Runoff Still Runs Downhill - Taking Topsoil, Sediment, Nutrients, and Bacteria

Implications for Feeding Site Locations

Dr. Joel DeRouchey
Extension Livestock Specialist
Dept. of Animal Sciences and Industry

The Problem

Nutrient pollution is one of America's most widespread, costly and challenging environmental problems, and is caused by excess nitrogen and phosphorus in the air and water.

Nitrogen and phosphorus are nutrients that are natural parts of aquatic ecosystems. Nitrogen is also the most abundant element in the air we breathe. Nitrogen and phosphorus support the growth of algae and aquatic plants, which provide food and habitat for fish, shellfish and smaller organisms that live in water.

But when too much nitrogen and phosphorus enter the environment - usually from a wide range of human activities - the air and water can become polluted. Nutrient pollution has impacted many streams, rivers, lakes, bays and coastal waters for the past several decades, resulting in serious environmental and human health issues, and impacting the economy.

Nutrient pollution explained

Too much nitrogen and phosphorus in the water can have diverse and far-reaching impacts on public health, the environment and the economy. Photo

Sources and Solutions

Excessive nitrogen and phosphorus that washes into water bodies and is released into the air are often the direct result of human activities. The primary sources of nutrient pollution are:

- Agriculture: Animal manure, excess fertilizer applied to crops and fields, and soil erosion make agriculture one of the largest sources of nitrogen and phosphorus pollution in the country.
- Stormwater: When precipitation falls on our cities and towns, it runs across hard surfaces - like rooftops, sidewalks and roads - and carries pollutants, including nitrogen and phosphorus, into local waterways.
- Wastewater: Our sewer and septic systems are responsible for treating large quantities of waste, and these systems do not always operate properly or remove enough nitrogen and phosphorus before discharging into waterways.
- Fossil Fuels: Electric power generation, industry, transportation and agriculture have increased the amount of nitrogen in the air through use of fossil fuels.
- In and Around the Home: Fertilizers, yard and pet waste, and certain soaps and detergents contain nitrogen and phosphorus, and can contribute to nutrient pollution if not properly used or disposed of. The amount of hard surfaces and type of landscaping can also increase the runoff of nitrogen and phosphorus during wet weather.

Animal waste contributes excess nutrients to our waterways when manure is improperly managed.

Our homes, yards and streets contribute to nitrogen pollution in a variety of ways, but solutions exist to address this pollution at its source.

The Sources and Solutions: Agriculture

Farming operations can contribute to nutrient pollution when not properly managed. Fertilizers and animal manure, which are both rich in nitrogen and phosphorus, are the primary sources of nutrient pollution from agricultural sources. Excess nutrients can impact water quality when it rains or when water and soil containing nitrogen and phosphorus wash into nearby waters or leach into ground waters.

Applying fertilizers in the proper amount, at the right time of year and with the right method can significantly reduce how much fertilizer reaches water bodies.

Fertilized soils and livestock can be significant sources of gaseous, nitrogen-based compounds like ammonia and nitrogen oxides. Ammonia can be harmful to aquatic life if large amounts are deposited to surface waters. Nitrous oxide is a potent greenhouse gas.

There are many ways that agricultural operations can reduce nutrient pollution, including:

- **Watershed efforts**: The collaboration of a wide range of people and organizations often across an entire watershed is vital to reducing nutrient pollution. State governments, farm organizations, conservation groups, educational institutions, non-profit organizations, and community groups all play a part in successful efforts to improve water quality.
- **Nutrient management**: Applying fertilizers in the

Keeping animals and their waste out of streams keeps nitrogen and phosphorus out of the water and protects stream banks.

Non-confined and Seasonal Feeding Site Location

- Generally historical locations utilized
- Often in weather protected areas
- Many have access to surface water as watering source
- Spring time – can turn into a small feedlot environment with increased mud accumulation
- Limited level of clean-up done after cattle removal

Where does the runoff go from the feeding area?

Sheltered Feeding Areas

- Hoffman and Self (ISU, 1970) collected data over 7 years, showed that cattle given access to shelter over the winter months gained 15% more than those with no access to shelter. Those animals with shelter also had an 11% improvement in feed efficiency. Thereby, locating winter feeding sites in areas that provide protection and shelter by producers can be justified.

However….

Influence of Mud on Cattle Performance

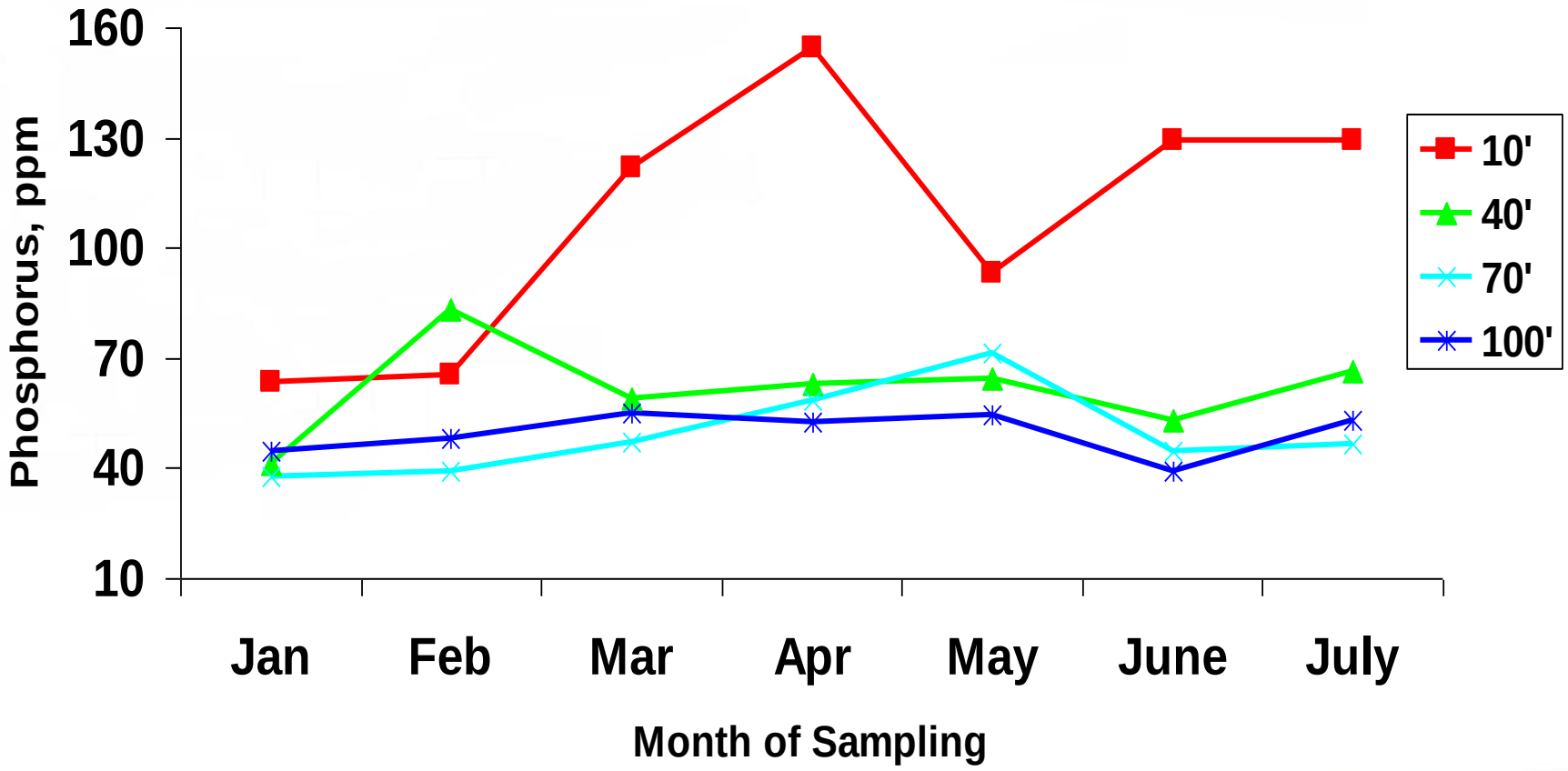
- Bond et al. (1970) reported that data collected from 3 trials revealed that mud had the greatest influence on cattle performance, followed by exposure to rain, while wind had the least influence. Mud reduced daily gains of animals by 25 – 37%, and increased the amount of feed required per lb of gain by 20 – 33%.
- University of Nebraska (1991) reported that the potential loss of gain as mud increased was:
  - No mud = 0%
  - Dewclaw deep = 7%
  - Shin deep = 14%
  - Below hock = 21%
  - Hock deep = 28%
  - Belly deep = 35%

K·STATE
Research and Extension

Feeding Site Location

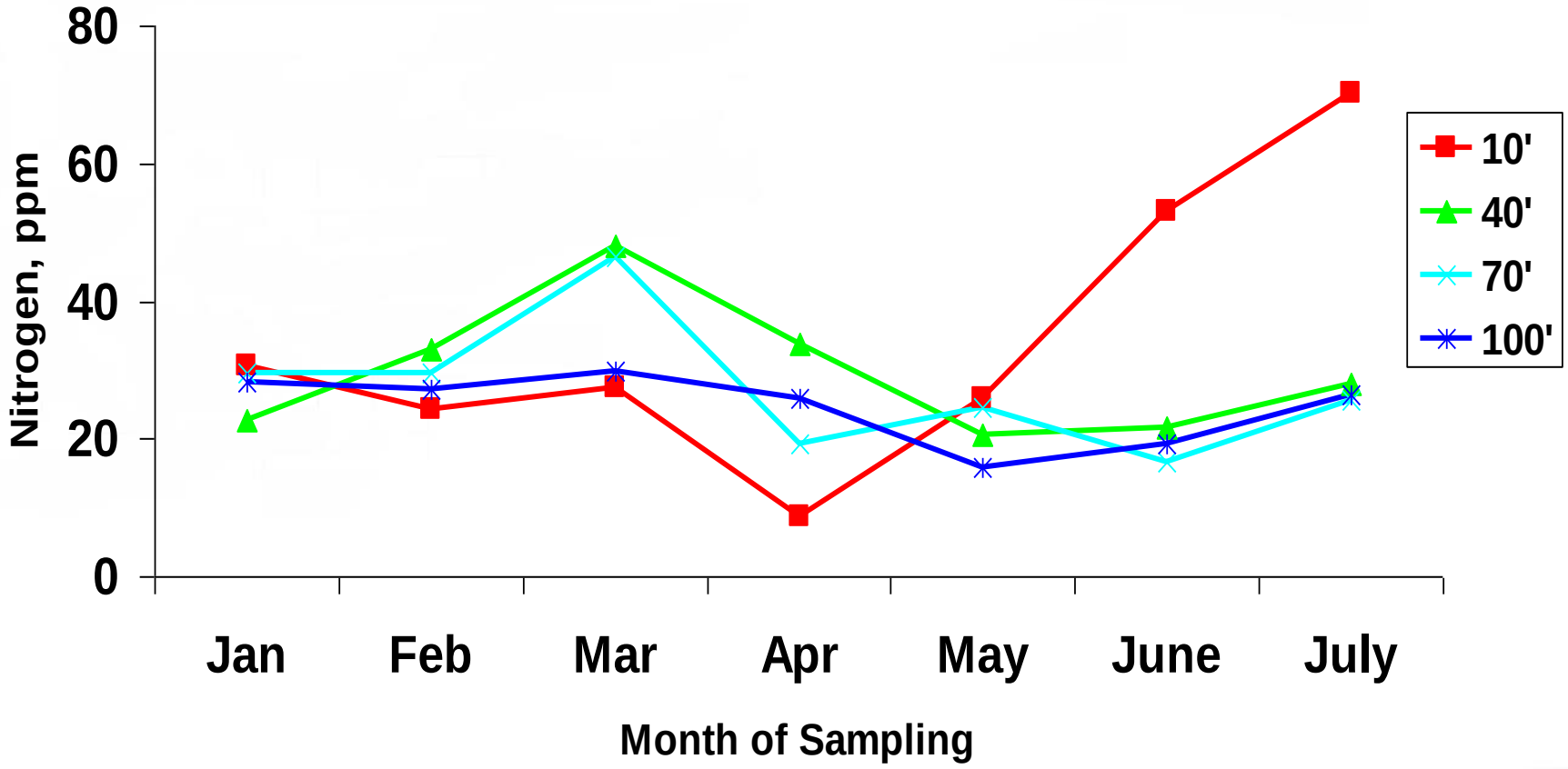
- Lenehan et al. (2005) evaluated nutrient and bacterial concentrations at hay ring feeding sites. (J. Anim. Sci. 83:1673-1679).
- 10 sites in Riley, Wabaunsee and Washington Counties were used.
- 6” soil samples were taken at 10, 40, 70, and 100’ from the ring feeders (~15 samples at each distance and mixed) at the end of the month from January through July of 2003.
- Cows were fed hay from February through the end of April.
- Samples taken pre-, during, and post cattle present at the feeding site

Soil Phosphate Concentrations, Bray 1



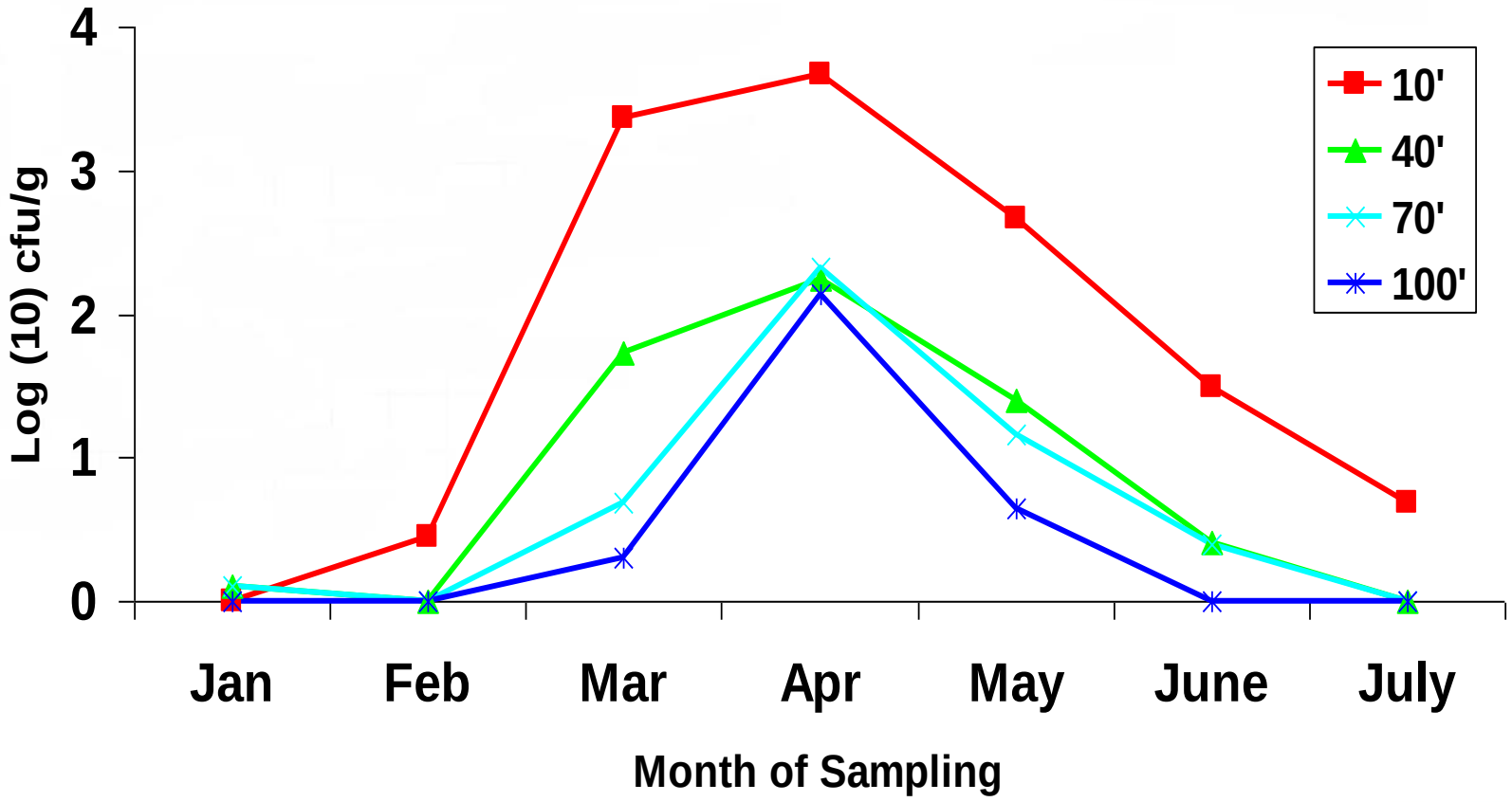
Lenehan et al., 2005

Soil Nitrogen Concentrations, DM



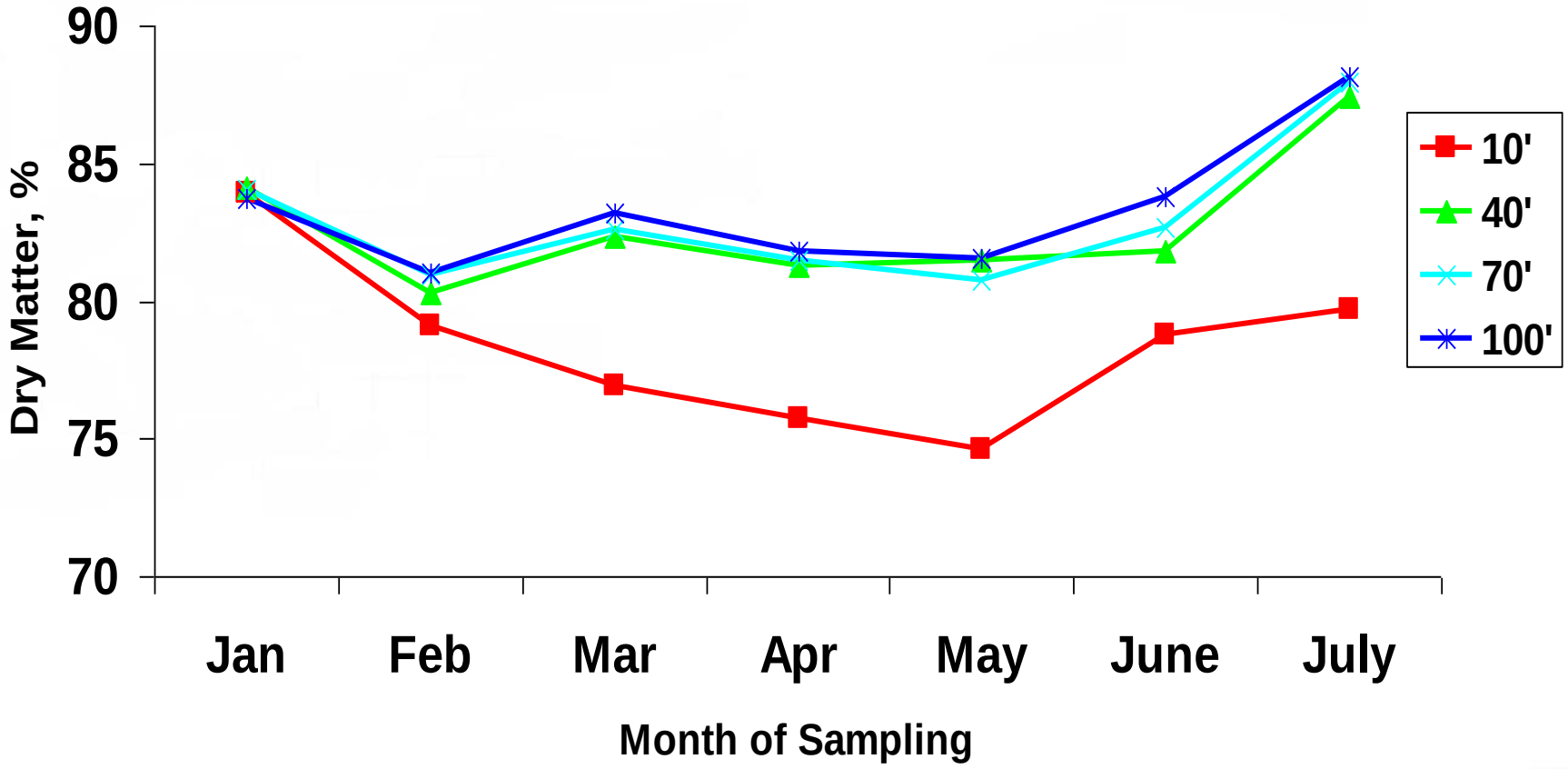
Lenehan et al., 2005

Soil Fecal E. Coli Concentrations



Lenehan et al., 2005

Soil Dry Matter Concentrations



Lenehan et al., 2005

Present Round Bale Site Location for Winter Feeding

Proposed Round Bale Site Location for Winter Feeding

Present Round Bale Site Location for Winter Feeding
Proposed Round Bale Site Location for Winter Feeding

Site location recommendations to reduce the impact of runoff:

Selecting the site:

- If surface water is present, locate feeding area at a distance to maintain vegetation between feeding and watering sites.
- Do not locate feeding areas directly in sheltered areas.
- Locate feeding sites where mud can be minimized.

Site location recommendations to reduce the impact of runoff:

Pasture Feeding Recommendations:

- Continual physical movement of feeding location.
- Rolling hay out in different locations throughout the pasture.
- Grinding or slicing hay helps prevent sorting by the animal, which decreases waste.
- Avoid overfeeding regardless of feeding method to prevent wastage.
- Feeding locations should have adequate drainage to prevent moisture accumulation surrounding the feeder. However, runoff from these sites should not directly enter surface water.

Site location recommendations to reduce the impact of runoff:

Sanitation:

- Once cattle are removed for spring grazing, CLEAN UP THE SITE to prevent environmental contamination throughout the summer.
- Clean up accumulated wasted forage and manure.
- Spread mixture after collected.
  - Sunlight and dry organic matter rapidly decreases bacteria survivability
- Pile and burn the residue.
- Pile and compost the residue.

Site location recommendations to reduce the impact of runoff:

Reduce total runoff volume:

- Diversion of water from entering feeding area or pen
- Guttering of buildings to divert water
- Vegetation buffer
  - Generally 2 x the size surface area that feeding pen
  - Maintain a vegetation area between feeding area and surface water when pasture feeding (more infiltration)
- Clean confined pens routinely when not muddy
- Clean pasture based sites each spring

Thank you!