

Use of Distillers Grains in Feedlot Diets:

Impact on Phosphorus Excretion

In Iowa, and nationally, states are increasing ethanol production in response to concerns over crude oil supplies. As a result, the market for corn distillers grains, the co-product of ethanol production from corn, is growing with questions raised regarding the ability of animal agriculture to consume all that will be available. In deciding whether or not to feed distillers grains in the feedlot and in deciding how much distillers grains to feed, one of the biggest issues raised is how much will phosphorus excretion be increased and what impact will that have on nutrient management planning. Trenkle (2006) reported that feeding 20 or 40 percent distillers grains with solubles (DGS) increased feedlot phosphorus in manure by 60 and 120 percent, respectively compared to feeding no DGS.

these questions, consider four different feedlot rations and how these rations affect phosphorus and nitrogen flows through a feedlot. Diet composition of the four example diets are shown in Table 1. Diets were formulated for a steer that is on feed for 152 days, gaining 3.3 lb/day with a feed:gain of 6.90. Starting weight of steers is 750 lb with a finish weight of 1250 lb.



Diet Examples

To help provide some insight into the answers to

Table 1. Diet composition of example rations containing varying amounts of distillers dried grains plus solubles (DDGS).

Ingredient Content, % of diet dry matter	Percent of dry matter			
Corn	81.5	72.9	62.7	47.5
Hay	10	10	10	10
DDGS	0	15	25	40
40% liquid protein supplement	8.5	0	0	0
Hight Ca 'Gluten Balancer' supplement	0	2.1	2.3	2.5
<i>Formulated composition</i>				
Crude Protein, %	12.58	12.56	14.64	17.78
Phosphorus, %	0.35	0.42	0.47	0.55

use of distillers grains in feedlot diets

Table 2. Manure nutrient content excreted by a yearling steer when fed diets containing varying amounts of distillers dried grains plus solubles (DDGS).

	Percent of DDGS in the diet (dry matter basis)			
	0	15	25	40
Nitrogen excreted per steer, lb	60	60	72	89
Phosphorus excreted per steer, lb	10	12	14	17

Manure Phosphorus Impacts

Estimates of manure excretion were made using a software program that is based on the newly revised American Society of Agricultural and Biological Engineers Manure Characteristics and Production Standard D384.2 (Table 2). What follows is a table of excreted manure phosphorus and manure nitrogen that would result from a single steer fed this ration (22.8 lb of feed consumed per day).

Acreage Requirements

Manure phosphorus content increases as the proportion of distillers dried grains plus solubles (DDGS) increases in the diet. As a result, more phosphorus needs to be managed by the feedlot.

Table 3 illustrates the acres of corn needed to apply the annual manure from a 1,000-head feedlot (two turns per year) fed the four different rations.

Assumptions made include

- Manure is applied based on crop removal of phosphorus (P-based application)
- Corn yield is 150 bu/acre,
- Fifty percent of manure nitrogen is lost to the atmosphere as ammonia from the feedlot,
- The feedlot is full 304 days/year, and
- The diets shown in Table 1 are offered throughout the duration that cattle are in the feedlot.

Table 3. Acreage requirements and nitrogen balance resulting from applying manure from a 1,000-head feedlot fed four different dietary inclusion levels of DDGS to corn, based on phosphorus uptake rates of the corn (150 bu/acre).

	Percent of DDGS in the diet (dry matter basis)			
	0	15	25	40
Corn acres need for phosphorus use (60 lb/acre P ₂ O ₅)	769	923	1,077	1,308
Corn acres need for nitrogen use (180 lb/acre N)	333	333	400	494
Nitrogen deficit (lb/acre)	102	115	113	112

impact on phosphorus excretion



Nitrogen Balance Effects

When the diets were formulated, the 0 and 15 percent DDGS diets contained similar crude protein. As a result, nitrogen excretion is similar when the steer is fed either of these diets. When either the 25 or 40 percent DDGS diet is offered, protein intake is increased, increasing nitrogen excretion. Table 3 illustrates crop nitrogen needs. Note that when manure is applied based on crop phosphorus needs, nitrogen needs are not met. However, as the dietary protein content increased as a result of feeding the 25 or 40 percent DDGS diets, the need to supplement manure nitrogen with commercial fertilizer did not change because dietary nitrogen content increased as well as dietary phosphorus content.

Corn Production Relative to Consumption

When considering acres needed for manure application, it is also important to consider acres needed for corn production in order to meet dietary needs. Table 4 depicts the total acres needed to grow corn to be fed as grain and as DDGS under each of the four diet scenarios.

Assumptions made include:

- 150 bushels of corn per acres (56 lb per bushel), and
- 1 bushel of corn yields 18 lb of DDGS

use of distillers grains in feedlot diets

Table 4. Corn acres needed to meet corn grain and DDGS needs of a 1,000-head feedlot (two turns per year; 304 total days on feed) fed four different dietary inclusion levels of DDGS.

	Percent of DDGS in the diet (dry matter basis)			
	0	15	25	40
Corn acres needed for feeding corn grain	670	601	518	390
Corn acres needed for feeding DDGS	0	385	642	1,025
Total corn acres	670	986	1,160	1,415

The Bottom Line

While increasing the proportion of the diet that is DDGS, the amount of manure phosphorus excreted does increase. In our example diets, feeding a 40 percent DDGS diet, compared to a diet with no DDGS, increased manure phosphorus by 42 percent. This diet also resulted in greater nitrogen excretion because DDGS contains higher protein content than corn. However, under all four diet scenarios, manure application based on phosphorus resulted in a nitrogen deficit and that deficit did not differ

much by diet. In all cases, supplemental fertilizer nitrogen would be needed unless atmospheric losses from manure could be minimized (50 percent loss assumed). Furthermore, while more acres are needed to spread manure phosphorus when DDGS diets are fed, the total number of acres needed to provide corn and DDGS exceeds the acres needed for manure application. Distribution of nutrients remains the issue rather than an issue related to too much excretion of phosphorus when DDGS diets are fed.

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