

**Manure utilization plans are essential to apply the right amount of nutrients, in the right place, and at the right time to maximize yield and environmental protection.**

## BMPs to Reduce Nutrient Losses

Managing the amount, source, form, placement, and timing of nutrient applications are activities that will accomplish both crop production and water quality goals. This holds true for all nutrient sources including manure, organic wastes, chemical fertilizers, and crop residues. Manure utilization plans are essential to apply the right amount of nutrients, in the right place, and at the right time to maximize yield and environmental protection. Proper nutrient management, however, encompasses more than simply applying the right amount of nutrients. It is also important to ensure that these nutrients are applied at the right times and in the proper locations. Proper maintenance and calibration of the application equipment is critical since a precisely calculated application rate does little if your machinery is not functioning properly. Nutrients also need to be applied when the vegetation can use it, during the spring or before periods of rapid growth. Avoid applying any nutrients during periods when the soil is saturated or frozen. Avoid land application immediately preceding large rainfall events; it does little good to spend a lot of time and money on nutrients that will be washed off the soil surface with the first large rainfall. If possible, incorporation is the best way to ensure that the plant nutrients remain in the soil.

A summary of the major nutrient management practices to enhance surface water and groundwater quality follows.

- Applying nutrients at rates commensurate with crop uptake requirements is one of the single most important management practices used to reduce off-site transport of nutrients.
- Maintaining good crop growing conditions will reduce both surface runoff losses and subsurface losses of plant nutrients. Preventing pest damage to the crop, adjusting soil pH for optimum growth, providing good soil tillage for root development, planting suitable crop varieties, and improving water management practices will increase crop efficiency in nutrient uptake.
- Timing of nutrient application to coincide with plant growth requirements increases uptake efficiency and reduces exposure of applied nutrients to surface runoff and subsurface leaching. The optimum time of application depends on the type of crop, climate, soil conditions, and chemical formulation of fertilizer or manure. To maximize crop uptake, consult a certified crop advisor or professional agronomist to discuss when manure/nutrients should be applied.
- Certain soil and water conservation practices will reduce sediment-associated nutrient losses. Contouring, terraces, sod-based rotations, conservation tillage, and no-tillage reduce edge-of-field losses of sediment-bound N and sediment-bound P by reducing sediment transport.
- Proper selection and calibration of equipment will ensure proper placement and rate of nutrient delivery. Improper calibration and equipment maintenance will result in over or under application of nutrients or uneven nutrient distribution. Appropriate handling and loading procedures will prevent localized spills and concentration of manure nutrients.
- Crop sequences, cover crops, and surface crop residues are useful tools for reducing runoff and leaching losses of soluble nutrients. Winter cover crops capture residual nutrients after the summer crop is harvested. Nutrient credits for “green manures” and cover crops must be considered when determining the appropriate rate of additional manure application.

- Deep-rooted crops, including alfalfa and to a lesser extent, soybeans, will scavenge nitrate leached past the usual soil-rooting zone. Used in crop rotation following shallow-rooted or heavily fertilized row crops, deep-rooted crops will recover excess nitrate from the soil and reduce the amount available for leaching to groundwater.

### Crop factors

- Use on-farm yield records or NRCS soils data to determine the yield that you can expect on each field. To calculate a field's average yield, take the average of the best three yields over the past five years. Apply animal manure at rates that do not exceed the N needs for realistic yield expectations (R.Y.E.) for the crop being grown. Deduct N credits for last year's legume crop from this year's fertilizer requirements.
- Use commercial fertilizer only when manure does not meet crop requirements.
- On sandy, leachable soils, manure should not be applied more than 30 days before you plant the crop or forages break dormancy. Since these soils have a high potential for leaching, consider multiple applications at lower application rates.
- Incorporate or inject manure to reduce N loss, odors, and nutrient runoff for crops where tillage is normally used.
- Harvest and remove the crop from the field it was grown in. Hay should be removed from the harvested area within one year.
- Applications of animal manure should not be made to grassed waterways. If applications are made, they should be conducted at agronomic rates and during periods of low rainfall, minimizing runoff from the site.
- Use caution when applying manure to grazed pastures. Grazing animals will recycle manure nutrients, reducing the need for subsequent applications. Reductions of 25% to 50% of the annual N requirement have been recommended in some states.

### Soil factors

- Avoid applying manure to wet soils, reducing compaction, runoff, denitrification, and leaching.
- Evaluation of the soil analysis should consider the concentration of elements to assess potential toxicity or if increased concentrations of one element (such as P) have reduced the availability of another element (such as zinc) to plants.
- To document changes in soil quality, soil test reports should be kept for at least five years.
- To minimize nitrate leaching from sandy soil, apply manure near planting time. To minimize leaching in general, apply smaller amounts of N more often rather than a large amount at one time.

### Which manure where?

- Apply manure with the highest N content in the spring or fall; apply manure with the lowest N content in the summer.
- Haul manure with the highest nutrient content to the farthest fields.
- Apply manure with the lowest nutrient content to the closest fields. If possible, irrigate with collected runoff water and lagoon effluent.
- Apply the manure with the highest nutrient content to crops with high nutrient demands.

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- To receive the most value from your manure, apply high-P manure to fields with the lowest soil P test levels.