Energy Value of Corn vs. Hay

If corn is valued at $80 per ton or $.04 per lb, considering an 85% dry matter (DM) content, the value of corn is $.047 per lb DM. According to the National Research Council (NRC), corn is approximately 90% TDN, 10% crude protein and contains 1.02 megacalories (Mcal) of net energy for maintenance (NEm) per pound of DM. Consequently, the NEm value is $.047 per Mcal.

Value of Corn NEm = $.047 / 1.0 Mcal = $.047 per Mcal

Low quality fescue is variable in terms of nutrient concentrations, therefore it is important to have a forage analysis conducted on your own hay. For our example, we will use the same hay shown in Table 2 which tested 92% DM, 9.5% DM protein, 48% DM TDN and .41 Mcal/lb DM NEm. If the tow quality hay is priced at $50 per ton, the DM value of NEm in the hay is $.066.

Value of Hay NEm = $.025 per lb / .92 = $.027 per lb DM / .41 Mcal = $.066 per Mcal

From this example it is evident that this low quality hay is a more expensive energy source than corn, given these prices and nutrient values. Expressed in another way, you could only afford to pay $35.46 for the hay on an as-fed basis.

As-fed Value of hay = $.047 * .41 = $.019 per lb of DM * .92 = $.018 per lb as-fed or $35.46 per ton

Before the amount of corn needed can be calculated, the associative effect that feeding high levels of a starch based concentrate, such as corn, has on the digestibility of the hay must be considered. A 1989 University of Missouri study demonstrated that cattle supplemented with 1% of their body weight as corn had reduced forage digestibility of 20%. Therefore, the NEm value of our hay would actually be .33 Mcal per pound (.41 * .8).

With these factors in mind, the amount of corn needed can be calculated. For this example, consider a 1200-pound cow in late pregnancy, and with either average or superior milking ability. We will feed .5% body weight hay dry matter or about 6.5 lbs as-fed. The NEm contribution of the hay is only 2.0 Mcal per day (6 lbs DM * .33 Mcal per lb). Table 3 lists the NEm required for three classes of cows and the amount supplied by hay and corn.

Table 3. Required level of NEm for three classes of cows, and the amount supplied by hay and corn.

Stage of Production	NEm required **(Mcal/day)**	NEm supplied by hay **(DM @ .5% BW)**	Nem Deficit **(Mcal/day)**	85% DM Corn required **(lb/day)**	Crude Protein required **(lb/day)**
Late pregnancy	10.83	2.0	8.83	10.2	1.7
Lactation, Average milk	12.09	2.0	10.09	11.6	2.1
Lactation, Superior milk	15.49	2.0	13.49	15.6	2.7

Gestating cows would need .75 lbs soybean meal (44% crude protein as-fed basis) to meet the protein requirement and cows with average milk production would require 1.25# SBM during lactation. Cows with superior milk production would require nearly 2 lbs SBM per day to meet the protein requirement.

Table 4. Summary of the limit fed rations for this example.

Stage of Production	Low quality Fescue hay **(lb as-fed)**	85% DM corn grain **(lb as-fed)**	44% Soybean Meal **(lb as-fed)**
Late pregnancy	6.5	10.2	.75
Lactation, Average milk	6.5	11.6	1.25
Lactation, Superior milk	6.5	15.6	2.00

Each of these diets would also require around .25 lb of limestone per day because of the high phosphorus level in corn. Keep in mind that these rations were formulated based on cow size, stage of production and milk potential. MU guide 2068 contains NRC recommendations for nutrient requirements of cows considering these factors.