



## *Calf Starter Research* Protein Levels and Sources for Calf Starters

The Dairy NRC (2001, 1989) lists 18% CP (as-fed basis; 20 % dry matter basis) as the requirement for calf starters. The calf model in the Dairy NRC (2001) suggests that energy, not protein, limits gain in calves' 130 to 200 lb body weight receiving only a dry feed. Trials by Akayezu et al. (1994), Luchini et al. (1991), and Hill, et al. (2001) substantiate that 18% CP diets are adequate. However, Drackley et al. (2003) found that calves fed starters containing 22% CP were more efficient than calves fed starters with 18% CP. Our trials evaluated the CP in starters fed with both 20% CP (as-fed) milk replacer (MR) fed at 1 lb daily and 26% CP (as-fed) MR fed at 1.5 lb daily (Hill et al. 2001; Figure 1). Exceeding 18% CP in the starters did not affect gain, starters intake, hip width, body condition score, or health measurements when calves averaged 1.4 lb daily gain (20% CP MR) or 1.7 lb daily gain (26% CP MR) from 0 to 56 days on-test. Two trials have fed starters less than and exceeding 18% CP, and each observed a plateau in gain at ~18% CP (Figure 1). Additionally, there were no differences in gain, efficiency, hip width change, and body condition change from 0 – 56 days between calves fed 18 and 21% CP starters and weaned at either 28 or 42 days (Hill et al., 2004).

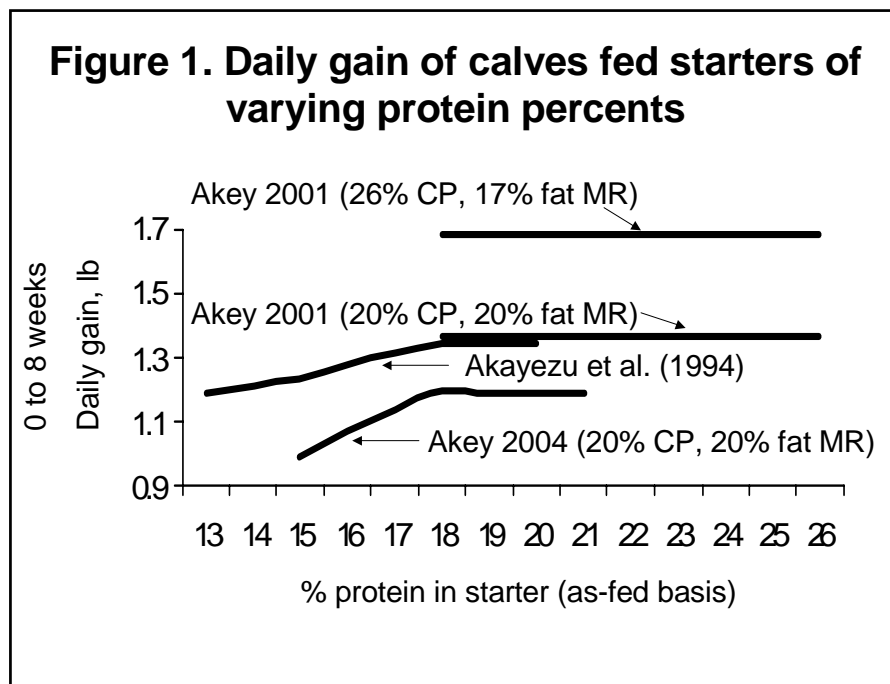
Swartz et al. (1991), Holtshausen and Cruywagen (2000), and Abdelgadir et al. (1996a) observed no differences in gains of calves when fed diets with different rumen undegradable protein (RUP) values. Abdelgadir et al. (1996b) observed improved performance when RUP sources were fed. Maiga et al. (1994) observed better gains when calves were fed extruded soybean meal vs. soybean meal. Abdelgadir et al. (1996b) observed improved performance when calves were fed protein and corn sources with similar rates of ruminal degradation, however, they saw similar gains regardless of corn and protein degradation rates. Bunting et al. (1996) found improved gains from RUP sources during hot but not cold weather. McCoy et al. (2003) observed trends for slower gains when RUP sources were fed. Fiems et al. (1987) observed no difference in calf performance when formaldehyde-treated soybean meal replaced soybean meal. Warner (1984) reviewed research prior to 1984 and reported no advantage to using RUP sources in calf starters. These trials show mixed results to adding RUP sources with more trials reporting no benefits to adding RUP sources than benefits.

Vazquez-Anon et al. (1993) and Holtshausen and Cruywagen (2000) observed that the rumen degradability of CP sources increased with age post-weaning, suggesting that this trend likely extends back into the pre-weaning phase of calf development. The lack of complete development of the rumen and its microbial population in pre-weaned calves may explain why there are no conclusive benefits to formulating starters with higher RUP sources.

A few studies have compared sources of protein used in starters. Fiems et al. (1985) observed numerically lower gains when rapeseed (canola) meal replaced soybean meal. Intake of the rapeseed meal diets were less than that of the soybean meal diets and poor intake (poor palatability) of rapeseed meal diets may be more of an issue, especially if the glucosinolate level is high, than digestibility, influencing gain. Sharma et al. (1986) observed poorer gains and digestibility of diets when rapeseed meal or extruded or pelleted whole cottonseed replaced soybean meal. However, they observed similar performance in calves fed unprocessed whole cottonseed seed, unprocessed whole sunflower seed, and soybean meal-based diets. Fiems et al. (1986) observed poorer digestibility, gains, and efficiency of gain when cottonseed meal replaced soybean meal in the starters. Replacing soybean meal with corn gluten feed resulted in poor efficiency of gains, greater intakes, and similar gains as diets with soybean meal. Replacing soybean meal with urea (approximately half of the protein in the diets from urea) supported slower calf gains and poorer efficiency (Fiems et al., 1987).

Corn and soybean meal combined offers a good balance of amino acids, is free of many anti-nutritional factors, is low in fiber, and is consistently digestible (as reviewed by Chiba, 2001, for pigs). Soybean meal was the base protein in the calf trials discussed above and calves fed the soybean meal-based diets performed as well or better than calves fed diets including other sources of protein.

**Conclusion: Starters formulated to 18% CP on an as-fed basis using soybean meal as the pre-dominant protein source appear optimum.**



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