

## PROTEIN NEEDS FOR LACTATION BETTER DEFINED

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In recent years there have been a large number of experiments at the University of Florida measuring the response of high producing dairy cows to various increments of protein in the complete ration. Various presentations and reports have been given to the dairy industry on individual experiments. However, it has not been until recently when we have surveyed the results of a large number of experiments that we have been able to develop what we think is a reliable response curve to increasing protein in complete rations.

First, let's consider soybean meal as the protein supplement. The response that would be given in increased milk yield by increasing the percent protein in the complete ration is a diminishing returns curve. That is, you would get a large increase in going from 8% protein in the complete diet to 10%, a medium response from 10% to 12%, and very little or none from 12% to 14%. The following table represents an estimate obtained from the results of 13 experiments with soybean meal to the milk yield and feed intake changes for each 1% increase in crude protein percent of the total ration dry matter. The changes are presented as expected increase in milk yield per cow daily and increase in feed cost so that actual increases in dollars returned and in dollars extra feed cost could be calculated. Feed costs increase both from some extra feed being consumed and in increases in the costs of each unit of all that is fed through the cost of increasing the percent protein. In this example, using \$10/cwt. milk, \$100/ton for the total air dry ration, and soybean meal costing \$100/ton more than corn, feed costs exceeded added value of milk in changing crude protein from 14% to 15% of the total ration dry matter. Increasing protein up to 14% gave more milk value than added cost. Thus, it might be concluded that 14% of the total ration dry matter is the most economical level of protein to feed under most situations if soybean meal is the supplement. If \$12/cwt. milk had been chosen, no financial loss would have been incurred in increasing to 15% crude protein in the total ration dry matter.

Of considerable interest is the fact that cottonseed meal apparently gives a bit different response curve than soybean meal. In a number of experiments where cottonseed meal was the supplement used to vary protein, we have found that cows do not perform quite as well at low levels of protein with cottonseed meal and hence respond more readily to increasing protein by adding more cottonseed meal. The conclusion we made was that it takes about 15% protein (13.5% of air-dry complete ration) with cottonseed meal as the supplement to equal 14% protein (about 12.5% air-dry) when soybean meal was the supplement.

A committee of scientists revising the publication entitled "Nutrient Requirements of Dairy Cattle" are recommending about 15% of the dry matter for situations fitting most of our milking cows in Florida. Thus, their recommendations are higher than would be indicated by supplementation with soybean meal but are probably appropriate recommendations for many general situations where supplements such as cottonseed meal are used, or .5% urea or other soluble protein are included in the diet.

#### Summary

1. Protein requirements are really not as specific as sometimes stated but can be determined on economic basis through costs and returns comparisons.
2. Soybean meal is superior to cottonseed meal at lower levels of protein feeding. Generally, protein requirements for milk production are quoted on a very liberal basis to allow use of supplements such as cottonseed meal and/or some urea. Equal performance can be obtained with about 1% less protein if soybean meal is the only nitrogen supplement used in the complete ration than if cottonseed meal is used. The same probably holds when comparing to rations containing 0.5% urea.
3. With these considerations, 14% protein in complete ration (12.5% on air-dry basis) is recommended if soybean meal is only supplement added in complete rations containing low protein forages. With other supplements, or in rations which need little added protein because they contain large amounts of high protein forage, 15% crude protein is recommended (13.5% on air-dry basis).
4. There may be some other protein supplements equal or better than soybean meal. However, without the extensive data necessary to make comparative response curves like we now have available for soybean meal and cottonseed meal I recommend the 15% feeding level being recommended for cottonseed meal for these other supplements.

Table 1. Marginal changes in milk, dry matter (DM) intake and estimated returns to changing ration protein percent WITH SOYBEAN MEAL.

Change in protein % of DM from:	% increase in:		Lbs/day increase in:		Daily increase in:	
	milk <sup>a</sup>	DM intake <sup>a</sup>	milk <sup>a</sup>	DM intake <sup>a</sup>	milk value <sup>b</sup>	feed cost <sup>b</sup>
9 to 10%	7.9%	3.9%	3.2 lbs	1.4 lbs	\$ .32	\$ .12
10 to 11%	5.6	2.9	2.5	1.1	.25	.11
11 to 12%	4.0	2.1	1.8	.8	.18	.10
12 to 13%	2.7	1.6	1.3	.6	.13	.09
13 to 14%	1.8	.8	.9	.4	.09	.08
14 to 15%	1.2	.6	.6	.2	.06	.07
15 to 16%	.9	.3	.4	.1	.04	.06
16 to 17%	.7	.1	.3	0	.04	.06

<sup>a</sup>The base values for 9% diets used in this example are 40.5 lbs of milk per day and 35.6 lbs feed intake per day.

<sup>b</sup>Milk value for this estimate is assumed to be \$10 per 100 pounds and feed cost of \$100 per ton for 9% crude protein ration. It is assumed also that soybean meal costs \$100/ton more than corn.