



Management of Spray Fields

Author: Forbes Walker, University of Tennessee, Knoxville, Tennessee

Definition:

Spray fields are crop, forage and pasture fields fertilized and irrigated by the nutrient-rich liquid, or mixtures of liquids and manure solids (slurries) from liquid manure storage structures. Management of spray fields includes installing the appropriate manure storage, pumping and application equipment, selection of an appropriate crop, estimating a rate of application that will avoid runoff and leaching of phosphorus and other nutrients, and supplying the crop with sufficient nutrients while avoiding over-irrigating and over-fertilizing the spray field.

Purpose:

Manures are a valuable source of plant nutrients, including phosphorus, and should be applied at rates that provide the crop with sufficient nutrients without impacting the environment. The over-application of manure phosphorus can increase phosphorus losses in runoff, increase phosphorus leaching to the ground water and impact water quality.

It is important to irrigate spray fields with rates that do not exceed the hydraulic capability (infiltration rate) of the soil or the nutrient requirements of the crop. Rates in excess of the soil infiltration will promote runoff. The appli-

cation of manure nutrients should not exceed the crop, forage or pasture nutrient requirements, in particular, phosphorus.

In drier regions of the country or during drier times of the growing season, a secondary benefit of irrigation with dilute, manure-laden wastewater is to supply irrigation water to the growing crop.

How Does This Practice Work?

Many swine and dairy operations and some poultry operations handle and store manure produced in the houses or dairy parlors by washing it into specially designed storage structures (lagoons or holding ponds). During storage, many nutrients including phosphorus are conserved, while others such as nitrogen are reduced. Manure storage lagoons and holding ponds must be emptied or partially emptied periodically. Prior to pumping, holding ponds are typically agitated to enable pumping of some manure solids. The nutrient-rich liquid from lagoons, or liquid/solids mixtures from holding ponds are pumped onto adjacent crop or pastures fields (spray fields) and used as a plant nutrient source.

It is important to have an adequately designed storage structure (lagoon or

holding pond). For smaller operations, it is often cheaper to hire pumps, pipes and irrigation equipment to apply the manure on the spray fields. For larger operations, it is cost-effective to own pumping equipment and have irrigation equipment permanently installed in the spray fields.

The irrigation of spray fields should not exceed the infiltration rate of the soil, otherwise runoff will result. For many soils this should not be greater than 1 inch per 24 hours.

Higher manure application rates are possible on crops and forages that take up a lot of phosphorus and produce a lot of biomass. Where possible, spray field applications should correspond with the active growing season for the crop or pasture. In many states, applications should not be made on bare soils more than 30 days prior to the growing season. (This may not be practical in many northern states.)

The nutrient requirements of the crop, forage or pasture being grown on the spray field will vary from state to state. Soil tests should be taken at least once every three to five years. Soils should be analyzed and nutrient recommendations made based on the soil test procedures or projected crop removal

Author's email
frwalker@utk.edu

Editing and Design:
Forbes Walker
Wanda Russell
Gary Dagnan
Anne Dalton

University of
Tennessee Extension

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Manure being land applied from a swine holding-pond

rates recommended by the state's land grant university.

Representative samples of the liquid or liquid and manure mixture being land-applied should be taken. Samples should be sent to an approved laboratory for analysis of the major plant nutrients (nitrogen, phosphorus and potassium). Availability factors used should be consistent with those suggested by the land grant university. Sample results typically take days or weeks to process, so a historic record of the manure nutrient analysis should be developed and used to estimate the nutrient content of the manure. If the liquids and solids are land-applied separately, samples should be analyzed separately.

The quantity of nutrients being applied on spray fields should be estimated (from the volume being applied per acre multiplied by the nutrient concentration of the liquid being applied). In most cases, applications based on the crop nitrogen requirements will exceed crop phosphorus requirements. In many states it may be necessary to conduct a field-specific assessment using the state phosphorus risk index to determine the potential risk of phosphorus loss to the environment and allowable phosphorus application rates.

Application rates should not exceed the nitrogen requirements of the crop. In fields that test high for phosphorus, application rates should be based on crop removal rates. Crops or forages that take up a lot of phosphorus and produce

a large biomass that is transported off the field after harvest are recommended.

After the application of the manure on spray fields, additional tests may be recommended. For corn, a pre-sidedress nitrate test will assess the availability of nitrogen. Forage testing to assess potassium levels is recommended for all forages to be fed to lactating dairy animals.

Where This Practice Applies and Its Limitations:

This practice applies where manure and manure-laden wastewater are collected and stored and where there are nearby fields that can use the nutrients (and water). The risk of environmental problems from the over-application of liquid manures on spray fields is greatest on sites where the risk of run-off or leaching is highest. The application of manures with very low nitrogen or very high phosphorus contents may have to be restricted, and some supplemental fertilizers used. The nutrient requirements (including phosphorus) of many pasture crops is generally low and will limit the amount of nutrients that can be applied by irrigation.

Effectiveness:

If managed correctly, the irrigation of spray fields with liquid manures is an efficient way of using stored manures for fertilizing and irrigating crops, forages and pasture fields. It is most effective if the fields are close to the manure-storage structure, and if the bulk of the crop or forage being grown is harvested and removed from the field. It is less effective for pasture fields where fewer nutrients can be removed from the site.

Cost of Establishing and Putting the Practice in Place:

The cost of establishing adequate manure storage and in-

stalling an adequate pumping and irrigation system can be high. The cost of an adequately designed lagoon system can be several hundred thousand dollars. The installation of a permanent irrigation system can cost from \$500 to \$1,000 per acre. Custom pumping of manure depends on the size of the operation, but will average between \$5 and \$8 per 1,000 gallons to install temporary irrigation equipment and pump. Soil and manure testing to determine the appropriate manure application rates are usually under \$10 per soil sample and under \$30 per manure sample for basic tests. In some states, soil and manure sampling is free.

Operation and Maintenance:

Maintenance of the pumps, pipes and the irrigation spray heads is important. Pipes and spray heads will occasionally have to be changed due to the buildup of deposits. Where manure-laden wastewater is surface-applied, any buildup of solids in the first few feet after discharge from the ditch or pipe should be removed and spread within the field.

References:

Local Cooperative Extension offices are recommended for soil and manure sampling techniques and interpretation of results. Local USDA-NRCS and Extension Service technical references and standards are available at local county offices.

For Further Information:

Contact your local conservation district, USDA-NRCS or Cooperative Extension Service office for system design assistance. Cost share may be available for manure storage structures and pumping equipment from the Consolidated Farm Service Agency (CFSA).