Feed coproducts: “We’re one, but we’re not the same”

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Introduction

Ruminant production systems, including milk production, have become more efficient over time. When comparing dairying practices and resources needed in 1944 to 2007, Capper et al. (2009) reported that over this time dairy producers used 21% less animals, 23% less feedstuffs, 35% less water, and 10% less land to produce the same one billion kg of milk. Despite this increase in efficiency, increased pressure for land use and high commodity prices over the past decade have increased feed costs for dairy farmers, challenging them to consider less costly sources of protein and fiber ((Bradford and Mullins, 2012). In doing so, feed coproducts have played a major role in dairy nutrition but they also represent a means by which efficiency of human food production is improved. This is because when animals consume coproducts they are using a feed resource that from a human perspective would be considered a waste product (VandeHaar and St-Pierre, 2006). To illustrate this, Karlsson et al. (2018) recently conducted an experiment in which all feedstuffs which could be considered human-edible product were removed from the diet of lactating dairy cows and replaced with feed coproducts. They examined these formulations and their effects on what is known as “human-edible feed conversion efficiency.” This is an index which is determined by measuring human-edible material produced by a system minus the human-edible material used by the same system. In this study replacing human edible material (cereal grains and soybean meal) with human-inedible by-products (beet pulp, DDGS, and canola meal) resulted in a net increase in human food protein production without lowering milk production. Although often advantageous, the use of coproducts in dairy cattle diets may also be challenging because they vary in availability and in chemical composition. The objective of this work is to outline the nutritional value of common feed coproducts and to discuss how those can be effectively included in dairy rations.

Recent Studies on Coproducts

In general, soybean meal is the preferred protein supplement for dairy cattle. This is because it is widely available and high in CP content (Huhtanen et al., 2011). Solvent extracted soybean meal contains approximately 54 % CP and 10 % NDF (DM basis). The rumen undegradable protein (RUP) content is approximately 43 % and this bypass protein is highly digestible (93 %) (National Research Council (U.S.) and Subcommittee on Dairy Cattle Nutrition, 2001)(NRC, 2001). In comparison, the RUP content and intestinal digestibility of RUP (dRUP) of canola meal is lower (36, and 75%, respectively). In contrast, the RUP content and dRUP in DDGS (51, and 85%, respectively) is higher than either soybean meal or canola meal (NRC, 2001). In a recent study conducted at the University of Nebraska-Lincoln experimental diets in which canola meal or DDGS replaced soybean meal and corn were formulated. These diets were fed to lactating Jersey

cows in an energy metabolism facility in which total fecal and urine is collected. Body heat was also indirectly measured using indirect calorimeters. The milk performance of cows consuming diets containing coproducts was very similar; however, modest reductions in the digestibility of CP and NDF were observed in cows consuming canola meal. These effects resulted in a trend in the reduction of net energy balance (energy available for both milk and tissue) for cows consuming canola meal.

We have also recently completed a study comparing blood meal and hydrolyzed feather meal (HFM). In this study HFM was titrated into in the diet of lactating Jersey cows and in doing so blood meal was removed. As above, measures were taken in an energy metabolism facility in which total fecal and urine was collected and body heat was also indirectly measured using indirect calorimeters. In this study there were no difference in feed intake or fat correct milk when HFM was fed. The inclusion of HFM did reduce digestibility of CP and milk protein, but surprisingly, measured supply of energy and that available to tissue and milk increased. The increased supply of energy is likely a result of fat from HFM that supplies digestible energy.

Conclusions

The use of coproducts by the dairy industry is a practice that will continue. Such a practice increases the environmental sustainability of the industry because coproducts are resources that are unfit for human consumption. Feeding studies indicate that these feeds also supply valuable nutrients but subtle differences in availability of nutrients require good understanding of chemical composition and in some cases in vitro testing provides information that can be contribute to our need for knowledge on whole animal nutrient supply and utilization.

References

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