



Cattle Producer's Library

Incorporating Non-Fat Dried Milk into Beef Cattle Rations

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Recent federal drought assistance programs have resulted in the increased use of non-fat dried milk (NDM) in beef cattle rations. Based on laboratory analysis and limited studies, NDM is an excellent source of supplemental protein and is well-suited for grazing or confined feeding situations, provided the use of proper feed handling equipment. Crude protein levels range from 35 to 37 percent, with average energy values of 0.80 Mcal/lb NEM and 0.52 Mcal/lb NEg.

Non-fat dried milk can be used as a protein and energy source when included in rations and range supplements. However, the physical characteristics of the product make it challenging to feed. Some of these characteristics include the hygroscopic nature of powdered milk, settling and separation issues, hardening qualities of NDM when used in commercial feeds and supplements, and storage and handling concerns.

Successful feeding methods include limiting daily intake of NDM and improving the handling qualities by diluting it with feed grains and byproduct feeds, decreasing the dustiness and improving handling by adding vegetable oils, and minimizing the product handling challenges by adjusting the sequence of ingredients added to the feed mixer or wagon.

Nutritional Characteristics

As several popular press articles and publications have emphasized, NDM is an excellent feed resource (Table 1) with high levels of degradable protein. Protein associated with NDM has been reported to be 80 percent casein and 20 percent whey (Stock et al. 1986a; Taniguchi et al. 1995; Köster et al. 1996). Researchers claim it would work well in a grazing situation, supplying high quality protein to grazing livestock (Hendrix et al. 1973; Prokop et al. 1976; Stock et al. 1986b).

One of the major concerns are that NDM also contains readily available sugars and proteins that can cause digestive upset if large amounts are consumed. In addition,

Table 1. Nutrient analysis of non-fat powdered milk, as-fed basis. (Source: Erickson et al. 2003)

Item	USDA specs	Erickson study
Dry matter (%)	96.8	
Energy		
TDN (%)	74	90
NEM (Mcal/lb)	.80	
NEg (Mcal/lb)	.52	
Protein (%)	36.16	34 to 37
Fat (%)	0.77	.6 to 1.25
Minerals		
Calcium (%)	1.257	1.35
Phosphorus (%)	0.968	1.1
Iron (g/lb)	0.00145	
Magnesium (g/lb)	0.50	
Potassium (g/lb)	8.14	1.7%
Zinc (g/lb)	0.0185	
Copper (g/lb)	0.000186	

readily available sugars have a negative effect on low quality forage digestion, counter-acting any positive effects of the protein.

Most recommendations are to limit daily intake of NDM to around 2.0 lb/day when feeding NDM as a protein supplement to grazing cattle, and to reduce feeding and handling concerns by diluting it with other feeds, such as cereal grains, byproduct feeds including soybean hulls, wheat middlings, and corn gluten feed.

Handling Concerns with Non-Fat Dried Milk

Hygroscopic Nature of Powdered Milk

Non-fat dried milk is extremely dry and powdery, with bagged feed averaging 98 percent DM. One of NDM's unique characteristics is its ability to attract

moisture. This can lead to several concerns in handling feed. Once moisture comes in contact with the NDM, it has a tendency to “set up.” If it is not mixed or blended with other feeds, it has the potential to clog feed augers, cake feeders, etc.

Producers may realize a problem if they choose to hand-mix powdered milk into mineral supplements. If large amounts are hand-mixed into mineral supplements, it may lead to over-consumption of the mineral. If moisture comes in contact with the mineral, it will tend to harden, and large amounts of moisture may create conditions where the NDM-based feed will sour.

Because the NDM is hygroscopic, and attracts moisture, it is sometimes difficult to mix the dry form into mixed rations and supplements. If there are any wet ingredients, the NDM “clings” to the wet, resulting in uneven distribution and clumps. Producer comments and field observations both indicate mixing difficulties, especially when trying to combine NDM in prepared feeds and sacked TMR diets containing molasses.

Settling and Separation Concerns

Because the powdered milk is extremely fine, it has a tendency to settle out when it is mixed with grain and other coarse feeds. This could create problems if the NDM is included in grain mixtures for self-feeders or calf creep feeders. The NDM will tend to settle to the bottom, causing feeding problems, especially if it comes in contact with moisture.

Hardening Qualities of NDM

Many producers and feed mill managers in the western U.S. received a crash course in incorporating NDM in supplements. One of the lessons learned was that high levels of NDM in range cubes and cakes increased the hardness of the product. Most feed mills producing range cubes restrict the level of NDM to a maximum of 10 to 15 percent to avoid extremely hard range cubes.

Palatability Concerns When NDM Is Fed at Higher Levels

In nearly all cases, dried non-fat milk works well in total rations that contain a smaller percentage of NDM. However, field observations suggest that rations and supplements containing high levels of NDM may lead to reductions in feed intake. Situations where this may occur include limit-fed rations, or topdress supplements containing high levels of NDM. This may be an important factor to consider when intake is important, such as high-protein receiving supplements for weaned calves.

Uses for Supplemental NDM

Determining how to effectively use NDM in summer grazing situations is challenging. While high protein supplements are effective at improving digestion of low quality forages, improving intake and overall energy status, it may be difficult to provide additional NDM to

cattle on remote summer grazing allotments. Because of this challenge, many producers chose delayed delivery of their drought assistance program NDM for late summer, fall, and winter supplementation programs.

Storage Concerns

If producers choose to store NDM through the fall and winter, actual storage of the NDM may be difficult. Its hygroscopic nature, as well as insect and rodent concerns, create a challenge when trying to store the product for a long time. Keeping the product dry and well protected is essential for longer-term storage.

Recommended Winter Rations with NDM

Several states have published winter feeding recommendations for feeding NDM, depending on available feed resources. University of Nebraska recommendations (Erickson et al. 2003; based on 1,100 lb cow) are as follows:

Gestation (amounts on an as-fed basis):

1. 47 lb corn silage, 2 lb NDM
2. 25 lb grass hay (53% TDN, 6% CP), 2 lb NDM
3. 22 lb crop residue (45% TDN, 4% CP), 2 lb NDM, 0.8 lb distillers dried grains (DDG), 1.7 lb grain
4. 9 lb crop residue, 2 lb NDM, 9.15 lb grain

Early Lactation (as-fed basis):

1. 60 lb corn silage, 2 lb NDM, 0.55 lb DDG
2. 25.5 lb grass hay (53% TDN, 6% CP), 2 lb NDM, 2.8 lb DDG
3. 21 lb crop residue (45% TDN, 4% CP), 2 lb NDM, 5.5 lb DDG, 2 lb grain
4. 9 lb crop residue, 2 lb NDM, 6.7 lb DDG, 6.7 lb grain

Late Lactation (as-fed basis):

1. 55 lb corn silage, 2 lb NDM
2. 28 lb grass hay (53% TDN, 6% CP), 2 lb NDM, 1.6 lb DDG
3. 23 lb crop residue (45% TDN, 4% CP), 2 lb NDM, 4.5 lb DDG
4. 9 lb crop residue, 2 lb NDM, 3.3 lb DDG, 8.3 lb grain

Feeding Recommendations

Common suggestions with handling and feeding NDM include:

1. Limiting non-fat dried milk levels to less than 2.0 lb/day when feeding as a supplement. However, several backgrounding and finishing operations have had success feeding higher levels to confined animals receiving total mixed rations.

2. Use vegetable oils and fats to condition NDM rations, helping to reduce dust and eliminate problems with “setting up.” Experience at the University of Wyoming would suggest that 2.5 to 5 percent oil works extremely well. Water and/or molasses would also work to condition the supplement or feed, but require much higher levels.
3. When including NDM in total mixed rations, the order of feed ingredients during mixing is critical. Wet ingredients must be thoroughly mixed before adding NDM to prevent clumping and poor distribution. Several large feeding operations have avoided the mixing challenges of NDM by adding the non-fat dried milk directly to their silage during the packing process.
4. Feeding NDM in the dry form, by topdressing on long stemmed hay, has proved to have little success. Non-fat dried milk is extremely fine and is prone to wind loss or settling. Animals that inhale the fine powder may increase their risk to additional respiratory problems.

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