UTILIZING DRY AND HIGH MOISTURE GRAIN EFFICIENTLY

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Introduction

Utilizing dry and high moisture (HM) grain efficiently requires considering resource management as well as nutrition. The key is to consider how each corn type affects your overall operation. It is not just a question of which grain will produce higher ADG. Production costs that include distribution of labor and machinery requirements, marketing flexibility and market strategies impact grain value. Grain value in turn affects cattle cost of gain. The type of cattle fed, types of diets used and facilities also influence grain choices. These circumstances make it impossible to formulate the "best" diet and have it work for everyone. All I can do is outline some nutrition and management factors that could help you as you look for ways to lower the cost of gain in your feedlot.

Feed Values for Corn

Corn is so common that we all must know its energy content. We all presume to know, but we don't actually use the same numbers. The NE values for whole shelled corn shown in Table 1 vary considerably. Other unpublished values may be used by feed companies and consulting nutritionists. The point is that measuring NE is not an exact science. Even growing conditions that affect bushel weights have dramatic effects on NE value of a feed.

There are some consistencies that appear in Table 1. HM corn is generally perceived to have more energy than dry corn. In fact, HM corn appears to contain as much NE as steam flaked corn. As the corn kernel dries down the starch becomes more compact. This compaction and other physiological developments make the kernel less digestible. We can reverse the process by steam flaking. Dry rolling or grinding does not alleviate all of the problems of dry corn. Properly harvesting and storing wet corn prevents the problems from ever developing. It is a low cost grain processing method.

There are disadvantages to maximizing grain digestibility. HM grain ferments rapidly and most of the starch content is indeed fermented in the rumen. Dry corn ferments slowly; so slowly that much of the dry corn starch actually escapes the rumen and is digested in the small intestines. The shift in site of digestion means that when feeding HM corn more acid is produced by the rumen in a shorter period of time. Excess fermentation acid loads can depress intake. In more extreme cases it causes acidosis. Metabolic disorders are more common and intake is lower when steam flaked grain is fed. The same situation can be expected when HM grain is fed.

Balancing Fermentation

When a steer consumes 5 lbs of dry whole shelled corn there is a relatively slow, steady fermentation and acid production that follows. If the steer consumed an equal amount of starch as HM corn there would be a rapid fermentation leading to a build up of acids in the rumen and the blood stream. It is the height of the acid peaks in Figure 1 more than breadth that causes digestive problems.

We could offer the steer a mix of dry and HM corn. For the same meal size we now see two acid production peaks of lower magnitude than if either grain were fed alone. This is an example of the principle behind balancing fermentation. In theory these conditions should allow the most efficient use of grain by the rumen. Table 2 shows the results of a pooled data analysis done by Stock et al (1985) where HM corn was substituted for either whole corn, rolled corn or rolled milo. Blends of the rapidly fermented HM corn and more slowly fermented grains produced better feedlot production than either all HM or all dry grains. Actual intakes differed only slightly from calculations of expected values (Figure 3). ADG based on intakes observed were substantially higher than expected when 50/50 mixtures of HM and dry grains were fed (Figure 4). Feed efficiency responded as well (Figure 5) and the maximum advantage appeared to be when diets contained 50 to 60% HM grain (dry matter basis). The ideal mixture of HM and dry corn will vary with HM corn storage conditions. Grinding HM corn to store in a bunker increases its rate of fermentation over whole HM corn. As the ground HM corn is stored in the bunker its potential rate of fermentation increases even more. The higher the moisture content of the grain, the more rapidly it is fermented. Relatively low moisture (22 to 24%) content corn ferments more rapidly than dry corn but not as rapidly as HM corn stored at 30% moisture. Higher moisture content grains ($\geq$30% moisture) reduce intake and gains unless they are blended with more slowly fermented grains.

Managing Wet Grains

Storage and feeding of HM grain is much more complicated than using dry grain. To store whole HM corn you must have an O_2 limiting silo. HM corn must be rolled or ground for storage in bunker or stave silos. There is no need to re-process HM corn coming out of any silo and in fact further grain processing could be detrimental to cattle performance.

Spoilage and most shrink of HM corn occurs at the edges/surfaces of the silo. Accordingly, the larger the silo diameter or depth, the lower the percentage loss of dry matter, that is if a) you can fill the silo quickly and b) you feed out at rate that exceeds surface spoilage. Because of these constraints, silo size is dictated by harvest machinery available and the tons of grain fed daily. An improper match of silo size to your operation can cause a 10% increase in dry matter lost to spoilage.

Adding HM corn to your diet means feed is less stable in the mixer or bunk. Cattle will need to be fed twice daily in warm weather and it is no longer safe to leave a load of feed in the truck until the next feeding. Carryover feed can cause serious problems. The time it takes these diets to begin heating depends on how the grains fermented in that part of the silo. It becomes important to stick your hand in feed bunks at odd times of the day to ensure feed quality is being maintained. The moisture content of corn within a silo may vary by 8 or 10 points in some years. This means the true grain content of your diet can be changing by 8 or 10%. Weekly checks of grain moisture content become very helpful.

Most producers I visit with that use HM corn start feeding the wet corn in the fall as the only grain source in the diet. They switch to dry corn diets after the HM corn supply is exhausted. This approach ensures less weather damage or spoilage during storage. It means HM corn is not being fed in hot weather when bunk spoilage can be a problem. Dry corn that is in storage is available next spring if you decide to sell corn and quit feeding cattle. Finally, it ensures that the HM corn inventory will be gone before the next crop becomes available.

This system fails to take advantage of the benefits of mixed dry and HM corn diets. I also learned the hard way that this system increases the total annual feed costs for feedlots that continually feed cattle. Figure 6 shows average corn prices by month for the four years 1989-1992 and the odd pattern for corn prices in 1993. By feeding HM corn in the winter and dry corn in the summer we pay peak annual prices for the dry corn. We also maximize our exposure to wild price fluctuations that can occur due to new crop growing conditions. Feeding a blend of dry and HM corn means buying more corn during annual price lows and less corn during annual price highs. The advantage for the cattle feeder that produces all needed corn at home is that corn in grain bins that will be fed before warm weather does not have to be dried down. Cold air will keep the corn for short term storage.

Summary

Harvesting and storing HM corn makes much more sense than drying corn and then reconstituting or steam flaking the dry corn to recover its original feed value. HM corn alone is not the answer. To achieve optimums in our production, blends of dry and HM corn diets are important. The grain blends improve cattle performance, but their greatest impact on production costs comes from other areas. Harvesting HM and dry grains increases the time window for grain harvest. This can reduce machinery and labor costs. Feeding blends distributes price risks in the grain market and can reduce grain drying costs. The suitable ratios of dry and HM corn is somewhere between 75/25 and 25/75. Within that range each operation will need to establish the proportion that works best for their total enterprise.

Literature Cited

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Table 1. Energy Values for Corn of Various Forms[a]

	Whole Shelled		High Moisture		Rolled		Ground		Steam Flaked		Light Weight	
	NE_m	NE_G	NE_m	NE_G	NE_m	NE_G	NE_m	NE_G	NE_m	NE_G	NE_m	NE_G
US-CAN[b]	95	64	102	70	85	56	92	62	96	66		
BEEF NRC[c]	102	70	106	73					108	76		
Preston[d]	98	65	100	68					100	68		
Birkelo, et al[e]	98	65									112	75

[a]*all values reported on a dry matter basis.*
[b]*NRC, US-Canadian Tables of Feed Composition. 1982.*
[c]*NRC, Nutrient Requirements of Beef Cattle and Sheep. 1989-90.*
[d]*R. L. Preston, Typical Composition of Feed for Cattle and Sheep. 1989-90.*
[e]*Birkelo et al, 1994.*

Table 2. Performance of Cattle Fed Dry-HM Grain Mixtures[a]

	High Moisture Corn[b], %				
	100	75-67	67-50	50-33	0
No. of Trials	5	5	5	5	5
ADG	2.79	2.90	2.96	2.96	2.82
DMI	18.64	18.79	19.05	19.52	20.09
Feed/Gain	6.87	6.66	6.53	6.67	7.34

[a]*Stock et al, 1985*
[b]*percentage of all grain, dry matter basis*

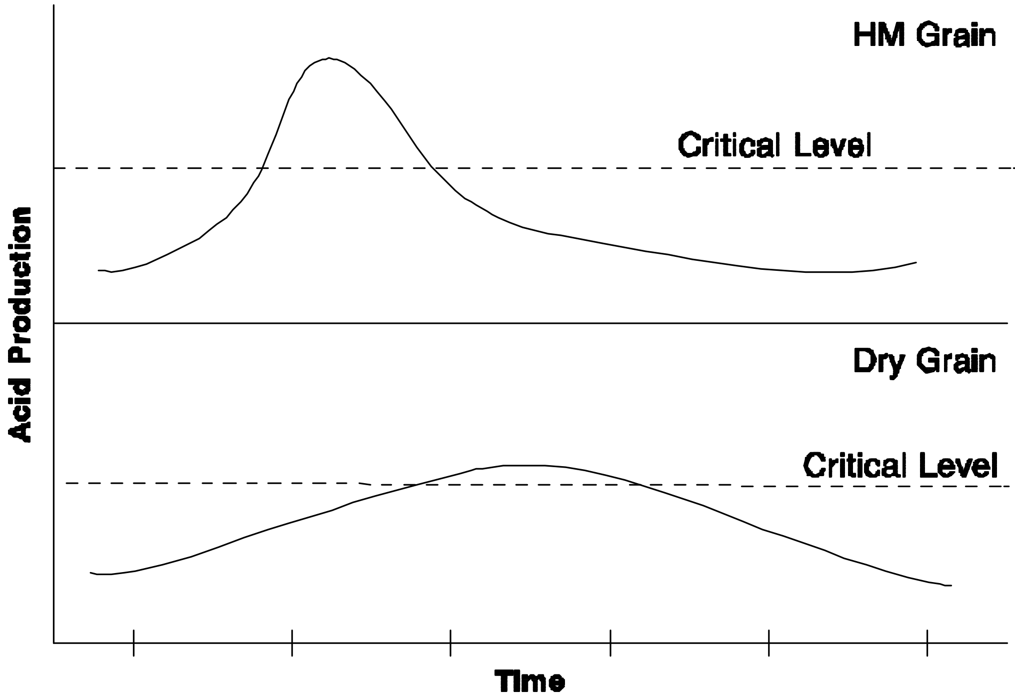

Figure 1. Acid production in the rumen after either dry or HM grain is consumed.

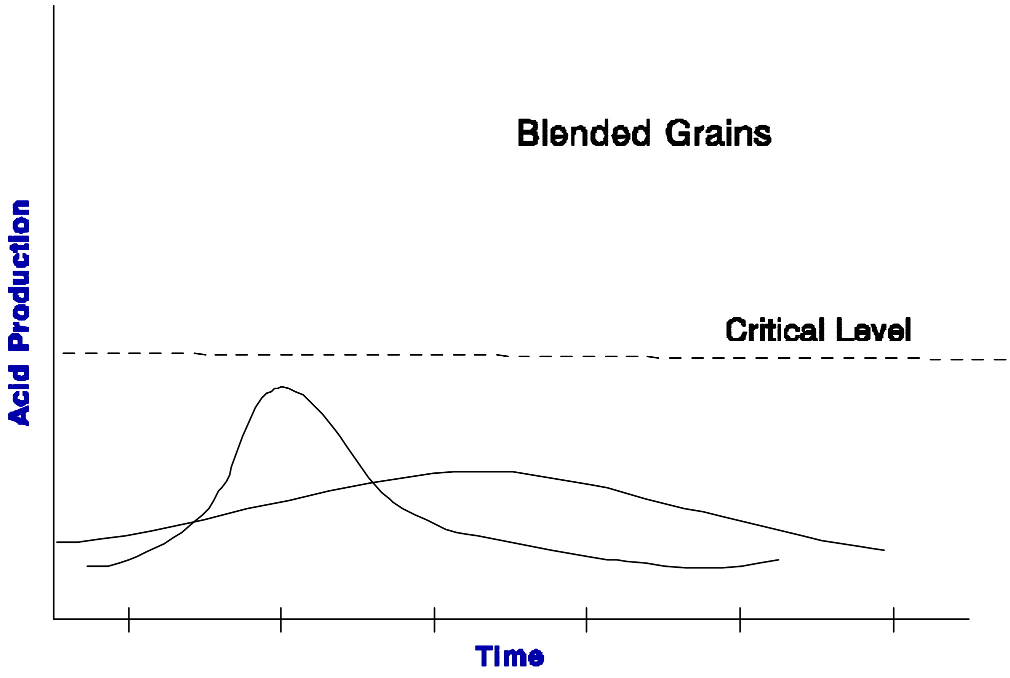

Figure 2. Acid production in the rumen after a blend of dry or HM grain is consumed.

Figure 3. The expected and actual DMI when varying the proportions of high moisture and dry corn in high concentrate finishing diets. Stock et al. (1985)

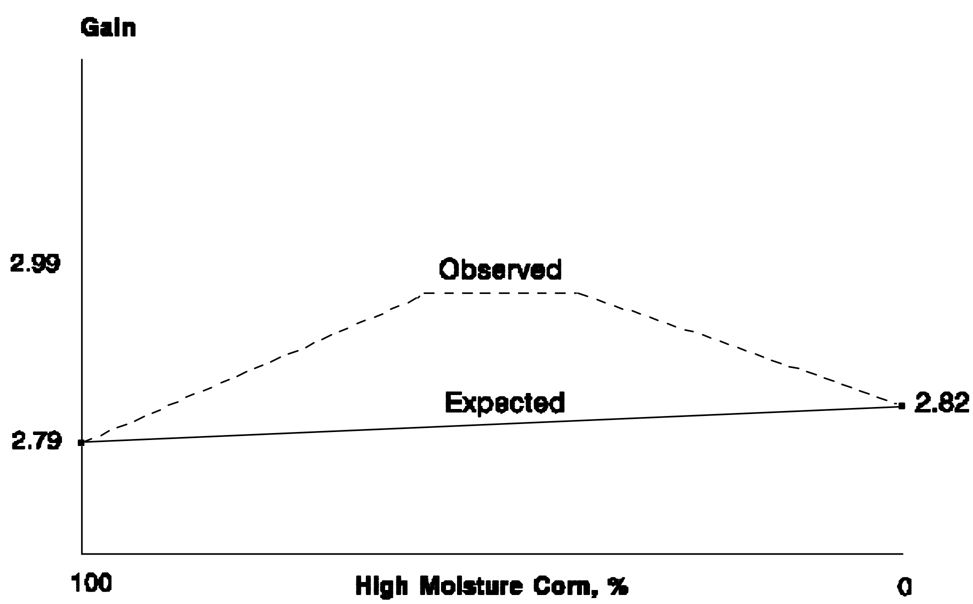

Figure 4. Expected and actual ADG when varying the proportions of high moisture and dry corn in high concentrate finishing diets. Stock et al (1985)

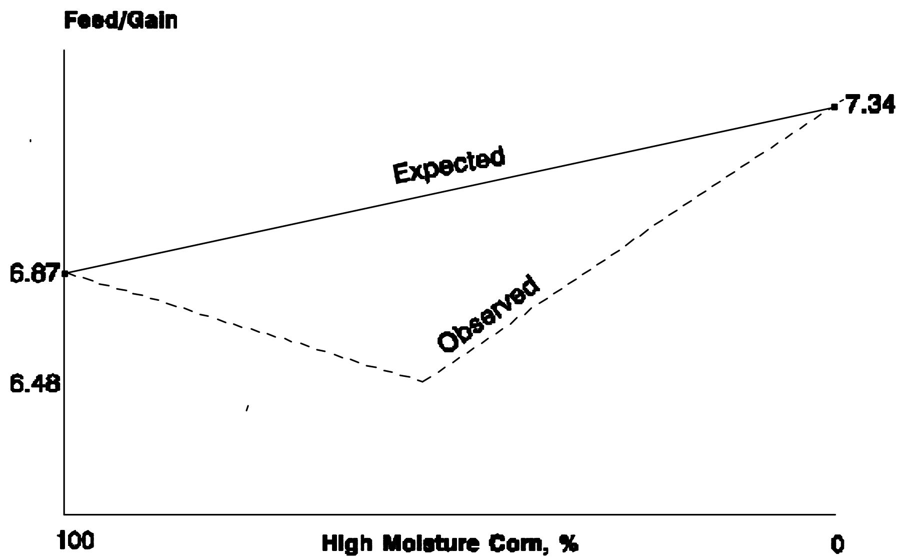

Figure 5. Expected and actual feed/gain (DM basis) when varying the proportions of high moisture and dry corn in high concentrate finishing diets. Stock et al (1985)

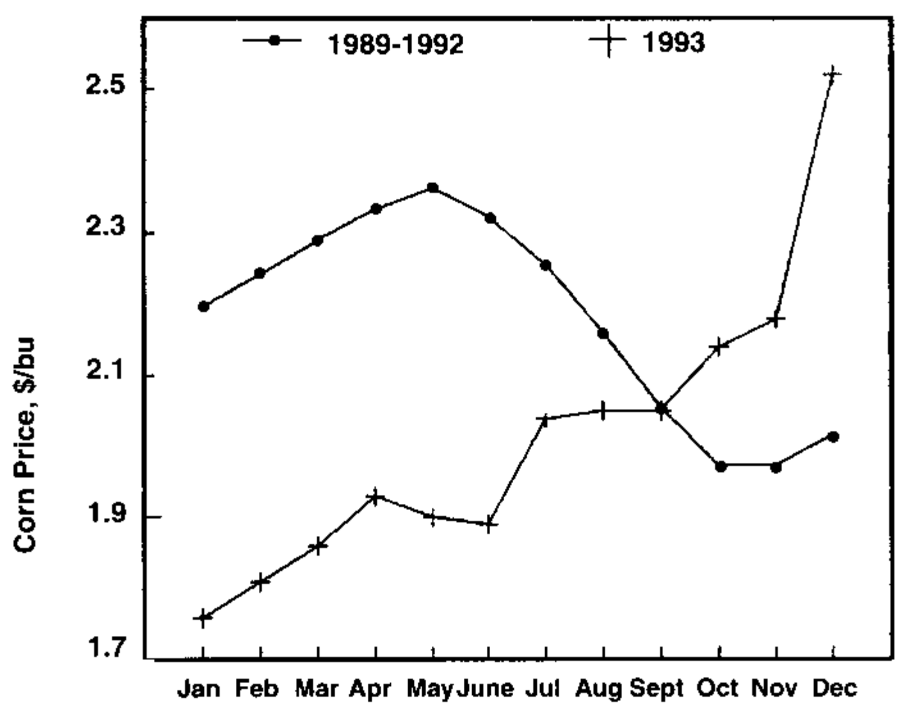

Figure 6. The monthly average corn price 1989-1992 and 1993 for eastern South Dakota. SD Ag Statistics (1994)