

# Fundamentals of Ration Balancing for Beef Cattle

## Part 1: As-Fed versus Dry Matter Basis

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A concept that is often difficult to understand for those learning to balance rations for beef cattle and other farm animals is **As-Fed versus Dry Matter Basis**. When you receive a laboratory analysis on your hay or other feeds, the report usually has two columns describing the nutrient content of your feed: **As-Fed or As-Received Basis** and **Dry Matter Basis**. All feeds used for farm animals naturally contain varying amounts of water, sometimes termed **moisture**. All feed components that are not water are considered portions of the Dry Matter (DM), which contains all of the other nutrients (carbohydrates, proteins, lipids, minerals, and vitamins). There are 4 classifications of animal feeds based on water or moisture content: 1.) **Air-Dried**, usually 85 to 90% DM and 10 to 15% water; 2.) **Haylages and Silages**, 40 to 60% DM and 40 to 60% water; 3.) **Fresh Pasture Forages**, 20 to 30% DM and 70 to 80% water; and 4.) **Liquid Feeds**, 10 to 20% DM and 80 to 90% water. Since the nutrient requirements of farm animals and the nutrient content of animal feeds can be expressed on either an As-Fed or a Dry Matter Basis it is important to understand these concepts and the associated arithmetic.

Rules of Thumb:

1. Remember, **Percent (%)** means parts per hundred. A hay that is 90% dry matter (DM) is (100-90) 10% water (moisture). A hay that is 90% DM contain **90 lbs. of DM per 100 lbs. of hay (90 lbs. DM/100 lbs. of hay)**, which is the same concentration as **.90 lbs. of DM/lb. of hay**.
2. When making **As-Fed/Dry Matter conversions**, you will either **multiply** or **divide** by the **Dry Matter Percentage**.
3. When converting **nutrient concentrations** from an **As-Fed Basis to a Dry Matter Basis** (think of water being removed, so nutrient concentrations will increase), **divide** by the Dry Matter Percentage.
4. When converting **nutrient concentrations** from a **Dry Matter Basis to an As-Fed Basis** ( think of water being added, so nutrient concentrations will be decreased), **multiply** by the Dry Matter Percentage.
5. When converting **feed intake** from an **As-Fed to Dry Matter Basis** (think of water being taken away, so intake (lbs.) would be decreased, **multiply** by the Dry Matter Percentage.
6. When converting **feed intake** from a **Dry Matter to As-Fed Basis** (think of water being added, so intake (lbs.) would be increased), **divide** by the Dry Matter Percentage.

Arithmetic Review:

- If a hay was **12.0 % crude protein (CP) on an As-Fed Basis**, what would the CP concentration be on a Dry Matter Basis if the hay was 88.0% DM? (12.0% CP = 12.0 lbs. CP/100 lbs. of hay, 88.0 lbs. DM/100 lbs. of hay or **.88 lbs. DM/lb. of hay**): 12.0 lbs. CP/100 lbs. of hay  $\div$  .88 lbs. DM/lb. of hay = **13.64 lbs. CP/100 lbs. of DM**.
- If a haylage contained **.60 mcal of NEm/lb. on a Dry Matter Basis**, what would the NEm concentration be on an As-Fed Basis, if the haylage was 58% DM? (.60 mcal NEm/lb. DM, 58 lbs. DM/100 of haylage or **.58 lbs. DM/lb. of haylage**): .60 mcal NEm/lb. DM **X** .58 lbs. DM/lb. of haylage = **.348 mcal NEm/lb. of haylage**.

- If a beef cow consumed 30.0 lbs. of hay that was 91.2% DM, how much DM would she consume? (30.0 lbs. hay As-Fed, 91.2 lbs. DM/100 lbs. hay or .912 lbs. DM/lb. of hay): 30.0 lbs. hay  $\times$  .912 lbs. DM/lb. of hay = **27.36 lbs. DM.**
- If a yearling/stocker steer consumed 18.7 lbs. of DM from a pasture that was 28.4% DM, how much pasture forage was consumed? (18.7 lbs. DM, 28.4 lbs. DM/100 lbs. pasture forage or .284 lbs. DM/lb. of pasture forage): 18.7 lbs. DM  $\div$  .284 lbs. DM/lb. of pasture forage = **65.85 lbs. of pasture forage.**

The following table demonstrates **As-Fed/Dry Matter Nutrient Concentration Conversions** for an **Air-Dried Feed** with accompanying calculations:

As-Fed Basis		Calculation	Dry Matter Basis
Water, %	10.0		0
Dry Matter, %	90.0		100.0
<b>N.D. Fiber, %</b>	60.0	60 lbs. NDF/100 lbs. feed $\div$ .90 lbs. DM/lb. feed $\longrightarrow$	<b>66.67</b>
<b>Non-Fiber CHO, %</b>	8.0	$\longleftarrow$ 8.89 lbs. NFC/100 lbs. feed $\times$ .90 lbs. DM/lb. feed	8.89
<b>Crude Protein, %</b>	12.0	12.0 lbs. CP/100 lbs. feed $\div$ .90 lbs. DM/lb. feed $\longrightarrow$	13.33
<b>Crude Fat, %</b>	2.0	$\longleftarrow$ 2.22 lbs. CF/100 lbs. feed $\times$ .90 lbs. DM/lb. feed	2.22
<b>Ash, %</b>	8.0	8.0 lbs. ash/100 lbs. feed $\div$ .90 lbs. DM/lb. feed $\longrightarrow$	8.89
<b>Total</b>	<b>90.0</b>		<b>100.0</b>

The following table show **As-Fed/Dry Matter Feed Intake Conversions** for feeds with various dry matter contents with accompanying calculations:

DM, %	As-Fed Intake, lbs.	Calculation	Dry matter Intake, lbs.
89.6	30.00	30.0 lbs. feed $\times$ .896 lbs. DM/lb. of feed $\longrightarrow$	26.68
25.3	140.71	$\longleftarrow$ 35.6 lbs. DM $\div$ .253 lbs. DM/lb. feed	35.60
41.7	12.84	12.84 lbs. feed $\times$ .417 lbs. DM/lb. of feed $\longrightarrow$	5.35
22.3	9.64	$\longleftarrow$ 2.15 lbs. DM $\div$ .223 lbs. DM/lb. feed	2.15
66.2	61.34	61.34 lbs. feed $\times$ .662 lbs. DM/lb. feed $\longrightarrow$	40.61

**Cost per Unit of Dry Matter** is an important concept in Animal Nutrition. Dry Matter/Moisture relationships can have a major impact on the cost of feeding farm animals. The following table shows the Cost/Unit of Dry Matter for feeds of **similar nutrient content** but various costs and dry matter content:

DM, %	\$/ton, As-Fed	Calculation	\$/ton of DM
91.0	80.00	\$80.00/ton As-Fed $\div$ .91 lbs. DM/lb. feed =	87.91
87.7	80.00	\$80.00/ton As-Fed $\div$ .877 lbs. DM/lb. feed =	91.22
85.4	80.00	\$80.00/ton As-Fed $\div$ .854 lbs. DM/lb. feed =	93.68
35.6	25.00	\$25.00/ton As-Fed $\div$ .356 lbs. DM/lb. feed =	70.22
61.3	43.04	\$43.04/ton As-Fed $\div$ .613 lbs. DM/lb. feed =	70.22