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Feedstuff Comparisons – As Fed versus Dry Matter

Jane Parish, MSU Extension Beef Specialist

With winter supplementation continuing throughout Mississippi, both stocker operators and cow-calf producers regularly compare feedstuffs for use in supplementation programs. Price is only one component of feedstuff comparisons. Prospective feeds must also be compared in terms of nutrient composition and potential contribution to the nutritional program. The nutrients required by cattle can be classified into the following groups:

- ✓ Water
- ✓ Energy (Fats, Carbohydrates, Proteins)
- ✓ Proteins
- ✓ Minerals
- ✓ Vitamins

"Dry Matter" Versus "As Fed"

Water (moisture) is contained in both concentrate feedstuffs and forages, including hay and silage. Water content of various feeds and forages can vary tremendously. Nutrient analyses expressed as "as fed" or "as received" include this water component. As the water content increases in a feedstuff, the amounts of other nutrients present per pound of that feedstuff decrease. In contrast, feed and forage nutrient analyses expressed as "dry matter" represent the percentages of nutrients present excluding water content.

Dry matter content of a feedstuff is important because it reveals the actual amounts of various nutrients available to the animal consuming the feed. As fed represents the feed or forage as it is fed to the animal including the moisture content. While as fed is an accurate representation of the feed being offered, it does not provide a good indication of the nutrient composition of the non-water feed components, particularly when the moisture content is high. Consider the following examples of converting "as fed" to "dry matter".

Nutrient Analysis – As Fed Basis – Feed Example #1
Moisture 13.2%
Total Digestible Nutrients (TDN) 50.79%
Crude Protein (CP) 7.2%

To convert this nutrient analysis from "as fed" to "dry matter":

1) Figure the dry matter percentage. Subtract the moisture content from 100%. In this example 100% - 13.2% = 86.8% dry matter.
2) Convert individual nutrients from "as fed" to "dry matter". Divide the "as fed" percentage of a particular nutrient by the dry matter percentage calculated in

step 1. In this example for TDN, 50.79% / 86.8% = 58.51%. For CP, 7.2% / 86.8% = 8.3%. Multiply by 100 to convert the resulting decimal to a percentage. This is the same as moving the decimal two places to the right. The initial 0.5851 result from the TDN dry matter calculation is equivalent to 58.51%.

Therefore, the dry matter analysis would be as follows:
Nutrient Analysis – Dry Matter Basis – Feed Example #1
Moisture 0%
Dry Matter 100%
Total Digestible Nutrients (TDN) 58.51%
Crude Protein (CP) 8.3%

Now consider a conversion from "as fed" to "dry matter" of the following high moisture feed example.

Nutrient Analysis – As Fed Basis – Feed Example #2
Moisture 75.9%
Total Digestible Nutrients (TDN) 14.10%
Crude Protein (CP) 2.0%

To convert this nutrient analysis from "as fed" to "dry matter":

1) Figure the dry matter percentage. Subtract the moisture content from 100%. In this example 100% - 75.9% = 24.1% dry matter.
2) Convert individual nutrients from "as fed" to "dry matter". Divide the "as fed" percentage of a particular nutrient by the dry matter percentage calculated in step 1. In this example for TDN, 14.10% / 24.1% = 58.51%. For CP, 2.0% / 24.1% = 8.3%. Multiple by 100 to convert the resulting decimal to a percentage. This is the same as moving the decimal two places to the right. As in the previous example, the initial 0.5851 result from the TDN dry matter calculation is equivalent to 58.51%.

Therefore, the dry matter analysis would be as follows:
Nutrient Analysis – Dry Matter Basis – Feed Example #2
Moisture 0%
Dry Matter 100%
Total Digestible Nutrients (TDN) 58.51%
Crude Protein (CP) 8.3%

Note that the TDN and CP dry matter percentages in feed example #2 are the same as in feed example #1, yet the as fed versions of TDN and CP were much lower in feed example #2 than #1. This is due to the high moisture content of feed #2. When trying to understand and use as fed and dry matter nutrient analyses in practical beef cattle diets, remember that **as fed is what the cattle are offered to eat including the water content of the feed or forage** and **dry matter is what the cattle are offered to eat that is not water**. As fed amounts (feed weight in feeding form) of various ingredients are important to know for measuring out feed (pounds of feed ingredient) for feed mixing

and feeding. Feed mills mix feed based on an as fed basis. However, individual feed ingredients can be most easily evaluated on a dry matter basis for nutrient composition. The old adage of comparing apples to apples and oranges to oranges applies to comparing as fed to as fed and dry matter to dry matter. Cattle diets can be formulated on a dry matter basis and later easily converted to as fed for mixing and feeding purposes. Dry matter and as fed nutrient percentages for common feedstuffs are listed below.

Nutrient Analyses %	Dry Matter	TDN*	CP*	TDN**	CP**
Whole shelled corn	90	90	9	81	8.1
Soybean meal	90	84	48	75.6	43.2
Soybean hull pellets	90	80	12	72	10.8
Corn gluten feed	90	83	24	74.7	21.6
Whole cottonseed	93	90	24	83.7	22.3
Dried distillers grain	92	86	27	79.1	24.8
Cottonseed hulls	91	42	4	38.2	3.7

**Dry Matter basis*
*** As Fed basis*

Supplementation Example
A 600 lb. stocker steer requires 14.4 lb. of dry matter intake to gain 2.5 lb. per day with 73% TDN and 13.5% CP on a dry matter basis. This means that the steer needs 10.5 lb. of TDN (14.4 x 0.73) and 1.95 lb. of CP (14.4 x 0.135) in dry matter. If the forage fed only supplies 8 lb. of TDN and 1.5 lb. of CP, then an additional 2.5 lb. of TDN and 0.45 lb. of CP dry matter is needed to meet the steer's nutrient needs.

In order for the steer to receive his additional 2.5 lb. of TDN, 3.3 lb. of corn gluten feed (2.5 / 0.747) or 3.5 lb. of soybean hull pellets (2.5 / 0.72) will be needed on an as fed basis. To achieve 0.45 lb. of CP, 2.1 lb. of corn gluten feed (0.45 / 0.216) or 4.2 lb. of soybean hull pellets (0.45 / 0.108) would be needed on an as fed basis. If corn gluten feed was fed as the lone supplement to meet the TDN and CP requirements, then 3.3 lbs. would be needed as supplement on an as fed basis. This equates to 3.3 lb. x 90% = 3.0 lb. of corn gluten feed on a dry matter basis. If soybean hull pellets were fed as the lone supplement to meet the TDN and CP requirements, then 4.2 lb. would be needed as supplement on an as fed basis. This equates to 4.2 lb. x 90% = 3.8 lb of soybean hull pellets on a dry matter basis.

Water content of feeds and forages is also very important from the standpoint of transportation. It is generally not cost effective to transport feeds with high water content over long distances. One example of this is wet distillers grains which contain approximately 76% moisture (water). Therefore, only 24% of the weight transported contains nutrients other than water. It is generally not profitable to pay a lot of money to haul excess water. Economical transportation distance will depend upon available feed substitutes, feed nutrient composition, and transportation costs. Moisture content of feeds and forages can also impact storage needs and practical storage life.

Economic Replacement Values

The concept of Economic Replacement Values was introduced in the September 2006 *Stocker Cents* article. The basic idea is that the nutritional makeup of feeds and what the feeds will contribute to beef cattle performance determines the feed's true value. The relative value of feeds can be compared in terms of dollar value for total digestible nutrients and crude protein content as compared to whole shelled corn and soybean meal base feeds. The Economic Replacement Values do not account for roughage levels needed in the diet or other feeding considerations but can be useful in quick overall comparisons of feed prices and nutrient replacement values. Computer spreadsheets are from Mississippi State University available to calculate Economic Replacement Values. For more information on feed comparison spreadsheets or other beef cattle production topics, contact your local Extension office.