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Ten Land Application BMPs

When properly carried out, land application BMPs improve water quality. Generally, an animal operation will have a combination of several manure management BMPs, practices that optimize nutrient uptake by plants and minimize nutrient impact on the environment. They will change over time as technology and our understanding of the environment improves. Likewise, BMPs are very site specific, and a BMP in one place may not be useful for another location. Ten key land application BMPs (adapted from DeFrancesco 1997) to consider for your farm include:

1. Manure utilization plan
2. Manure testing
3. Equipment calibration
4. Soil testing
5. Buffers/field borders
6. Winter cover/scavenger crops
7. Manure injection/incorporation
8. Recordkeeping
9. Site inspection
10. Emergency action plan

Manure utilization plan

How it works

A manure utilization plan is a formal written plan that balances the application of stored manure to farmland. This site-specific plan ensures that manure nutrients are applied at rates that can be used to achieve a desired or predictable crop yield.

How it helps

- It can reduce commercial fertilizer costs.
- Manure can boost yields and improve soil quality.
- Manure adds vital organic matter to the soil, which greatly improves soil tilth. It makes clayey soils more friable and improves the water-holding capacity of sandy soils.
- It protects water quality by preventing the overapplication of manure or fertilizer.

Issues to consider

- Manure utilization plans are generally organized to address four main issues.
 - (1) *Source*: How much manure, and thus nutrients (N, P), is being produced annually?
 - (2) *Amount*: What application rate is appropriate for each field?
 - (3) *Placement*: How will the manure or wastewater be applied to minimize losses?
 - (4) *Timing*: When should manure be applied to minimize losses and maximize crop yields?
- Many states do not allow manure to be applied to annual crops more than one month before planting or to perennial crops while dormant.
- Manure needs to be properly stored before it can be land applied to crops.
- Your history of manure application is important because not all of the nutrients in manure are available to crops during the first year.
- Maintain yield records. These records will document a field's relative fertility and should be used to "fine tune" your *Manure Utilization Plan*.
- Update your plan annually. Work with a trained technical specialist to develop and modify your plan. Annual changes might include yield updates, crop selection, or necessary changes due to new regulations.
- This plan may be required for certain operations. Check with your local conservation district or state water quality agency for more information.

Relative cost

Since a manure utilization plan is a written plan that highlights a system of practices, the relative cost depends on the practices used. This section of each BMP compares the cost of a specific practice to that of the other nine practices by using dollar signs (\$). As the number of bolded signs increases, so does the cost of that practice. However, many plans need only an investment of time and a commitment to follow through.

Want more details?

For more information, please refer to *Livestock and Poultry Environmental Stewardship Curriculum, Lesson 31, Manure Utilization Plans*.



A manure utilization plan... balances the application of stored manure to farmland.



Adding the right amount of manure to the soil can significantly reduce your fertilizer costs while protecting the environment.

Manure testing

How it works

Manure testing is one of the first steps in manure/nutrient management. Manure, litter, and wastewater samples are collected and tested to determine the manure's nutrient content and fertilizer value.

How it helps

- Testing tells you your manure's nutrient content.
- Adding the right amount of manure to the soil can significantly reduce your fertilizer costs while protecting the environment.
- It protects water quality by preventing the overapplication of manure or fertilizer. Testing the manure tells you its nutrient content, which enables you to apply the right amount according to your *Manure Utilization Plan*.

Issues to consider

- Carefully take a representative sample. The test results are only as reliable as your sampling methods.
- If possible, manure samples should be analyzed prior to application, allowing you to better plan for and use the manure nutrients.
- Be aware of any special sampling or handling procedures that your laboratory may require.
- Designate manure-sampling equipment and use them only for collecting and mixing manure samples. Buckets and shovels used for soil sampling or for fertilizing the garden may bias lab results.
- Once you receive your manure analysis, consult with your technical specialist or the local Cooperative Extension Service about converting the results into a plant-available concentration and a usable application rate.
- Update your farm's *Manure Utilization Plan* and *Application Records*. Annual or seasonal changes in manure nutrient content may greatly affect the amount of land required to apply a given amount of manure. Good records and regular manure sampling will allow you to best utilize your manure while preventing overapplications.
- Manure testing may be required. Check with your local conservation district or state water quality agency for more information.

Relative Cost

\$\$\$ but varies by state (see page 11).

Want More Details?

For more information, please refer to *Livestock and Poultry Environmental Stewardship Curriculum, Lesson 35, Land Application Records and Sampling*.

Equipment calibration

How it works

Calibration ensures that the desired manure application rate is being achieved. This simple but necessary process is the only way to really know “how much you are applying.”

How it helps

- Calibration allows you to select, achieve, and document the manure’s application rate.
- Annual calibration of equipment can “trouble shoot” problems with application equipment, pumps, or sprinklers.
- It protects water quality by preventing the overapplication of manure or fertilizer. Proper calibration ensures that the application rate, specified in your *Manure Utilization Plan* and adjusted by your *Manure Sample*, is not being exceeded and that manure is being uniformly applied across a field.

Issues to consider

- Equipment should be calibrated annually. Equipment that is used year-round may need to be calibrated more frequently.
- Refer to the equipment’s operating manual to make the appropriate gear or gate setting and to achieve the desired rates.
- A calibration “run” is only valid for a specific application condition (i.e., travel speed, gate setting, sprinkler pressure). You will need to re-calibrate when operating conditions change.
- Manure consistency or density can significantly affect a spreader’s calibration. Re-calibrate as manure density changes.
- Uniformity: Use catch pans to collect applied manure. Visually inspect the spread distribution to determine the uniformity and to estimate the required overlap.
- Irrigation systems: Use pressure gauges as close to sprinklers as possible to verify that the system is operating at the designed operating pressure.
- Traveling sprinklers (hard-hose travelers, pivots, and linears): Frequently measure travel speed and make appropriate changes, if necessary.
- Calibration is not required in most state, but it is the easiest way to make sure you are getting the most out of your manure and adhering to your *Manure Utilization Plan*.

Relative cost

\$\$\$ and time (see page 11).

Want more details?

For more information, please refer to *Livestock and Poultry Environmental Stewardship Curriculum, Lesson 36, Land Application Equipment*.

Calibration
...is the only way
to really know
“how much you
are applying.”





...soil samples should be collected and analyzed prior to application, allowing you to better plan for and use the manure nutrients.

Soil testing

How it works

Soil samples are analyzed to check soil pH and the amount of plant nutrients already present in each field, enabling you to apply the right amount of lime, manure, and fertilizer for your crops at the right time.

How it helps

- You save money because you apply only the amount of nutrients that your crops needs.
- It helps water quality because you are less apt to overapply manure “just to be sure you have enough.”
- Since nutrients are most available to plants within a certain pH range, soil testing also tells you how much lime to apply.
- Your soil test report also shows the respective level of soil nutrients (N, P, and K) as well as metals (Cu and Zn). Deficiencies or excessive levels may need to be tracked, according to your *Manure Utilization Plan* or state regulations.

Issues to consider

- Take a representative sample carefully. The test results are only as reliable as your sampling methods.
- If possible, soil samples should be collected and analyzed prior to application, allowing you to better plan for and use the manure nutrients.
- Designate soil-sampling buckets and probes and use them only for collecting and mixing soil samples. Buckets and shovels used for *Manure Sampling* or for fertilizing the garden may bias laboratory results.
- Do not use galvanized buckets or probes.
- Once you receive your soil analysis, consult with your technical specialist or the local Cooperative Extension Service for help with interpreting results and preparing lime and fertilizer recommendations.
- As a general rule: sample in the fall and winter for spring-planted crops. Sample cool season perennial pastures in the summer, warm season perennials in the winter.
- Soil testing may be required. Check with your local conservation district or state water quality agency for more information.

Relative cost

\$\$\$ but varies by state (see page 11).

Want more details?

For more information, please refer to *Livestock and Poultry Environmental Stewardship Curriculum, Lesson 35, Land Application Records and Sampling*.

Buffers/field borders

How it works

Buffers serve as setbacks and natural treatment areas to protect wells, streams, and wetlands during land application.

How it helps

- Buffers around streams, wetlands, lakes, and ponds filter sediment and prevent nutrients from entering surface waters.
- Grassed borders and forested or riparian buffers serve as nature's "kidneys," filtering and treating excess nutrients and pathogens as they flow over the buffer and through shallow groundwater.
- In many cases, grass and legume borders may be harvested.
- Research shows those farms with native plant field borders and buffers support substantially more quail, rabbits, and songbirds than do farms without them.

Issues to consider

- A combination of grassed and forested buffers will provide the greatest protection from and treatment of sediment, nutrients, and pathogen. For low and moderate slopes, a 25-foot grassed field border and a 25-foot forested area is sufficient.
- Manure should not be applied to riparian buffers. Most states have regulated setbacks for streams and wetlands. Contact your state water quality agency or local conservation district for more information.
- Manure should not be applied near active wells or abandoned wells. A setback of 100 feet is required in most states.
- Walk your buffers annually to inspect them for signs of excessive erosion, gulling, or manure runoff. Like all BMPs, buffers need some level of maintenance.
- Programs such as the Conservation Reserve Program (CRP), the National Conservation Buffer Initiative, and several others may provide money or tax incentives for setting aside stream buffers. Contact your local conservation district or the Natural Resources Conservation Service for more information.

Relative cost

\$\$\$ (see page 11).

Want more details?

For more information, please contact your local conservation district or the Natural Resources Conservation District to learn more about the CRP and the National Conservation Buffer Initiative.



...riparian buffers serve as nature's "kidneys," filtering and treating excess nutrients and pathogens.



Cover crops... trap nutrients, conserve soil moisture, and stop erosion... .

Winter cover/scavenger crops

How it works

Grasses, legumes, or small grains are planted to protect the soil from erosion during non-crop periods. Crops also utilize residual N and P from last season's crop. Cover crops last until the main crop is planted.

How it helps

- Cover crops add organic matter to the soil, improving fertility, soil tilth, and overall soil quality, which helps long-term crop production.
- This practice traps nutrients, conserves soil moisture, and stops erosion because it keeps the soil covered.
- It traps and cycles excess N that remains after the previous crop is harvested. The N that the cover crops scavenge can be released for future crops. The excess N is utilized and will not run off into streams or leach into groundwater, helping water quality.
- It increases the food supply for soil microorganisms, resulting in higher biological activity.
- It provides additional residue cover for use in conservation tillage.

Issues to consider

- Rye and millet are excellent cover crops for scavenging N.
- Use the minimum herbicide rate on the main crop. If you overapply, it will cost you money, hurt water quality, and could carry over and damage the cover crop.
- Cover crops keep weeds from an unused field, reducing herbicide costs.
- Legume cover crops will lower your manure requirement. *Soil test* your fields and contact your technical specialist or the local Cooperative Extension Service (CES) to adjust your manure application rate.
- Your *Manure Utilization Plan* should note which fields are to be planted in cover crops. Plans should also reflect any carry-over N from winter cover crops, if not harvested.
- Plant cover crops as soon as possible after the crop harvest.

Relative cost

\$\$\$ (see page 11).

Want more details?

For more information, please contact your local conservation district or local CES.

Manure injection/incorporation

How it works

Manure is applied directly or tilled into the soil rather than being surface applied.

How it helps

- Placing manure directly into the soil conserves N, increasing its fertilizer value.
- Ammonia lost from surface applications will be deposited downwind, potentially impacting surface waters.
- Injected manure is not as susceptible to surface runoff.
- Since manure is placed directly into the soil, more organic matter will accumulate in the soil over time than in fields where manure is applied on the surface.
- Manure injection can be done in conjunction with many conservation tillage practices.

Issues to consider

- Soil injection allows producers to get the most fertilizer value for their manure.
- Manure injection is more commonly used where manure is stored as slurry. Lagoon effluents or other wastewater are not commonly injected.
- Soil injection requires significantly more tractor power than that required for surface application. Contact your local equipment dealer or extension agricultural engineer for more information.
- Manure can be injected through umbilical-hose toolbars, reducing application cost and time.
- Several states allow narrower buffers when soil injection is used. Contact your state water quality agency or local conservation district for more information.

Relative cost

\$\$\$ (see page 11).

Want more details?

For more information, please refer to *Livestock and Poultry Environmental Stewardship Curriculum, Lesson 36, Land Application Equipment*.



Manure injection can be done in conjunction with many conservation tillage practices.



Good records and regular manure sampling allow you to best utilize your manure while preventing overapplications.

Recordkeeping

How it works

Farm records keep track of each crop's yield history, plus manure and fertilizer applications.

How it helps

- You will be less willing to overapply manure and fertilizer when you see that it does not improve yields and may harm the environment.
- Do not trust your memory. Records on application dates, number of loads, fields irrigated, fertilization dates and rates, etc., are valuable information!
- *Soil and Manure Analyses* should be kept for several years. This on-farm data is your best source of information for planning current and future applications.
- Good application and yield records helps you plan for the future. Working with a technical specialist, you should review your records and evaluate if you should change your *Manure Utilization Plan*. Many producers find that they are shorting themselves by using “book values.”

Issues to consider

- Successful farmers share at least one common trait: the ability to plan and then follow through with that plan. Good recordkeeping makes this easier.
- Several states require specific information to be collected. Contact your state water quality agency if standardized forms can be adopted to better meet your needs.
- Computers make recordkeeping less a chore that it used to be. Many easy-to-use computer programs are available to assist you. Contact your local Cooperative Extension Service for more information.
- Many states require records to be kept for a certain period; check with your local conservation district or state water quality agency for more information.
- Other useful records
 - Weather conditions (rainfall, snow)
 - Manure storage/lagoon levels
 - Wind direction and speed
 - *Self-Inspection Forms*

Relative cost

\$\$\$ (see page 11).

Want more details?

For more information, please refer to *Livestock and Poultry Environmental Stewardship Curriculum, Lesson 24, Operation and Maintenance of Manure Storage Facilities, and Lesson 35, Land Application Records and Sampling.*

Site inspection

How it works

Self inspections of application sites and manure storage facilities allow you to proactively address situations before they become problems.

How it helps

- Regular self inspections help to highlight conditions on your farm that may lead to regulatory violations or environmental degradation.
- A voluntary self-inspection program demonstrates a high level of attention and care, especially to regulatory agencies.
- Records of previous inspections will be helpful if an accident ever occurs on your farm.

Issues to consider

- Inspections should be conducted on a regular basis. Consider implementing the following voluntary inspections on your farm:
 - Land application sites (*end of each application*)
 - Manure storage structures/lagoons (*monthly*)
 - Manure storage level (*weekly*)
- Inspect the perimeter of land application sites. It may be necessary to walk low areas to determine if runoff is occurring or has occurred. If it has, initiate your *Emergency Action Plan* and contact your state water quality agency.
- During applications and inspections, note areas in the field where ponding (slow-infiltration) or poor stands of vegetation exist. Comment on what corrective actions (ex., *Soil sampling* or sub-soiling) that may be necessary to correct problem.
- Frequently inspect tile drains following manure applications and after heavy thaws where manure was applied during the winter.
- Consider taking water samples from farm streams as part of your inspection program. These samples demonstrate concern for the environment and may be necessary in an emergency.
- Several states require specific inspections to be conducted. Contact your state water quality agency for more information and example inspection forms.

Relative cost

\$\$\$ (see page 11).

Want more details?

Table 32-1 provides a post-application checklist.

For more information, please refer to *Livestock and Poultry Environmental Stewardship Curriculum; Lesson 24, Operation and Maintenance of Manure Storage Facilities; Lesson 35, Land Application Records and Sampling; and Lesson 50, Emergency Action Plans.*

Inspect the perimeter of land application sites. ...walk low areas to determine if runoff is occurring or has occurred.



Table 32-1. Post-application self-inspection checklist.

Farm: _____	Field #: _____	Facility ID: _____	
Inspected by: _____	Date: _____	Time: _____ am/pm	
Manure Level			
Manure level today: _____ ft.	Last observation: _____ ft.	Date: _____	
Distance below overflow/spillway: _____ ft.	Last observation: _____ ft.	Date: _____	
Approximate percent filled: _____ %	Last observation: _____ %		
Land Application Site/Field			
Date of last application event: _____	Time: _____ am/pm		
Application rate: _____ gal/ac or acre-in			
Item	Yes	No	Corrective Measures Taken/Planned
Are there soggy or damp areas at the edge of application site?			
Are there signs that manure runoff has left the field edge?			
Does surface water diversions have adequate depth?			
Are diversions properly vegetated to minimize erosion?			
Are diversion outlets properly stabilized and maintained?			
Following application, are there areas of ponded manure?			
Are there areas in the field that received excess manure or litter application?			
Is there a reason for the overapplication? (spillage, equipment malfunction, leak)			
Are there bare areas in field that are inconsistent with cropping or fertilization patterns?			
Are there leaks from permanently installed application equipment, risers, or pipe?			
Are temporary manure stockpiles properly covered?			

Emergency action plan

How it works

An emergency action plan is a basic, yet thorough, commonsense plan that will help you make the right decisions during an emergency.

How it helps

- Behind most manure spills and discharges is a chain of events that leads up to poor judgment, an unsafe act or condition, or a combination of factors.
- If a plan is written down and employees are trained, the plan is usually followed.
- Developing a plan gives you the time to think about and plan ways to handle possible emergencies on your farm.
- Emergency action plans also highlight what to do during a medical emergency involving you and/or other farm workers.

Issues to consider

- Emergency action plans should be written down, and all farm workers should know where it is and how to implement it.
- Most accidents and spills in the United States occur when manure is being applied.
- Preventing spills is an important part of the plan. What can be done on your farm to prevent spills or discharges?
- Post a “simple” emergency action plan, including important phone numbers, by every phone on the farm.
- Plans usually follow the following format:
 - *Eliminate the source.*
 - *Contain the spill.*
 - *Assess the extent of the spill, and note obvious damage.*
 - *Contact appropriate agencies.*
 - *Clean up the spill and make repairs.*
 - *Prepare and submit summary report.*
- Many states require an emergency action plan. Contact your state water quality agency or your local Cooperative Extension Service for more information.

Relative cost

Since an emergency action plan is a written plan that highlights a system of measures, the relative cost depends on the measures used. However, many plans need only an investment of time.

Want more details?

For more information, please refer to *Livestock and Poultry Environmental Stewardship Curriculum, Lesson 50, Emergency Action Plans*.



Post a “simple” emergency action plan, including important phone numbers, by every phone on the farm.