AKEY Dairy Newsletter

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Distillers Grains on the Farm

There may not be a livestock producer in the U.S. that has not heard of or tried distillers grains in their rations. However, as the ethanol distillation industry matures, each producer will be faced with new and different products to evaluate. In a recent issue of Feedstuffs (Nov 3, 2008), the estimate of DDGS production for 2008-09 was 31.3 million tons or roughly equivalent to the amount of feed used by cattle in Texas, Kansas, Nebraska, and Colorado. However, as this industry has matured, the processes used have changed such that today, not all distillers grains are created equally.

Distillers grains are produced from two different methods. The product generally called DDGS is from a traditional dry grain process where the whole grain is ground and fermented. Recently, we are seeing a lot of products from a milling (either wet or dry) process. In this process, the starch is separated from other portions of the grain prior to fermentation resulting in more than one waste product stream that can have different feed values. In addition, because of the variation in plant efficiency and incoming grains, the final products can and do vary. The table below has values and ranges of nutrients in DDGS samples analyzed by Akey through early 2008 across various plants throughout the US.

Table1: Nutrients values in DDGS samples

	Mean	Min	Max
CP, %	27.1	22.1	31.2
ADF, %	12.1	5.1	19.4
NDF, %	27.2	20.4	47.4
Fat, %	10.2	6.4	12.9
Starch, %	3.2	0.30	13.4
P, %	0.84	0.08	1.3
S, %	0.70	0.3	1.1

As you can see there is a wide range in the nutrient content of products marketed as “distillers grains with solubles.”

In addition, the newer ethanol plants can pre-fractionate the incoming corn product into multiple products. These products should not be named distillers grains since they do not meet the AAFCO definition. However, depending on the broker, they may in fact be sold as a generic distillers grain. We usually find three products (high protein DDGS, corn germ meal, and corn bran) coming from these plants and this next table has expected nutrient analysis values. Data in this table for the high protein DDGS are from analysis conducted by Akey while those for the corn germ and corn bran are from the Poet energy web site.

Table 2: Nutrient values of three corn by-products

	High Protein	Germ	Bran
DM, %	92	91	89
CP, %	39	15	15
Fat, %	6	16	10
ADF, %	12	8	6
NDF, %	23	21	21
Ash, %	4	6	5

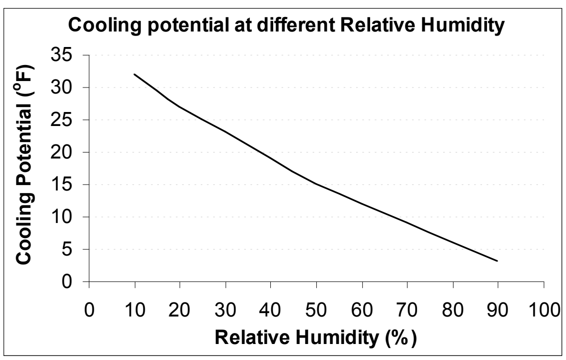
As you might expect, given the differing nutrient profiles, these products have different impacts on diets when fed to dairy cows. But by knowing which product(s) you have available, your nutritionist can better tailor recommendations to your dairy’s unique set of available feeds.

Opportunities with Low Profile Cross Ventilated Freestall Facilities

Low profile cross ventilated (LPCV) freestall buildings are one option for dairy cattle housing. These facilities are mechanically ventilated across the width of the building and can be used with or without an evaporative cooling cell. Low profile barns typically have a very flat roof, around a 1/2 x 12 pitch rather than the typical 3 or 4 x 12 pitch of naturally ventilated barns. This will make the roof just slightly higher than the tractors and mixers etc. moving through them. These barns will have a series of baffles to help bring the air back down over the cows and off the ceiling so the air movement across the cows can approach 6-8 mph. These facilities allow producers to have more control over a cow’s environment during all seasons of the year. As a result, an environment similar to the thermo-neutral zone of a dairy cow is maintained in both summer and winter, resulting in more stable core body temperatures. Heat and cold stress significantly decrease income over feed costs; limiting environmental stress throughout the year can increase the efficiency of feeding a dairy cow. LPCV facilities can improve pregnancy rates and reduce abortions by decreasing the impact of heat stress on reproductive performance as well as its impact on present and future milk production. LPCV facilities allow for buildings to be placed closer to the parlor, thus reducing time cows are away from feed. Performance of these facilities is dependant upon the environment they are placed in and they will not perform the same in all geographic regions.

The upper critical temperature or upper limit of the thermo neutral zone, for lactating dairy cattle is estimated to be approximately 70 to 80° F (NRC, 1981). When temperatures exceed that range, cows begin to combat heat stress by decreasing feed intake (Holter et al., 1997), sweating, and panting. The last two mechanisms increase the cow's energy demand, resulting in up to 35% more feed necessary for maintenance (NRC, 1981). When dry matter intake decreases during heat stress, milk production also decreases. A dairy cow in a 100° F environment decreases productivity by 50% or more, relative to thermo-neutral conditions (Collier, 1985).

The ability to lower air temperature through evaporative cooling is a function of both ambient temperature and relative humidity. As relative humidity increases, the cooling potential decreases, regardless of temperature. This type of cooling system performs better as the humidity decreases below 50%.



As you can see from the above graph, in high humidity environments the ability to lower the temperature is greatly reduced. In the upper Midwest during a high humidity summer day, you may only be able to lower the temperature on the cattle by 3 to 6°. Meanwhile that same facility with evaporative cooling located in Arizona would be able to lower the temperature by 27 to 32°. These facilities are much better suited for the arid West rather than upper Midwest and Northeast during summer heat.

One of the advantages of a cross-ventilated facility is how the air flows over the cows. In a tunnel ventilated barn, the feed alley gets the majority of the air flow through it, and the air that does go over the cows' only hits one side of her. In a LPCV facility, the air flow surrounds the entire cow going over both sides doubling the capacity to remove heat from the cow. There is an approximate 1° F temperature rise across the building per 100 feet of building and these buildings can range in width from 200 to 500 feet. In higher humidity environments, it is strongly recommended that you limit the width of these buildings to 200 to 300 feet. In the summer months, the full building air exchanges will be every minute or 60 exchanges/hour.

Compared to research on the impact of heat stress, little attention has been spent on cold stress in lactating dairy cattle. The high metabolic rate of dairy cows makes them more susceptible to heat stress in the U.S. climates, so, as a result, the lower critical temperature of lactating dairy cattle is not well established. Regardless, there is evidence that the performance of lactating cows decreases at temperatures below 20° F (NRC, 1981). In cold temperatures, cows also maintain body temperature by shivering or metabolic uncoupling, both of which increase maintenance energy costs. These two mechanisms decrease milk production by more than 20% in extreme cold stress. However, even when cold stress does not negatively impact productivity, decreased feed efficiency can hurt dairy profitability. The average building temperature of a LPCV is 20 degrees warmer than the ambient temperature during winter months, but winter ventilation rates will influence the temperature increase. These buildings will have a high variation in temperature from one side to the other. Incoming air will be slightly higher in temperature than the temperature outside (10° or so) as it generally comes in from above and mixes with the warmer air as it drops down to the cows, but because the air is moving slower (8 times slower than in the summer) it has a lot more time to heat up, so it can be 20 to 30 degrees F warmer by the time it exits the building. Air exchanges during winter months will be about every 8 minutes or 7.5 exchanges/hour. At 0 to 40° F these facilities will struggle with management. LPCV facilities are always trying to balance the equation of reducing operating costs, keeping alleys from freezing, keeping cattle and people warm vs. air quality. However, the top priority must be to maintain air quality. Again, these buildings tend to be more designed for areas of the country that have a more stable ambient temperature under these colder climates winter will be the toughest season to manage.

The design set up of LPCV facilities allow for more cattle to be confined to a given land area. In a conventional free stall facility whether it be a 4 or 6 row configuration, you have to have a certain amount of space between buildings to allow for cooling of the barns in the summer months. These barns also tend to be quite long compared to their width so as cattle numbers grow we start to get farther away from the parlor, resulting in a longer walking distance and more time spent away from feed, water, and beds. LPCV facilities are nothing more but a 4-row configuration placed side by side with each other so they tend to provide more sq footage/animal than a 6 row conventional barn. Below is a typical configuration for various width barns. All these facilities would be 120 feet in length.

Width	Pens	Feed Spaces	Free Stalls
210	4	240	216
260	5	300	270
310	6	360	324
410	8	480	432
510	10	600	540

Some of the advantages of these facilities:
Fans are easy to service
Smaller footprint required
Orientation not an issue
(for the most part – see below)
Earth moving cost reduced
Fly control
Starling control
Walking distance to parlor
Ability to control lighting
Air quality improved (yes and no)
Can essentially stand in the middle of the barn and see all the cows

As far as the site selection is concerned, we can orientate the barn to face any direction, but there are some items that need to be taken into consideration depending on what kind of cooling system you are going to use.

Cooling	Orientation	Other	Fans
Evaporative Pad	North South	Pads on West	East
High Pressure	East West	Nozzles on South	North
No Cooling	East West	Open on South	North

Proper management of the facility will take some adjustment time. Environment can be a challenge on these facilities – designed for a more arid/stable temperature climate. Lighting of the facility can take some time to get used to. There must be a back up generator (which is for most dairy's a good idea anyway), but in LPCV facilities you need to go even a step further. There must be a back up plan in case the generator fails. Air quality can go bad quickly and you have about 1 hour to get cattle out of the building and much less time to get humans out or death can result. Sand bedding is necessary to reduce particulate matter in the air.

The economic considerations and benefits of a LPCV facility appear to offer a viable alternative to the traditional naturally ventilated free stall barn. Based on the projections used in an analysis, the LPCV barn resulted in almost a 2% higher return on assets and about $92/cow advantage in returns over costs. Keep in mind these facilities will cost on average roughly $500/cow or more to build and electric costs can be as much as 50% higher. Also, in the analysis certain assumptions were made such as; being able to better control temperature and manage cow comfort should result in increased milk production and improve feed efficiency. As we discussed in the article this may or may not be realized depending on management and the environmental location we place the facility.

Dairy Housing of the Future Conference (Sept 2008)– Joe Harner, PhD, John F. Smith, PhD, Kansas State University

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