

# **A** Replacement Report

## *Milk Replacer Research* Feeding Rate of Milk Replacers

There are milk replacer programs marketed that recommend feeding more than the conventional amount of approximately 1 lb of powder per calf daily. These programs were stimulated by research in Dr. Van Amburgh's lab at Cornell University (Diaz et al., 2001) where calves were fed from an average of approximately 1.6 lb of 30% protein, 20% fat milk replacer powder daily up to approximately 5.5 lb of powder daily from near birth up to 230 lb body weight. These calves were not fed starter. Subsequently, some companies started marketing milk replacer powders similar to those fed at Cornell to be fed at rates of two to three pounds daily. After several failed attempts to make these programs work in controlled research where calves were fed starter, we evaluated multiple combinations of protein concentrations, fat concentrations, and feeding rates not exceeding 2 lb daily. Based on our research, in 2000 we began marketing Pinnacle milk replacer, a 26% protein (with synthetic amino acids), 17% fat milk replacer powder recommended to be fed at 1.5 lb daily.

Since then, we have received many questions about the feeding rate of Pinnacle milk replacer. Most all are based on an idea that it should be fed at a greater rate than 1.5 lb daily. Some people have suggested that 1.5 lb may be OK in warm months, but too low in cold months. For 20 years or more, people have suggested that calves should be fed more energy or more milk replacer powder in the cold weather to cover the increased maintenance requirement of calves under cold stress.

In the winter of 2005, we fed calves a 20% protein, 20% fat milk replacer at 1.0, 1.25 and 1.5 lb of powder daily during a 56-day trial that averaged 22 °F (based on hourly temperature measurements). The calves were weaned at 42 days. Body weight gain from 0-56 days did not differ because of amount of milk replacer fed (Figure 1). Starter intake and gain to feed efficiency declined as the amount of milk replacer fed increased (Figure 2). When those calves were moved to group pens and fed a common dry feed from 56 to 84 days, body weight gain, intake, and gain to feed efficiency was inversely related to the amount of milk replacer that the calves had been fed. These calves were bedded well and kept dry. Even though on paper these calves were in cold weather, well below their thermoneutral zone, feeding more milk replacer did not improve gain and efficiency. The reason for this is largely related to the negative impact that greater amounts of milk replacer had on starter intake, possibly rumen development, and efficiency.

Also in the winter of 2005, we fed calves a 26% protein, 17% fat milk replacer at 1.5, 1.75 and 2.0 lb of powder daily during a 56-day trial that averaged 20 °F

(based on hourly temperature measurements). The calves were weaned at 42 days. Body weight gain from 0-56 days did not differ because of amount of milk replacer fed (Figure 3). Starter intake and gain to feed efficiency declined as the amount of milk replacer fed increased (Figure 4). Again, these calves were well below their thermoneutral zone and the reason for no change in body weight gain with increasing amount of milk replacer fed is largely related to the reduction in starter intake and efficiency.

In previous years during more moderate temperatures, we have evaluated feeding Pinnacle milk replacer at rates over 1.5 lb daily. In each of those trials we observed no improvement in body weight gain and a reduction in starter intake as the calves were fed more milk replacer (Figures 5 and 6). Feed efficiency was reduced in one of those trials.

Feeding a 26% protein, 20% fat milk replacer has resulted in no improvement in daily gain and reduced starter intake compared to feeding a 26% protein, 17% fat milk replacer with each being fed at 1.5 lb daily. As will feeding more milk replacer powder, feeding more fat reduced starter intake.

With this said, we are not suggesting the calf's maintenance requirement is unaffected by temperature. We are suggesting that the weaning process is compromised when we feed too much milk replacer. Also, the amount of milk replacer that can be fed and not disrupt weaning is related to nutrient profile of the milk replacer. If the milk replacer is 20% protein and 20% fat, feeding more than 1 lb of powder daily will likely reduce starter intake, possibly rumen development, and efficiency. If the milk replacer is 26% protein and 17% fat (Pinnacle MR), feeding more than 1.5 lb of powder will likely reduce starter intake, possibly rumen development, and efficiency.

Additionally, we observed in both of the 2005 trials reported above (with the 20% protein, 20% fat milk replacer and the 26% protein, 17% fat milk replacer) a greater body weight gain when straw was used vs. dry hardwood shavings. This suggests the straw is a better insulating bedding material than shavings. With both bedding materials, calves were managed to have a clean and dry environment in an unheated and non-insulated nursery. The cold temperature was likely increasing maintenance requirements of the calves to some degree but elevating the milk replacer and its subsequent negative impact on starter intake and efficiency was most disruptive to calf performance at and after weaning. Cold weather management should include adequate dry, insulating bedding material, combined with a draft-free yet adequately ventilated area rather than increasing caloric intake via the liquid diet. Additionally, increasing or changing the bedding material for cold weather would be a fraction of the cost of increasing the milk replacer fed.

Recent research by Stamey et al. (2006) compared feeding three milk replacer programs. Treatment 1 was a conventional program that targeted approximately

1 lb daily of a 20% protein, 20% fat milk replacer. Treatment 2 targeted stepping calves up to approximately 2 lb daily of a 28% protein, 17% fat milk replacer. Treatment 3 targeted stepping calves up to approximately 2.5 lb daily of a 28% protein, 20% fat milk replacer. While calves fed Treatment 3 gained the most weight up till weaning, they consumed almost no starter (Table 1). They also appeared to gain the slowest post-weaning and ended up being numerically the lightest and shortest calves at 20 weeks of age (Table 2). Calves fed Treatment 2 gained more weight than calves fed Treatment 1 up till weaning but consumed less than a quarter of the starter of calves fed Treatment 1. Calves fed Treatment 2 appeared the heaviest and tallest of the three treatment groups by 20 weeks of age.

Based the targeted 2 lb feeding rate of Treatment 2 and the very low starter intake of the treatment group relative to considerable data from our lab, the milk replacer in Treatment 2 was over fed. The even lower starter intake and crash in performance post-weaning of calves on Treatment 3 is consistent with four out of four trials in our lab and suggests that the milk replacer was over-fed and too high in fat.

Pinnacle milk replacer should be fed at 1.5 lb of powder daily. Feeding more powder depresses starter intake and efficiency, even during cold weather. Abatements in cold weather should involve increases in good insulating bedding materials and extra attention to maintaining a dry, draft-free environment.

References:

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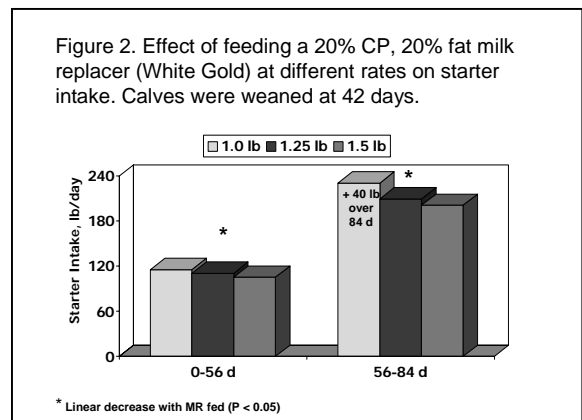
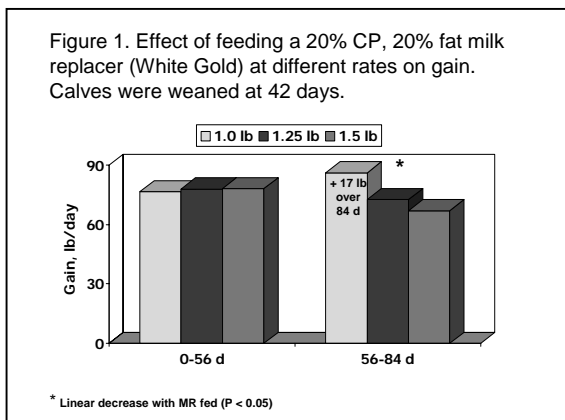


Figure 3. Effect of feeding a 26% CP, 17% fat milk replacer (Pinnacle) at different rates on gain. Calves were weaned at 42 days.

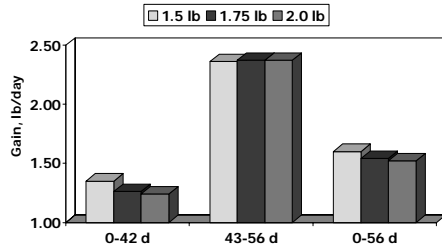
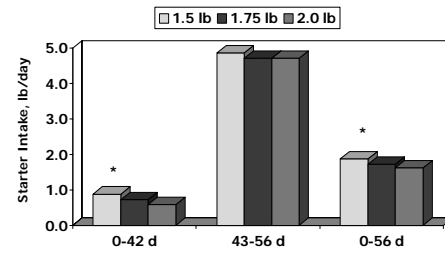
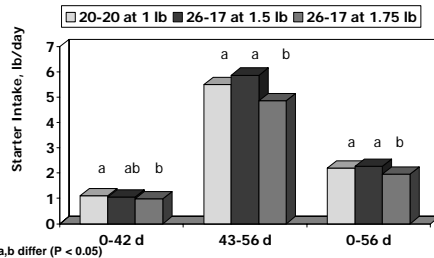


Figure 4. Effect of feeding a 26% CP, 17% fat milk replacer (Pinnacle) at different rates on starter intake. Calves were weaned at 42 days.



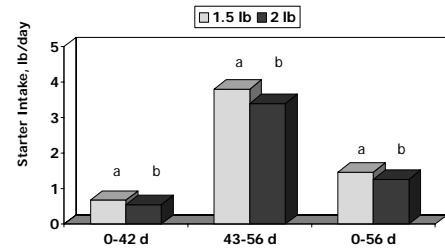
\* Linear decrease with MR fed (P < 0.05)

Figure 5. Effect of feeding a 20% CP, 20% fat milk replacer at 1.0 lb/day and a 26% CP, 17% fat milk replacer (Pinnacle) at 1.5 or 1.75 lb/day on starter intake. Calves were weaned at 42 days.



a,b differ (P < 0.05)

Figure 6. Effect of feeding a 26% CP, 17% fat milk replacer (Pinnacle) at different rates on starter intake. Calves were weaned at 42 days.



a,b differ (P < 0.05)

Table 1. Effect of feeding three different milk replacer programs on pre-weaning performance. Calves were weaned at 42 days. (Stamey et al., 2006)

Milk replacer and starter program	Treatment 1 20-20 MR 18% Starter	Treatment 2 28-17 MR 20% Starter	Treatment 3 28-20 MR 22% Starter
Approximate milk replacer powder fed, lb/day			
Week 1	0.72	1.21	1.21
Weeks 2-5	1.00	2.00	2.50
Week 6	0.50	1.00	1.25
Gain, 0-6 weeks, lb/day	0.93 <sup>a</sup>	1.21 <sup>b</sup>	1.37 <sup>c</sup>
Gain/feed eff., 0-6 weeks	0.39 <sup>a</sup>	0.60 <sup>b</sup>	0.62 <sup>b</sup>

<sup>a,b,c</sup> Means with different letters differ (P < 0.05).

Table 2. Effect of feeding three different milk replacer programs on post-weaning performance. Calves were weaned at 42 days. (Stamey et al., 2006)

Milk replacer and starter program	Treatment 1 20-20 MR 18% Starter	Treatment 2 28-17 MR 20% Starter	Treatment 3 28-20 MR 22% Starter
Gain, 7-12 weeks, lb/day	2.16 <sup>ab</sup>	2.36 <sup>a</sup>	1.81 <sup>b</sup>
Body weight, 12 weeks, lb	231 <sup>b</sup>	248 <sup>a</sup>	233 <sup>b</sup>
Wither height, 12 weeks, in	37.0 <sup>ab</sup>	37.4 <sup>a</sup>	36.8 <sup>b</sup>
Body weight, 20 weeks, lb	407 <sup>ab</sup>	418 <sup>a</sup>	396 <sup>b</sup>
Wither height, 20 weeks, in	41.8 <sup>ab</sup>	42.2 <sup>a</sup>	41.5 <sup>b</sup>

<sup>a,b</sup> Means with different letters differ (P < 0.05).