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# ANIMAL WASTE MANAGEMENT

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Management of animal waste is an important part of any livestock operation. Properly managed manure reduces wind and water erosion. The additional organic matter can increase the water-holding capacity of the soil and promote growth of beneficial soil organisms, resulting in improved soil fertility and crop yields. Inadequate manure management can impair soil fertility and result in water contamination.

The effectiveness of individual waste handling systems varies greatly. Some waste management systems function properly to prevent water pollution and odor while others experience recurring difficulties. The following are some considerations for preventing ground and surface water contamination.

**PLANNING:** Choosing an appropriate site for a new facility is important and needs to consider proximity to streams and hydrologic properties of the soil. If animal facilities are built adjacent to a stream, runoff control efforts can become complicated and costly. It is wise to locate the facility as far as possible from surface water. Contact the North Dakota State Health Department for required specifications of livestock facilities.

**RUN-OFF COLLECTION:** The run-off from outdoor lots can be collected with reasonable cost by using properly designed control structures. Consider the use of diversion ditches to prevent run-off from entering surface water, wells or water tables. Infiltration and groundwater storage and return flows are minimal for most established feedlots in continuing use. Once a manure pack is formed on the surface of a continuously used feedlot, movement of water into the soil profile is insignificant. Manure should be removed from the feedlot when not in use, otherwise leaching of nitrates may begin due to cracks developing in the manure pack.

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**WELLS AND GROUNDWATER:** Wells should be located on an elevated area so that run-off will not drain into the vicinity. The most common sources of entry of coliform organisms into a water supply are near the immediate area of a well or into a water storage container (cistern). Dug wells commonly have very poor surface cover and/or inadequate protection against small animals or from surface runoff. Drilled wells which terminate in a well pit are also commonly contaminated by drainage into the pit. The well pit should be filled with a compacted loam or clay soil and all surface water should be directed away from the well location.

Pollutants can enter deep aquifers through abandoned wells which have not been adequately sealed. A rusted or perforated well casing may allow ground water from a shallow water table to contaminate a deep aquifer.

**PONDS:** Pond designs should include waterways which prevent uncontrolled surface run-off from entering the water supply. The watersheds for ponds should be of adequate size and should be protected against erosion, high applications of manure or chemicals.

**LAGOONS AND GROUNDWATER:** Field studies on lagoons shortly after construction have demonstrated that an "initial flush" occurs. Elevated nutrient concentrations in groundwater near the lagoons are thought to be caused by infiltration of manure constituents prior to the full development of an effective seal. Later results, usually after about one year, suggest groundwater concentrations return to background levels. Evidence of leakage of manure nutrients into the groundwater below small-scale earthen manure storages, particularly those located on fine or medium texture soils, has been minimal after three years. Coarse-textured, sandy soil seems the least satisfactory for building lagoons.

**WASTE WATER:** Waste water from cleaning a barnyard should be discharged to the manure/urine storage area or a separate waste water storage area. The manure/urine storage area needs to be designed to hold this additional fluid.

**CLEAN WATER DIVERSION:** Clean water access to a waste system is evident by a downspout directed onto a feedlot or waste storage pit. Repair broken roof gutters and drain clean water away from manure storage areas via tile or diversion ditches.

**APPLICATION - WHEN:** Untimely application is more of a problem in the Midwest than excessive application. Delay application before or after a heavy rain. Local precipitation records should be evaluated to avoid spreading wastes when runoff or leaching potential is high. When applied to crops under conditions leading to maximum spring run-off, such as melting snow, large amounts of the organic materials and other potential pollutants can be transported from the land.

In general, manure should be spread in the spring in order to obtain the most nitrogen from it. The time of year has little effect on the amount of phosphorus and potassium lost. If you apply manure to sandy or loamy sand soils in the early fall at soil temperatures greater than 50 degrees F, manure nitrogen (N) will be converted to nitrate N and may move to groundwater. On these soil

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types, apply manure only where a cover crop has been established or when soil temperatures are less than 50 degrees F.

Row crops, no-till systems, and small grains can receive animal wastes before planting or after harvest. Slurries or liquids may be applied before land preparation, after harvest, or through pipeline irrigation systems as needed during crop growth. On irrigated land, time should be allowed for salt dispersion and nitrification so ammonia concentrations are wtihin crop tolerance levels at planting time. Small grains or suitable grasses grown during winter reduce nutrient leaching and enhance nutrient recovery. Coarse-textured soils, because of high water permeability or intake rate, accept high liquid application rates without run-off. Since most coarse-textured soils have a very low ability to hold plant nutrients, animal wastes should be applied at low rates to those soils throughout the growing season to reduce N leaching.

Grasses can receive solid, slurry, or liquid wastes at any time except during germination and seedling stages. The best time is usually after a period of grazing by livestock or following each hay harvest. No more than 1.5 inches of liquid or slurry (about 5 percent solids) should be applied to pastures within a 30-day period. Grasses tolerate heavier applications of liquids than broadleaf plants. Cattle may not eat grass coated with large quantities of wastes.

**APPLICATION - WHERE:** Do not spread manure near creeks, rivers or their flood plans. High levels of nitrates or slime on ponds may be caused by manure application on their watersheds. The buffer area should be 25 or 30 feet on summer fallow or bare grounds. The buffer zone for frozen ground near surface water needs to be increased approximately seven times.

Apply waste on cropland only if the slope of the land is less than or equal to 6 percent. When applying livestock waste to farmland with a slope of greater than 6 percent, the waste should be injected or immediately incorporated into the soil if other diversion practices are not done. A space of 10 feet should be allowed for a slope of 4 percent near surface water. If the slope is greater than 6 percent the free zone should be 60 to 100 feet if vegetation is present or 150 to 200 feet for bare, erodible ground. If you apply manure to frozen soils with slope of 6 to 12 percent, contour strips, terraces or other conservation measures must be in place.

If possible, do not spread manure on porous or sandy soil because leaching can occur. Gravel soils may have water tables near the surface in the spring. Avoid areas with creviced bedrock in order to prevent groundwater contamination. A soil depth of at least 10 inches should be present before spreading manure on or near bedrock.

**APPLICATION - HOW MUCH:** Applying a large quantity of livestock waste on a small area of cropland can easily result in surface run-off and water quality problems. Apply waste at agronomic rates so as to make the best use of the fertilizer value contained in the waste and not overload the soil. Application rate should be tailored to the infiltrative capacity of the soil and the volume of nutrients contained in the manure (usually nitrogen and phosphorus) used by the growing crop. Volume per application is related to the root zone depth of the crop and existing soil moisture conditions. Low rates of application over a large cropland area often result in greater returns than do heavy applications on a small area.

Soil tests should be considered before commercial fertilizers are put on a field where manure has been applied. Soil tests may show that no fertilizer is required and thus reduce additional run-off and leaching. Fertilizer application could result in nutrient imbalances.

Available nitrogen (N) and salt limitations are the major determining factors in application rates of livestock manure. Since N is both the most used element and the most mobile element (thus creating potential for surface and ground water pollution), it is the most logical component on which to base application rates. For groundwater contamination to take place, there must be leaching water. In some dry areas, such leaching may be very infrequent. In some irrigated or dry areas, however, salt buildup in the soil may limit application rates. Because of these factors, the most useful short-range guidelines for determining land-application rates of livestock and poultry manures are N and salt contents. Occasionally phosphorus may be a limiting factor. If phosphorus soil-test levels reach 300 pounds per acre, apply no more manure until the level is brought down.

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