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## G96-1293 Feedlot Abandonment Recommended Procedures

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## Feedlot Abandonment<sup>1</sup> Recommended Procedures

**An abandoned animal feeding facility is a significant threat to the environment. Procedures to minimize the risk are discussed.**

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Feedlot abandonment occurs for various reasons, including economic and social changes, environmental concerns, consolidation for more cost effective management and operation, and modification of personal goals. Whether a feedlot is abandoned for a short time until some crisis passes, or permanently, steps are necessary to minimize the risk of environmental degradation.

Under both scenarios, an abandoned feedlot poses an immediate threat to surface and groundwater quality. The unused facility is also a potential nuisance and source of health problems for humans and animals.

The purpose of this NebGuide is to identify guidelines that will minimize environmental risk associated with feedlot abandonment. No matter how long the period of non-use is expected to be, manure should be removed to minimize transport of manure from the site via runoff and the risk of groundwater pollution. In all instances the risk of accidental entry into manure storages and holding ponds by animals and people must be minimized.

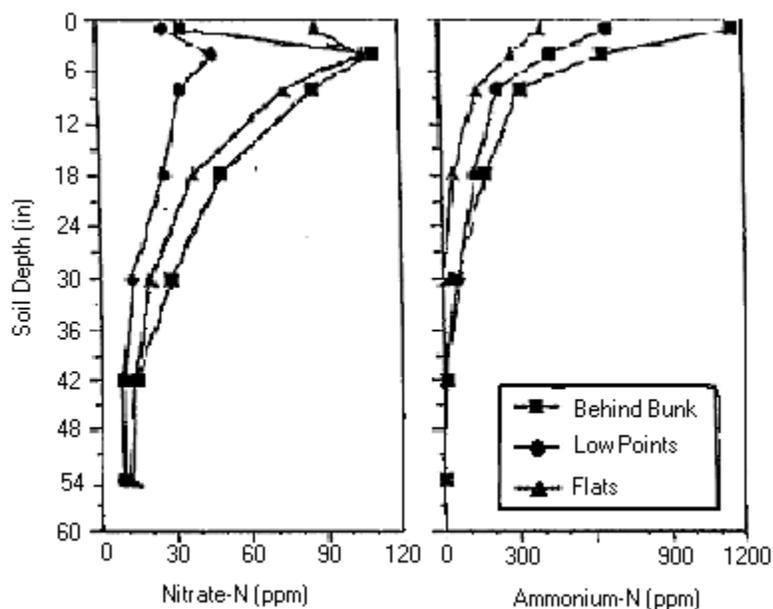
Abandonment for periods exceeding one to two months during spring, summer or fall requires steps to

control weeds and insects. Abandonment during any time of year dictates a need for rodent control in pens, feeding areas, and around feed storage facilities. With long-term or permanent abandonment, the challenge is to return the lot area to productive crop growth in the shortest feasible time.

## Manure Removal

The first step in feedlot abandonment is removal of as much manure as possible, down to the soil surface, as soon as feasible after the animals are removed. Ridges of manure along fences and beneath feedbunks must be eliminated. Ideally, manure should be scraped, loaded and hauled directly for application on agricultural cropland. Stockpiling is recommended only when field/soil conditions are not conducive to spreading. Stockpiling is not a solution, but can provide a short-term convenience. Runoff and odors from the stockpiling area, as well as insects and rodents, will continue as potential problems.

Manure should be applied to cropland at rates consistent with anticipated crop requirements, considering nutrients available from all sources. Sources include soil mineralization, soil residual, starter fertilizer, manure, irrigation water, crop residue, cover crops, and any supplemental fertilization during the growing season. In most instances the rate-limiting nutrient for land application of manure will be phosphorus. However, potassium can limit application rates for effluent from lagoons and holding ponds. Representative samples of manure or effluent should be analyzed by a qualified laboratory to aid in determining appropriate application rates.

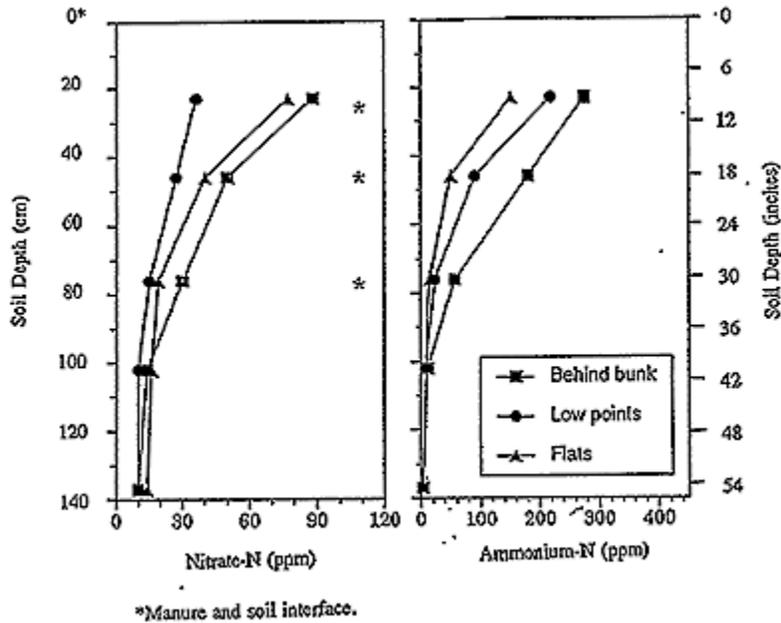


**Figure 1. Nitrogen concentration in soil vs. depth beneath the manure pack of four active beef feedlots in Nebraska. Source: John Lory, USDA-ARS, 1995--(preliminary data).**

The quantity of inorganic nitrogen and salts present near the surface of a feedlot is usually many times greater than the levels in the underlying soil (*Figure 1*). Failure to remove the manure pack dramatically increases the potential for nitrate contamination of groundwater.

In an active pen, hoof action and compaction by the animals create conditions that minimize movement of nitrogen and other salts from the manure pack. Following removal of animals, soil cracking due to drying, freeze-thaw cycles, and other activities contribute to changing the pen from a primarily anaerobic condition to an aerobic environment.

Aerobic conditions allow large pools of relatively immobile organic and ammonium nitrogen to be converted to mobile nitrate-nitrogen. Loosening the soil and cracks that form following abandonment serve as conduits to increase water infiltration, further promoting nitrate leaching.



**Figure 2. Nitrogen concentration at manure-soil interface and underlying soil beneath four Nebraska feedlots.**

One study found an average of 6,400 lb./acre nitrate-nitrogen in the 30 ft. of soil profile beneath four feedlots that had been abandoned at least three years in Nebraska. This compares to 500 lb. nitrate-nitrogen found in the same profile below cropland. Removal of the manure pack is the only feasible method to prevent these types of massive nitrate leaching events.

The heavy concentration of nitrogen in the top few feet of soil (*Figure 2*) enhances the opportunity for nitrogen recovery by crops. The sooner crops

can be established, the greater the quantity of mineralized nitrate-nitrogen that can be intercepted and used by the crop before it leaches below the root zone.

Complete removal of manure from fencelines and beneath feedbunks is necessary to eliminate harboring rodents and to control insect breeding. Following pupation, mature insects may travel several miles and become problems for adjoining neighbors and livestock producers. Large populations of adult flies frequently are found in areas other than where eggs are laid and larva develop into mature insects. Whether the abandonment is short-term or permanent obviously will influence whether cleaning around or complete removal of fences and feed bunks is most appropriate.

### **Vegetative Cover**

As shown in *Figures 1* and *2*, substantial amounts of nitrogen and salts will remain in the soil beneath a feedlot even after manure removal. When the pen or feedlot abandonment is expected to be more than one to two months, steps should be taken to establish a vegetative cover as quickly as feasible. Doing so will reduce erosion and minimize percolation of contaminants into the soil profile. Soil tests should be taken and submitted to a laboratory for analysis to determine salt content, the possible need for other nutrients to encourage crop growth, and to aid in determining what crop is most appropriate.

The accumulation of salts in the soil initially may complicate establishing typical agronomic crops on the site. ("Salt" is a generic term referring to compounds of the major cations--Na, Ca, K, Mg and Mn.) The influence of soil salinity on crop production is summarized in *Table I*. In one Nebraska study, researchers measured soil conductivity on one site of 5.8 millimhos/centimeter. (A mho, pronounced mow, as in "mow the lawn," is a unit of electrical conductance. It is the reciprocal of resistance (ohm). One thousand millimhos equals one mho.)

<b>Table I. Crop response at different salinity levels</b>	
<b>Range of Salinity (millimhos/cm)</b>	
0-2	Salinity effects mostly negligible
2-4	Yields of very sensitive crops may be restricted
4-8	Yields of many crops restricted
8-16	Only tolerant crops yield satisfactorily
Above 16	Only a few very tolerant crops yield satisfactorily

Corn and alfalfa were successfully grown on this site, but only after the top 6 inches of soil were removed. An alternative would have been to select more salt-tolerant crops for the first few years (*Table II*).

<b>Table II. Relative salt tolerance of forages and crops</b>		
<b>Tolerant</b>	<b>Moderately Tolerant</b>	<b>Sensitive</b>
Alkali Sacaton	White Sweetclover	Peanuts
Saltgrass	Yellow Sweetclover	White Dutch Clover
Bermudagrass	Perennial Ryegrass	Red Clover
Rhodesgrass	Dallis Grass	Ladino Clover
Rescue Grass	Sudan Grass	Potatoes
Barley	Alfalfa	Orchard Grass
Birdsfoot Trefoil	Rye	
Sugar Beets	Wheat	
	Oats	
	Blue Grama	
	Fescue	
	Smooth Brome	
	Corn	
	Soybeans	
	Sorghum	

To speed return of the feedlot to crop production, the top 6-12 inches of soil may need to be removed. This will remove a substantial portion of excess salts and nitrogen.

Crops not tolerant to salts (e.g., alfalfa) should thrive if the top several inches of soil are removed. Alternatively, crops that are more salt tolerant will likely be required for the first few years. Bermudagrass, barley and birdsfoot trefoil are examples of more salt-tolerant crops.

The soil removed can be spread over agricultural land in a thin layer, resulting in the excess salts gradually being leached or worked into the soil profile at concentrations that do not adversely affect crop growth. Care is required in spreading the soil to avoid a simple relocation of the problem.

Harvested crop quality should be checked for nitrate accumulations if used as animal feed. The large amount of nitrates removed from the soil will be partially accumulated in the plant tissue. One research study suggested that green chop corn produced from abandoned feedlots was potentially toxic to livestock, while alfalfa produced from the same site was far below toxic levels. The alfalfa also proved better at recovering soil nitrates by a factor of three over corn.

Any crops grown on abandoned feedlots will be particularly susceptible to drought. High nitrogen availability in combination with poor soil structure and elevated salt levels makes crop failure a distinct possibility. Provisions to provide supplemental water as necessary should be included in plans for reclaiming the feedlot for crop production.

The practice of deep chiseling or plowing should be avoided. This practice has been used in the past as a means of encouraging improved infiltration. Unfortunately, the practice also increases the rate of transport of nitrates deep into the soil profile, often beyond the root zone. When this occurs, the risk of contamination of groundwater increases markedly.

The goal in any abandonment process must be to get the lot area into a good, vegetative cover in the shortest practical time. This initiates the process of farming excess nutrients out of the soil profile and hopefully obtaining some economic return from the efforts to clean up the lot area. Even if the first year's efforts at establishing a vegetative cover are less than an overwhelming success, all normally harvested plant growth should be removed. Removing plant growth is necessary to remove excess nutrients and salts from the site.

### **Debris or Settling Basins**

During short-term abandonment, debris basins need to be monitored continually and managed for accumulated solids that can contribute to odor and insect problems. Stable flies, in particular, thrive in such locations. Periodic removal of solids will be necessary. Materials removed from debris basins should be applied onto agricultural land at rates consistent with agronomic production practices. Permanent abandonment requires eliminating debris basins and hauling soil to fill low areas.

### **Runoff Ponds and Lagoons**

Runoff or holding ponds must be monitored and managed to assure adequate capacity to store the required volume of runoff and net precipitation throughout the year. Abandonment of the lot for even a few weeks is not a license to allow a discharge from a runoff pond any more than it was from an operating feedlot. Consequently, continual monitoring and management will be necessary to assure adequate capacity for storage of 25 year/24 hour rainfall runoff and freeboard are maintained at all times.

The abandonment process should include arrangements and identification of a person or persons responsible for overseeing such continual management inputs. The holding pond and lagoon must be operated and maintained within the limits set forth in the initial design and any existing permits.

Caution is required with runoff ponds in which organic matter has accumulated. Allowing the water level to become too low and a feather-edge of damp or moist organic material, manure and water to develop can create an ideal situation for the multiplication of stable flies. These blood-sucking insects are costly to the livestock industry.

The best control strategy is either to assure freedom from organic matter by complete removal or to

assure sufficient water is maintained to keep the organic matter covered. If need be, a backhoe can be used to remove soil, create a "sharp dropoff," and eliminate the thin water layer and moist organic material. Conditions that are either too wet or too dry are effective in controlling insect breeding.

Extreme caution is required with manure storages and debris basins where a floating debris layer or mat develops. With or without vegetative growth, the surface can unwittingly become a trap for animals and unsuspecting persons. The seemingly solid surface will not support the concentrated load of a person or animal. Animals have been lost due to drowning and humans have suffered irreversible health problems from breaking through the crust and becoming submerged in manure storages.

Fencing, warning signs and routine mowing to control weeds are required to minimize the risk of accidents. **Warning:** Many earthen bank manure storages, runoff or holding ponds, lagoons, etc. are constructed with side slopes that are too steep to allow safe operation of conventional farm tractors and maintenance equipment. Special boom-supported mowers might be required to safely mow banks. Keeping weeds mowed also will be beneficial in controlling mosquitoes. Uncontrolled weeds increase the risk of seepage and groundwater contamination. As roots decay the open channel can convey polluted water deep into the soil profile.

Lagoons and holding ponds can be abandoned after the feedlot is returned to crop production and erosion is under control. Abandonment requires removal of accumulated liquids and solids. The impoundment area then should be graded to eliminate any depression and vegetative cover established.

Alternatively, the impoundment can be retained as a pond if appropriate modifications are made to control the water level. A properly installed mechanical overflow and emergency overflow or spillway structure are required. Over about a 10-year period, the organic matter will decay and the water quality gradually will improve.

### **Feeding Area**

Feedbunks--or waterers--set on risers with open space beneath should be removed and the debris scraped and hauled onto agricultural land. The space beneath feedbunks commonly harbors rodents and provides a medium for insect reproduction.

Even when the abandonment is for a relatively short time, feedbunks should be tipped over (if necessary) to allow removal of the debris from beneath them. New construction should provide a solid raised platform for feedbunks to eliminate debris accumulation.

Rodent control is more difficult if slab-on-grade construction of feeding aprons has been used. The lack of cattle and vehicle traffic allows undisturbed use of the space beneath slabs for shelter. Observation of any evidence of rodent burrowing should be followed by prompt initiation of an enhanced rodent control program. New construction should include vertical foundations or grade beams at the edges of all slabs to reduce rodent burrowing.

### **Feed Storage**

All feedlots have some form of feed storage for silage, hay, grain or ground feed. Unless silage and grain products are stored in rodent-proof bins or silos, they soon become a major source of rodent reproduction, as adequate shelter and convenient feeding are provided in areas where they will not be disturbed during the abandonment period.

If silage in open bunker or trench silos is to be retained for future use, the exposed areas should be smoothed and covered with appropriately supported or weighted black plastic to minimize spoilage. Where lots are being permanently abandoned, arrangements should be made for the feed to be transported and used by other livestock operators in the area. Old or spoiled silage should be removed and applied on agricultural land.

Spilled grain around feed mixing and storage areas should be cleaned up and either put back into storage, fed or spread on agricultural land. Spilled feed and grain encourage the development of large populations of rodents and birds. In some instances, insect reproduction is enhanced. Each of these increases the risk of disease spread and degradation of the overall environment.

Many producers use old tires or other materials to weight the plastic on bunk and trench silos. Accumulated water in these tires and in discarded plastic can become a major source and reservoir of mosquito breeding. Steps need to be taken to ensure water cannot accumulate within the tire carcass, or else old tires should be properly disposed of in accordance with state regulations. (For further information and guidance, contact the Nebraska Department of Environmental Quality at 402-471-4210.) All debris such as plastic or other materials associated with silo operation should be removed and disposed of in a proper manner. Lumber should be stored above ground to minimize harboring rodents.

## **Utilities**

Many feedlots use electrically heated waterers. During abandonment all utilities (electrical, propane, water, etc.) should be turned off. Waterlines should be drained if abandonment is for an extended period of time or occurs during freezing weather. A high airflow capacity commercial air compressor can be used to remove water from lines that are not graded for self-drainage.

Water tanks should be drained to prevent freezing and accumulation of stagnant water conducive to mosquito breeding. Turning off the water and electricity reduces the risk of erosion, injury and wasted water in the event a waterline or electrical cable is damaged by cleaning equipment or fails due to general deterioration.

Be sure to thoroughly inspect and test all systems for proper function when the feedlot is returned to service. Faulted or improperly wired waterers can result in electrocution of cattle or people and reduced water intake--with associated poor performance--due to extraneous voltage.

## **Weed Control**

Continual concern is necessary and management inputs are required to control the growth of weeds and other undesirable vegetation around the entire lot area, including the lot surface itself, debris basins, runoff control facilities, etc. Failure to control weeds can in some instances increase the risk of insect breeding (particularly mosquitoes along the edge of a runoff control pond), present a less-than-positive impression to non-agricultural passersby, and increase the risk of water movement deep into the soil profile as weed roots decay and provide open channels.

## **Summary**

The outlined procedures for abandonment are not really any different than those that should be applied to a functioning productive feedlot on a routine basis, with the exception of planting vegetation in the lot area and possible removal of the top few inches of soil. Consequently, the good and conscientious feedlot operator will find little difference between the way he goes about abandoning a lot and the way

he managed it during the time it was used for production of livestock.

The application of appropriate strategies during the abandonment process will help assure the positive image of a feedlot operator as a steward of the soil. The environment is maintained and the risk of environmental degradation is minimized. The application of reasonable abandonment procedures as outlined herein will help to assure the livestock industry continues to be perceived as a good neighbor.

<sup>1</sup>For purposes of this NebGuide, a feedlot is defined to include both paved and unpaved animal feeding areas without regard to species. A few elements, e.g., nitrate accumulation and soil cracking, apply only to unpaved lots.

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***File G1293 under: BEEF***

***F-4, Miscellaneous***

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