or slurry systems, and lagoons, primarily anaerobic lagoons. Anaerobic lagoon design has been researched and is well known to environmental engineers. Anaerobic lagoons work better in warm climates where biological activity continues most of the year. Anaerobic digesters with controlled temperatures can be used to produce biogas and reduce pathogens but are difficult to justify due to high capital costs, high management requirements and a lack of incentives for using the systems. Covered lagoons and anaerobic digesters can significantly reduce odors and releases of unwanted gases.

Naturally aerobic lagoons can reduce nitrogen in the liquid significantly, but are impractical because of large size requirements. Mechanically

aerated lagoons are sometimes used. Autothermal thermophilic aerobic digestion, biofilm reactors, sequencing batch reactors and combinations of anoxic and aerobic treatments are being researched and offer advantages of odor reduction and waste degradation and stabilization. Additional research is needed to optimize these systems for nutrient reduction, pathogen destruction and energy use.

Solid-liquid separation can be used for both open lots and confinements. Open lots typically use settling basins. Confinements typically use mechanical separators. The efficiency of a separator depends on the type of waste and the separator. It's difficult to achieve high efficiencies of separation without pretreatment with coagulating chemicals. Solids from both separators and from open lots are sometimes composted.

Wetland treatment of manure liquids has received some research attention. It has been shown to offer some nutrient reduction advantages when designed properly. Initial design parameters have been determined for animal waste systems, but continued research is needed to adapt wetland systems to different types of livestock operations.

Chemical amendments remain a question. Both feed additives and manure additives have been tested by a number of researchers and have achieved only moderate success at best. Much research is needed before chemical additives will be major contributors to manure control solutions.

**National Center for Manure
and Animal Waste Management**

Land application systems are well developed but always need continued work to improve efficiencies and effectiveness. One of the primary areas of research needs currently is for injection units that minimize disturbance of the soil and crop residue cover.

Insect digestion of manure solids has been well

researched in laboratory settings. Effective field production systems need to be devised, and uses for the resultant high protein feedstuffs need to be developed.

Many of the above technologies can be combined into integrated treatment systems that protect soil, air and water quality.

The full text of the White Papers is available for \$25 from Midwest Plan Service,
<http://www.mwpsdq.org/>